Meteorological Annual Report For 1996

by

C. H. Hunter

Westinghouse Savannah River Company

Savannah River Site

Aiken, South Carolina 29808

C. P. Tatum

MASTER

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METEOROLOGICAL ANNUAL REPORT FOR 1996 (U)

Charles H. Hunter
Charles P. Tatum

Technical Reviewer

A. H. Weber
A. H. Weber

Date 7/21/97

Approval

R. P. Addis Date July 21, 97
R. P. Addis, Manager, Atmospheric Technology Group

A. L. Boni Date 7-22-97
A. L. Boni, Manager, Nonproliferation Technologies Section

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Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808

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Executive Summary

An analysis of meteorological data collected at the Savannah River Site (SRS) in 1996 shows that overall weather conditions for the year were characterized by below normal temperatures and near normal precipitation. The average temperature for the year, 62.2°F, was the lowest observed at SRS for the 33 years in which temperature data are available (1964-96). Temperature extremes for 1996 ranged from a minimum of 10°F on February 5 to a maximum of 100°F on July 2.

Monthly rainfall was near or slightly below average each month except March and August which had considerably above average rainfall. The maximum 24-hour rainfall was 2.47 inches on July 5. Daily rainfall in excess of 2 inches occurred on July 5 and August 25. These rainfall events were associated with slow moving cold fronts. Approximately one inch of snow was recorded in the SRS area on February 4.

The annual average wind speed, based on data collected at the Central Climatology meteorology tower, was about 10% higher than the average for a previous 5-year period (1987-91). The 1996 data also showed a slightly higher frequency of west to southwest winds and a slightly lower frequency of northeast winds than was observed in the earlier 5-year period. A winter storm that formed over Alabama and moved northeastward through east Tennessee March 18-19 produced the most notable period of sustained strong winds. Daily and 15-minute average wind speeds of 16 miles per hour (mph) and 26.6 mph, respectively, were recorded at Central Climatology.

Monthly average relative humidity for the year was lowest during the spring months (57% in April) and highest in the summer and early fall (81% in August). The average relative humidity for the year was 69% and the average daily minimum relative humidity, which typically occurs during the afternoon, was 45%.

Tropical Storm Josephine moved through eastern portions of Georgia and South Carolina on October 8 producing a total rainfall at SRS of about 1.8 inches. The highest 15-minute average wind recorded during the passage of this storm was 19.8 mph; the maximum instantaneous speed during this period was 35 mph. Hurricanes Bertha and Fran struck the southeast U.S. coast near Wilmington, North Carolina in July and September, respectively; however, these storms had little adverse affect on the weather at SRS.

Summary plots of 1996 daily minimum/maximum temperature, 24-hour total precipitation, daily minimum relative humidity, and daily average wind speed are shown in Figure 1.

FIGURE 1. SUMMARY OF DAILY DATA FOR 1996

Introduction

General SRS Climate

The southeastern U.S. has a humid subtropical climate characterized by relatively short, mild winters and long, warm, and humid summers (Oliver and Fairbridge 1987).

Summerlike weather conditions typically last from May through September, when the area is under the influence of the western extension of the semi-permanent Atlantic subtropical anticyclone (i.e., the 'Bermuda' high). Winds in summer are light and cold fronts generally remain well north of the area. Daily high temperatures during the summer months exceed 90°F on more than half of all days on the average. The persistent heat and humidity often result in scattered afternoon and evening thunderstorms.

The influence of the Bermuda high begins to wane during the fall, resulting in lower humidity and more moderate temperatures. Average rainfall during the fall is usually the least of the four seasons.

The weather is quite changeable during the winter months, as mid-latitude low-pressure systems and fronts migrate through the region. Weather conditions frequently alternate between warm, moist, subtropical air from the Gulf of Mexico region and cool, dry polar air. Although outbreaks of Arctic air occasionally can affect SRS, the extremely cold conditions associated with these air masses are moderated by the Appalachian Mountains to the north and northwest. As a result, less than one-third of winter days have minimum temperatures below freezing on the average and days with temperatures below 20°F are infrequent. Measurable snowfall is rare.

Spring is characterized by a higher frequency of occurrence of tornadoes and severe thunderstorms than the other seasons. Although spring weather is somewhat windy, temperatures are mild and the humidity is relatively low.

Detailed descriptions of the climate of the SRS are contained in Hunter (1989), Hoel (1984), and Weber (1993).

SRS Meteorological Monitoring Program

The Atmospheric Technologies Group (ATG) of SRTC collects, archives, and analyzes basic meteorological data supporting a variety of activities at SRS including the design, construction, and operation of nuclear and non-nuclear facilities, emergency response, environmental compliance, resource management, and environmental research.

The ATG maintains a network of eight 200-foot meteorological observation towers located at A, C, D, F, H, K, L, and P Areas. Additional meteorological instrumentation is located at the Central Climatology facility near N Area, which includes a 200-foot observation tower and on the 1000-foot WJBF-TV tower near Beech Island, South Carolina. Measurements of wind speed, direction, turbulence, air temperature, and dew point temperature are taken at a height of 200 feet above ground on all of the site towers. Identical measurements are made on the Central Climatology tower at heights of 13, 58, 116, and 200 feet. Additional measurements conducted at Central Climatology consist of precipitation, evaporation, solar radiation, barometric pressure, and soil temperature. At the WJBF-TV tower, measurements of wind speed, direction, turbulence, and air temperature are recorded at seven levels through 1000 feet. A measurement from each sensor in the network is taken at 1.5 second intervals by a centrally located computer. Fifteen-minute averages and standard deviations are computed and stored in a relational database.

Additional measurements of temperature and relative humidity are taken with a hygrothermograph mounted in a standard National Weather Service 'cotton region' instrument shelter adjacent to Building 773-A. Data from the hygrothermograph are continuously provided to a strip chart recorder. Daily maximum and minimum values of temperature and relative humidity are manually extracted from the strip charts and entered into a computer data

base. Daily precipitation is measured with a plastic wedge rain gauge located adjacent to the instrument shelter. Rainfall measurements are taken once per day, usually around 9 AM. Data collection at or near the 773-A site has been conducted since 1952 and the data have been used extensively in basic descriptions of the SRS climate. The data recorded at this site are subject to a manual quality control inspection to ensure the reasonableness of the data; nevertheless, some errors may be present in the data record.

A map showing each of the measurement locations is given in Attachment A. Parker and Addis (1994) and Kurzeja (1993) provide detailed descriptions of the NTS meteorological monitoring facilities and instrumentation.

Data Sources for the 1996 Annual Meteorological Report

This report contains tabular and graphical summaries of data collected during 1996 for temperature, precipitation, relative humidity, wind, barometric pressure, and solar radiation. Most of these data were collected at the Central Climatology facility. (Relative humidity is calculated from measurements of dew point temperature.) Summaries of

temperature and relative humidity were generated with data from the lowest level of measurement at the Central Climatology tower (13 feet above ground). Wind speed summaries were generated with data from the second measurement level (58 feet above ground). Wind speed measurements from this level are believed to best represent open, well exposed areas of the Site. In addition, seasonal and annual summaries of the joint frequency of occurrence of wind direction sector by wind speed category (i.e., wind roses) are provided for the Central Climatology tower (200-foot level only) and each of the eight area towers.

Valid data recovery for the onsite monitoring towers in 1996 ranged from 91% at the F-Area and K-Area towers to 96% at the A-Area and P-Area towers. Temperature and precipitation data from the 773-A instrument shelter were substituted for about five days of missing record at Central Climatology.

Data Summaries

Overview

Annual and monthly averages and extremes for each of the meteorological variables summarized in this report are given in Table 1. Plots of daily minimum and maximum temperatures, 24-hour total precipitation, daily minimum relative humidity, and daily average wind speed are shown in Figure 1.

Frequent periods of relatively cool weather affected much of the central and eastern U.S. during 1996 (NOAA 1997). These conditions were the result of a strong and persistent negative phase North Atlantic oscillation, an unusual hemispheric circulation pattern which produces an intensification and southward migration of the polar jet stream across North America. This pattern has occurred only twice in recent years (Halpert 1997).

Other than several days of cold and cloudy weather early in the month—the result of a major winter storm in the northeast U.S.—January was characterized by seasonal weather with monthly temperatures and rainfall only slightly below average.

The strongest of a series of Arctic high-pressure systems that affected the eastern U.S. during the first part of the year occurred in early February. Temperatures at SRS on February 4 remained below freezing throughout the day (high of 31°F), then dropped to a low of 10°F on the morning of February 5. A temporary northward shift in the polar jet brought somewhat warmer weather during the latter half of February. As a result, overall temperatures for the month were above average (+1.0°F) and total rainfall was below average (-1.54 inches).

Cold weather returned in March and persisted throughout much of the rest of the year. The average temperature for March 1996, 50.6°F, was the second lowest average temperature for the month in the 33-year period for which temperature data are available (1964-96). Low temperatures in the mid 20s occurred as late as March 22. A winter storm that formed over Alabama and east Tennessee March 18-19 produced the most notable period of sustained strong winds of the year. Daily and 15-minute average wind speeds of 16 miles per hour (mph) and 26.6 mph, respectively, were recorded at the Central Climatology meteorological tower.

Temporary shifts in the prevailing atmospheric circulation pattern brought relatively hot weather on two occasions—mid-May and late June through early July. The hottest temperature of the year, 100°F, was recorded July 2. Otherwise, summer temperatures remained exceptionally cool. The average temperature for the months of June, July, and August was 3.0°F below the 30-year average for that three-month period. The average temperature for August, 76.0°F, was the second lowest since 1964. High temperatures during the summer reached 90°F or higher on only 36 days, less than 50% of the annual average total of 76 days.

The unusually cool weather continued through the fall months (September-November). The average temperature for the fall was the second lowest since 1964, 3.6°F below the 30-year average for this three-month period. Tropical Storm Josephine moved through eastern portions of Georgia and South Carolina on October 8, producing a total rainfall at SRS of about 1.8 inches. The highest wind recorded during the passage of this storm was 19.8 mph with a gust of 35 mph. Other than the heavy rains occurring with Josephine, the fall months were relatively dry.

A somewhat permanent shift northward in the polar jet toward the end of the year resulted in a return to near average temperatures and rainfall for December.

Detailed Summaries by Variable

Temperature

Figure 2 shows a plot of 1996 daily minimum and maximum temperature. Annual and monthly average temperatures for the 30-year period 1967-96 are summarized in Table 2 and plotted in Figures 3 and 4.

Temperatures for 1996 ranged from a minimum of 10°F, observed on the morning of February 5, to a maximum of 100°F, observed on the afternoon of July 2. The average temperature for 1996 was 62.2°F, which is about 2.5 degrees below the average for the 30-year period 1967-96.

(Note that monthly and annual average temperatures for 1967-94, summarized in Table 2 and Figures 3 and 4, should be considered approximate values, as they are based on averages of observed daily minima and maxima at the 773-A instrument shelter. The average temperatures

given for 1995-96 are based on a near continuous record of 15-minute values at the Climatology Site.)

July was the warmest month of the year with an average daily maximum of 90.2°F and an average daily minimum of 71.1°F; January was the coldest month with an average daily high of 57.0°F and an average daily low of 35.4°F. Monthly average temperatures for 1996 were below their respective 30-year averages for each month except February and May. March, April, and the four-month period August through November was particularly cool with monthly average temperatures generally more than 3°F below 30-year mean values. High temperatures greater than 90°F were observed on only 36 days during the year (see Figure 5). The average number of days per year with temperatures equal to or exceeding 90°F is 74. Nearly half of the total 'hot' days for 1996 occurred in July (17 of 36 days). Minimum temperatures below 32°F were observed on 54 days, well above the 30-year mean of 37 'freeze days' per year.

Precipitation

Daily precipitation for 1996 is summarized graphically in Figure 6. Annual and monthly rainfall since 1967 is summarized in Table 3 and plotted in Figures 7 and 8, respectively.

Rainfall of 0.01 inches or more was observed on 121 days during the year. The maximum 24-hour rainfall was 2.47 inches on July 5. Daily rainfall in excess of 2 inches occurred on July 5 and August 25.

Total precipitation for 1996 was 48.7 inches, which is about 0.8 inches below the average annual precipitation over the 30-year period 1967-96. Above average rainfall was recorded in four of the 12 months (March and July through September). Rainfall totals for March (7.27 inches) and August (7.70 inches) were the fifth and sixth highest, respectively, over the period of record 1952-96.

Relative Humidity

A plot of daily minimum and maximum relative humidity is shown in Figure 9. Annual average relative humidity and monthly average minimum relative humidity, is plotted in figures 10 and 11, respectively.

Note: Relative humidity is defined as the ratio of the vapor pressure of water in the ambient air to the saturation vapor pressure. As the ambient temperature cools to the dew point temperature (assuming constant pressure), morning values of relative humidity can often approach 100%, even when the moisture content of the atmosphere

is relatively low. Therefore, daily minima of relative humidity are emphasized in the following discussion, as a more meaningful indicator of prevailing atmospheric moisture.

The lowest relative humidity observed in 1996 was 14% March 13, associated with a strong high pressure over the southeast U.S. Daily minimum relative humidity was frequently less than 30% during the winter and spring months but rarely below 40% during the summer and early fall.

The average relative humidity for 1996 was 69%, slightly higher than the average value of 68% for the 30-year period 1967-96. The average daily maximum for 1996 was 88%, and the average daily minimum was 44%. Monthly average relative humidity ranged from 57% in April to 81% in August. The monthly averages of daily minimum relative humidity were below 30-year means in April, November, and December and greater than the 30-year means in July through October.

Wind

A plot of daily average wind speed for 1996 is shown in Figure 12. The annual average wind speed for 1996 was 6.1 mph (measured at an elevation of 58 feet above ground). Monthly average speeds ranged from 7.7 mph in March to 4.3 mph in August. A winter storm that formed over Alabama and east Tennessee March 18-19 produced the most notable period of sustained strong winds. Daily and 15-minute average wind speeds of 16 miles per hour (mph) and 26.6 mph, respectively, were recorded at the Central Climatology meteorological tower. The maximum instantaneous gust for the year, 50 mph, occurred during a thunderstorm on July 15.

Annual and seasonal wind rose plots for wind data collected at the 200-foot level of the Central Climatology tower are shown in figures 13 and 14, respectively. Annual and seasonal wind roses for a five-year data set, 1987-91, are shown in Figures 13 and 15, respectively. (The five-year wind rose data set is comprised primarily of measurements from the H-Area tower, approximately three miles northeast of Central Climatology).

The annual wind rose for 1996 shows west and west-southwest winds occurred about 2% more often, and northeast and east-northeast winds occurred about 2% less often than were observed during the five-year period 1987-91 (Figure 13). These anomalies were due primarily to a series of strong polar high pressure areas that affected the southeast U.S. during the winter and spring months.

The annual average wind speed at the 200-foot level of the Climatology tower was 9.5 mph, slightly higher than the five-year average of 8.7 mph.

Wind roses for the A-, C-, D-, and F-Area towers and for the H-, K-, L-, and P-Area towers are shown in Figures 16 and 17, respectively. Wind roses for each of the area towers are similar, except for the D-Area tower. Since the D Area is located in the Savannah River valley, channeling of the wind by nearby higher terrain to the northeast and southwest resulted in slightly higher frequencies of northwest and southeasterly winds than was observed at the other towers. Annual average wind speeds for the area towers ranged from 7.9 mph at the D-Area tower to 9.7 mph at the C-Area tower. The frequency statistics used to generate the wind rose plots in Figures 13-17 are summarized in Appendix A.

Barometric Pressure

Average barometric pressure for 1996 was 1006.1 millibars(mb). The lowest daily average value, 981 mb, occurred on October 8 as the remnants of tropical storm Josephine moved to the east of the site. The highest daily average value, 1028 mb, occurred on March 10 during the passage of a strong Arctic high pressure. Daily average barometric pressure is plotted in Figure 18. The greatest variability in daily average pressure occurred in January through March and again in November through December.

Solar Radiation

The average daily total solar radiation for the year was 388 langley's per day (ly/day). Monthly average daily values ranged from 575 ly/day in May to 223 ly/day in January and December. A comparison of observed daily solar radiation to a theoretical, clear sky maximum was performed to infer relative cloudiness. The theoretical values were estimated from tables in Budyko (1974). April was the 'sunniest' month with an observed average daily solar radiation of 76% of the theoretical maximum for the month. January was the 'cloudiest' month with an observed average daily solar radiation of 52% of the theoretical maximum. Daily total solar radiation is plotted in Figure 19.

References

- Budyko, M. I., *Climate and Life*, Academic Press, New York, New York (1974).
- Hoel, D. D., *Climatology of the Savannah River Plant Site*, DP-1679, E. I. du Pont de Nemours (1984).
- Hunter, C. H., *A Climatological Description of the Savannah River Site*, WSRC-RP-89-313, Westinghouse Savannah River Company (1990).
- Kurzeja, R. J., *The Savannah River Technology Center Research and Development Climatology Center*, WSRC-TR-93-596, WSRC (1993).
- National Atmospheric and Atmospheric Administration (NOAA), *Daily Weather Maps for 1995*, Climate Analysis Center, Washington, DC.
- Oliver, J. E., and R. W. Fairbridge, ed., *The Encyclopedia of Climatology*, Von Nostrand Reinhold, New York, NY (1987).
- Parker, M. J., and R. P. Addis, *SRS Meteorological Monitoring Program*, WSRC-TR-93-0106, WSRC (1994).
- Weber, A. H., *Comparison of Savannah River Site's Meteorological Databases*, WSRC-RP-93-269, WSRC (1993).

Table 1. Means and Extremes of SRS Meteorological Data for 1996

Month	Temperatures (°F)												Precipitation (in)						
	Average				Extremes				Number of Days				Total	Departure	Greatest in 24 hrs	Date	No. of Days		
	Daily Maximum	Daily Minimum	Month	Departure	Highest	Date	Lowest	Date	Maximum ≥ 90 °F	Maximum ≥ 100 °F	Minimum ≤ 32 °F	Minimum ≤ 20 °F					≥ 0.01 in.	≥ 0.1 in.	≥ 0.5 in.
Jan	57.0	35.4	44.6	-1.2	70	18th	21	8th			15		3.97	-0.47	1.18	27th	11	9	2
Feb	61.3	40.7	50.1	+1.0	83	26th	10	5th			9	1	2.71	-1.54	1.35	28th	6	4	2
Mar	62.4	41.1	50.6	-6.4	77	26th	19	9th			8	1	7.27	+2.44	1.69	7th	15	9	6
Apr	74.6	50.0	61.6	-3.2	86	20th	30	10th			1		2.62	-0.40	1.72	30th	8	7	1
May	86.2	61.5	72.9	+0.8	96	19th	40	1st	9				3.31	-0.55	0.90	25th	6	5	4
Jun	88.1	66.5	76.5	-2.3	97	23rd	52	1st	8				3.36	-1.17	1.01	8th	12	8	3
Jul	90.2	71.1	79.3	-2.4	100	2nd	66	13th	17	1			6.24	+0.67	2.47	5th	14	8	4
Aug	86.0	69.2	76.0	-4.3	90	5th	63	22nd	1				7.70	+2.26	2.00	25th	15	8	5
Sep	83.3	64.5	72.7	-2.7	90	9th	52	14th	1				4.03	+0.40	1.09	10th	12	10	2
Oct	74.0	52.2	62.1	-3.5	85	28th	34	20th					2.35	-1.05	1.68	8th	5	4	1
Nov	64.8	41.3	51.6	-4.6	79	1st	28	29th			10		1.65	-1.24	0.95	8th	6	4	1
Dec	61.3	38.8	48.8	-0.3	77	31st	18	21st			11	1	3.49	-0.10	1.26	1st	11	7	3
Year	74.2	52.8	62.2	-2.5	100	7/2	10	2/5	36	1	54	3	48.70	-0.76	2.47	7/5	121	83	34

Table 1. Means and Extremes of SRS Meteorological Data for 1996 (cont'd)

Monthly Average	Wind Speed (mph)				Barometric Pressure (mb)					Solar Radiation (ly)					Relative Humidity (%)					
	Month	Max 15-min Average	Max Instantaneous	Date	Average	Lowest	Date	Highest	Date	Average Daily Total	% of Theoretical Max	Minimum Daily Total	Date	Maximum Daily Total	Date	Avg. Daily Maximum	Avg. Daily Minimum	Monthly	Lowest	Date
Jan	7.2	24.5	42	19th	1006.9	987	2nd	1020	28th	223	0.52	23	7th	349	20th	86	49	70	23	9th
Feb	7.6	25.9	45	12th	1003.2	992	15th	1015	7th	288	0.59	53	2nd	445	10th	82	43	64	21	11th
Mar	7.7	26.6	47	19th	1006.2	983	19th	1028	10th	348	0.58	53	17th	602	23rd	82	40	62	14	13th
Apr	7.0	23.1	43	20th	1004.8	995	1st	1013	22nd	525	0.76	57	6th	694	25th	80	31	57	17	24th
May	5.8	23.2	39	27th	1004.7	987	28th	1015	15th	575	0.75	219	13th	716	12th	85	39	63	26	21st
Jun	4.9	17.9	39	8th	1005.5	997	10th	1016	1st	560		379	19th	686	27th	92	44	71	31	28th
Jul	6.2	22.7	50	15th	1004.8	992	3rd	1014	17th	483	0.62	82	5th	670	4th	92	49	74	28	4th
Aug	4.3	22.6	33	8th	1006.9	999	12th	1014	20th	429	0.60	250	9th	555	21st	96	57	81	41	21st
Sep	5.3	17.7	39	28th	1002.9	995	13th	1014	30th	406	0.66	56	30th	566	14th	96	51	78	31	13th
Oct	5.5	19.8	35	8th	1007.1	981	8th	1018	27th	334	0.65	45	7th	468	12th	94	49	75	26	24th
Nov	5.9	20.2	34	26th	1011.5	995	21st	1026	15th	260	0.63	94	30th	393	3rd	87	43	67	25	13th
Dec	5.4	24.1	49	13th	1009.6	993	7th	1023	21st	223	0.63	24	1st	315	2nd	88	45	70	25	8th
Year	6.1	26.6	50	7/15	1006.1	981	10/8	1028	3/10	388	0.65	23	1/7	716	5/22	88	45	69	14	3/13

Table 2. Monthly and Annual Average and Extreme Temperatures, 1967-96

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1967	49.0	45.5	59.9	67.9	69.9	75.6	78.5	78.2	70.6	64.0	53.2	53.6	63.8
1968	43.5	43.4	57.1	66.5	71.3	80.0	83.1	82.8	77.0	67.0	55.4	45.9	64.4
1969	46.5	46.6	51.5	64.5	70.5	80.3	83.3	77.6	72.8	66.1	52.1	45.4	63.1
1970	39.0	47.2	55.9	66.8	74.2	79.0	81.1	80.8	78.6	67.0	51.6	49.3	64.2
1971	44.6	46.4	49.5	63.4	70.7	81.3	80.7	80.4	75.2	70.2	55.5	56.9	64.6
1972	51.7	45.6	57.6	67.4	72.4	75.3	79.7	80.6	77.2	64.8	54.4	53.2	65.0
1973	46.1	45.9	60.7	61.9	70.5	77.7	79.1	74.5	70.5	62.4	59.0	50.3	63.2
1974	59.6	50.8	62.2	66.2	75.3	77.5	81.5	80.9	75.3	64.5	56.6	49.0	66.6
1975	51.4	53.2	55.8	63.9	75.6	79.1	79.7	82.4	75.7	68.7	59.3	48.5	66.1
1976	44.2	55.7	61.5	64.8	68.9	75.6	80.4	78.0	73.1	60.1	48.7	44.8	63.0
1977	35.3	47.1	60.0	66.9	73.3	80.6	83.6	80.6	77.9	62.1	58.2	46.7	64.4
1978	39.3	41.3	54.2	65.7	70.9	79.7	82.1	81.2	77.1	65.6	60.7	49.6	64.0
1979	42.1	44.6	57.5	64.5	71.3	75.1	79.6	80.5	73.4	64.8	57.4	47.4	63.2
1980	45.9	44.3	52.6	63.5	71.2	78.3	83.8	82.5	79.2	62.7	52.8	46.0	63.6
1981	40.4	48.5	53.0	67.0	68.6	81.3	81.3	76.3	74.0	62.1	54.4	43.2	62.5
1982	43.0	50.0	58.9	62.4	75.7	78.8	80.9	80.1	75.0	66.2	58.7	54.8	65.4
1983	43.3	48.0	55.3	59.4	66.8	76.7	84.3	83.9	74.8	67.2	56.4	45.8	63.5
1984	45.0	51.7	56.5	62.6	71.9	80.1	80.1	80.8	74.0	73.4	53.4	56.9	65.5
1985	42.9	49.5	60.2	67.5	74.5	80.8	81.1	79.7	75.7	70.8	65.5	45.4	66.1
1986	45.4	54.6	57.9	66.4	74.4	82.7	86.9	80.1	78.4	67.1	61.3	49.3	67.0
1987	46.2	48.6	56.5	62.3	74.5	79.9	82.8	83.8	76.6	60.7	59.1	52.9	65.3
1988	42.3	47.8	56.8	64.2	70.4	76.8	81.6	81.4	75.4	61.2	58.0	49.1	63.8
1989	52.2	52.0	58.3	64.2	70.6	78.8	81.4	80.9	75.3	67.3	52.4	44.2	64.9
1990	54.9	57.5	60.0	64.0	72.9	80.5	83.7	83.8	79.0	69.4	59.9	54.6	68.3
1991	47.9	54.1	60.3	69.2	76.9	79.5	83.6	81.2	77.4	68.1	55.4	54.0	67.3
1992	49.5	54.1	57.2	65.0	71.2	78.9	83.7	80.7	76.9	65.0	57.1	48.0	65.6
1993	51.7	47.8	53.2	58.9	69.7	78.2	83.6	80.0	75.2	62.8	55.2	43.6	63.3
1994	41.5	50.1	60.2	68.0	71.2	82.3	81.8	81.2	77.4	67.2	62.3	53.3	66.4
1995	45.5	49.9	58.6	65.9	73.5	75.0	79.9	79.0	71.8	65.9	50.8	43.8	63.3
1996	44.6	50.1	50.6	61.6	72.9	76.5	79.3	76.0	72.7	62.1	51.6	48.8	62.2
Avg	45.8	49.1	57.0	64.8	72.1	78.8	81.7	80.3	75.4	65.6	56.2	49.1	64.7
Lowest Mon	35.3	41.3	49.5	58.9	66.8	75.0	78.5	74.5	70.5	60.1	48.7	43.2	62.2
Yr Lowest	1977	1978	1971	1993	1983	1995	1967	1973	1973	1976	1976	1981	1996
Rec Low	-3	10	11	29	38	48	56	56	41	28	18	5	-3
Yr Rec	1985	1996	1980	1983	1989	1984	1963	1986	1967	1976	1970	1962	1985
Highest Mon	59.6	57.5	62.2	69.2	76.9	82.7	86.9	83.9	79.2	73.4	65.5	56.9	68.3
Yr Highest	1974	1990	1974	1991	1991	1986	1986	1983	1980	1984	1985	1971	1990
Rec High	86	86	90	99	102	105	107	107	104	96	89	82	107
Yr Rec	1975	1989	1974	1986	1963	1985	1986	1983	1990	1986	1974	1984	1986

Table 3. Monthly and Annual Rainfall, 1967-96

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1967	3.66	3.80	5.68	2.82	5.01	3.74	7.52	7.32	1.70	0.64	2.51	3.13	47.53
1968	3.98	0.94	1.49	2.12	3.46	6.20	3.88	4.27	2.24	3.00	3.39	2.73	37.70
1969	2.00	2.46	3.38	4.09	3.02	3.95	2.71	5.42	4.56	1.16	0.40	4.19	37.34
1970	2.79	2.69	7.36	1.38	4.16	3.46	4.85	3.79	1.71	5.01	1.68	4.92	43.80
1971	5.11	4.16	8.68	2.92	2.98	5.92	10.53	8.76	3.80	5.95	2.31	2.89	64.01
1972	8.91	4.42	2.82	0.57	4.72	6.57	2.64	6.05	1.47	1.20	3.56	5.23	48.16
1973	5.36	5.26	6.38	4.58	3.50	10.89	6.04	3.81	3.71	1.22	0.31	4.64	55.70
1974	2.58	7.03	2.87	2.93	4.15	2.79	4.08	6.27	3.22	0.08	2.19	3.83	42.02
1975	4.98	6.64	5.91	4.42	5.15	3.84	8.55	3.83	5.18	1.74	3.41	2.03	55.68
1976	4.18	1.08	3.83	2.50	10.90	4.35	1.95	1.64	5.48	4.92	4.19	5.08	50.10
1977	3.72	1.62	6.86	1.27	1.79	2.47	3.42	7.30	5.50	4.27	1.63	3.86	43.71
1978	10.02	1.32	3.07	3.53	3.64	3.43	4.12	5.11	4.06	0.06	3.54	1.88	43.78
1979	3.59	7.74	3.09	6.49	8.94	1.54	7.85	2.12	6.13	1.35	3.95	2.17	54.96
1980	5.12	3.48	10.96	1.69	3.49	2.99	0.90	2.03	5.86	2.14	2.50	1.91	43.07
1981	0.89	5.02	4.72	2.07	6.90	4.29	3.97	5.79	0.54	2.81	1.00	9.55	47.55
1982	3.94	4.45	2.50	5.68	2.72	4.27	11.48	5.00	4.62	3.87	2.40	4.83	55.76
1983	3.77	7.21	6.77	5.77	1.67	6.57	4.85	6.32	3.56	1.92	5.38	4.15	57.94
1984	3.51	7.09	6.05	8.00	9.79	2.54	7.28	5.52	0.60	0.31	0.90	1.38	52.97
1985	3.01	6.91	1.31	0.84	1.70	4.61	8.10	4.37	0.49	6.34	6.36	2.48	46.52
1986	1.46	3.56	4.08	1.44	3.83	3.00	2.96	10.89	1.54	4.18	5.82	5.82	48.58
1987	7.39	7.55	4.97	0.69	3.57	5.64	4.86	4.92	3.55	0.29	2.74	1.41	47.58
1988	4.15	3.18	2.90	4.78	2.85	7.11	1.78	6.77	4.40	3.39	2.16	2.91	46.38
1989	1.42	3.59	5.52	4.89	2.60	6.67	11.46	3.27	4.87	3.35	2.99	4.41	55.04
1990	3.07	2.38	2.37	1.21	2.95	0.89	7.31	8.07	0.62	19.62	3.11	1.57	53.17
1991	7.03	1.84	5.44	4.73	3.06	2.17	7.89	9.26	4.40	0.99	1.55	3.32	51.68
1992	4.45	3.89	2.98	2.40	1.34	6.27	3.69	4.84	6.38	3.11	7.78	2.86	49.99
1993	7.45	3.62	8.37	1.75	1.43	3.27	3.12	2.48	7.29	4.13	1.87	1.81	46.59
1994	4.80	3.91	6.42	1.04	1.45	5.08	7.47	3.47	1.67	10.01	3.05	4.62	52.99
1995	6.95	7.97	0.91	1.28	1.77	8.15	5.71	6.92	5.75	2.64	2.38	4.47	54.90
1996	3.97	2.71	7.27	2.62	3.31	3.36	6.24	7.70	4.03	2.35	1.65	3.49	48.70
Avg	4.44	4.25	4.83	3.02	3.86	4.53	5.57	5.44	3.63	3.40	2.89	3.59	49.46
Max	10.02	7.97	10.96	8.20	10.90	10.89	11.48	12.34	8.71	19.62	7.78	9.55	73.47
Yr Max	1978	1995	1980	1961	1976	1973	1982	1964	1959	1990	1992	1981	1964
Min	0.89	0.94	0.91	0.57	1.31	0.89	0.90	1.04	0.49	0.06	0.21	0.46	28.82
Yr Min	1981	1968	1995	1972	1965	1990	1980	1963	1985	1963	1958	1955	1954

FIGURE 2. 1996 DAILY HIGH AND LOW TEMPERATURES

FIGURE 3. SRS ANNUAL AVERAGE TEMPERATURE 1967-1996 **FIGURE 4. SRS MONTHLY AVERAGE TEMPERATURE**

FIGURE 5. NUMBER OF FREEZING ($\leq 32^{\circ}\text{F}$) AND SWELTERING ($\geq 90^{\circ}\text{F}$) DAYS

FIGURE 6. 1996 SRTC DAILY PRECIPITATION

FIGURE 7. SRS ANNUAL PRECIPITATION 1967-1996

FIGURE 8. SRS MONTHLY PRECIPITATION

FIGURE 9. 1996 DAILY HIGH AND LOW HUMIDITY

FIGURE 10. SRS ANNUAL AVERAGE HUMIDITY 1967-1996

FIGURE 11. SRS MONTHLY AVERAGE MINIMUM HUMIDITY

FIGURE 12. 1996 DAILY AVERAGE WIND SPEED

FIGURE 13. Annual Wind Roses, 1996 and 1987-91

Note: directions are compass sector from which the wind blows

FIGURE 14. Seasonal Wind Rose:

NOTE: Directions are compass sectors from which the wind blows.

FIGURE 15. Seasonal Wind Rose, 1987-91

Note: Directions are compass sector from which the wind blows.

Figure 16. Annual Wind Roses for A, B, D, and F Towers

NOTE: Directions are compass sectors from which the wind blows.

Figure 17. Annual Wind Roses for H, K, L, and P Towers, 1996

FIGURE 18. 1996 DAILY AVERAGE BAROMETRIC PRESSURE

FIGURE 19. 1996 DAILY SOLAR RADIATION

M9300379.01 SRS

Attachment A. Map of the Savannah River Site Showing the Location of the Meteorological Towers

Appendix A. Joint Frequency Tables of Wind Speed by Wind Direction

Appendix A-1. Occurrence Frequencies of Wind Direction Sector by Wind Speed Category for 1996, Central Climatology Tower, 61- Meters

Direction	0-2 m/s	2-4 m/s	4-6 m/s	6-8 m/s	8-12 m/s	>12 m/s	TOTAL
N	.00596	.01329	.01098	.00271	.00054	.00000	.03348
NNE	.00662	.01910	.01829	.00605	.00144	.00000	.05149
NE	.00635	.02563	.02948	.00857	.00063	.00000	.07065
ENE	.00677	.02430	.02346	.00689	.00057	.00000	.06199
E	.00734	.02376	.02145	.00244	.00003	.00009	.05510
ESE	.00752	.01726	.01772	.00168	.00003	.00003	.04424
SE	.00743	.01627	.01928	.00256	.00018	.00000	.04572
SSE	.00725	.02048	.02891	.00731	.00153	.00000	.06548
S	.00680	.02463	.03444	.00782	.00138	.00000	.07507
SSW	.00614	.02740	.02665	.00782	.00096	.00000	.06897
SW	.00638	.03032	.03697	.01116	.00129	.00003	.08614
WSW	.00611	.03104	.04265	.01612	.00454	.00015	.10061
W	.00502	.02933	.03706	.01714	.00914	.00039	.09808
WNW	.00529	.02099	.02539	.01065	.00626	.00012	.06870
NW	.00755	.01874	.01308	.00208	.00069	.00003	.04217
NNW	.00722	.01558	.00731	.00190	.00009	.00000	.03209
TOTAL	.10572	.35814	.39309	.11288	.02933	.00084	1.00000

**Appendix A-2. Occurrence Frequencies of Wind Direction Sector by Wind Speed Category - 1987-91,
H-Area Tower (supplemented), 61-m Level**

Direction	0-2 m/s	2-4 m/s	4-6 m/s	6-8 m/s	8-12 m/s	>12 m/s	TOTAL
N	.00511	.01497	.01041	.00121	.00007	.00000	.03176
NNE	.00614	.02480	.02426	.00365	.00043	.00000	.05928
NE	.00653	.04425	.03601	.00381	.00030	.00000	.09089
ENE	.00646	.04050	.02677	.00180	.00005	.00000	.07558
E	.00584	.02843	.01812	.00046	.00005	.00000	.05289
ESE	.00536	.02608	.01488	.00082	.00005	.00000	.04719
SE	.00602	.02562	.01814	.00089	.00000	.00000	.05068
SSE	.00559	.02690	.02779	.00294	.00037	.00000	.06360
S	.00589	.03254	.03674	.00507	.00062	.00000	.08085
SSW	.00536	.03135	.02759	.00399	.00087	.00000	.06916
SW	.00657	.03560	.03144	.00436	.00064	.00000	.07861
WSW	.00561	.04128	.03354	.00500	.00078	.00002	.08623
W	.00641	.03569	.02759	.00682	.00228	.00000	.07879
WNW	.00607	.02809	.02250	.00719	.00240	.00002	.06627
NW	.00557	.01898	.01009	.00201	.00027	.00000	.03692
NNW	.00605	.01695	.00723	.00089	.00018	.00000	.03176
TOTAL	.09458	.47205	.37308	.05091	.00934	.00005	1.00000

Appendix A-3. Occurrence Frequencies of Wind Direction Sect by Wind Speed Category for the Winter 1996, Central Climatology Tower, 61-m Level

Direction	0-2 m/s	2-4 m/s	4-6 m/s	6-8 m/s	8-12 m/s	<12 m/s	TOTAL
N	.00258	.00674	.00754	.00218	.00020	.00000	.01924
NNE	.00198	.01250	.01706	.00476	.00000	.00000	.03630
NE	.00258	.02063	.01904	.00099	.00000	.00000	.04324
ENE	.00377	.02916	.02896	.01071	.00020	.00000	.07280
E	.00218	.03194	.03075	.00595	.00000	.00000	.07082
ESE	.00278	.01845	.01587	.00218	.00000	.00000	.03928
SE	.00317	.00893	.01904	.00417	.00119	.00000	.03650
SSE	.00397	.01071	.00913	.00694	.00674	.00000	.03749
S	.00417	.01547	.02162	.01032	.00516	.00000	.05673
SSW	.00298	.01468	.00952	.01012	.00139	.00000	.03868
SW	.00298	.01845	.05257	.02619	.00000	.00000	.10018
WSW	.00198	.02539	.06546	.04245	.01012	.00000	.14541
W	.00198	.02162	.04285	.04086	.02519	.00079	.13331
WNW	.00139	.02539	.03769	.02420	.01528	.00060	.10454
NW	.00397	.01627	.01587	.00536	.00337	.00000	.04483
NNW	.00317	.01091	.00536	.00119	.00000	.00000	.02063
TOTAL	.04563	.28724	.39833	.19857	.06884	.00139	1.00000

Appendix A-4. Occurrence Frequencies of Wind Direction Sector by Wind Speed Category for the Spring 1996, Central Climatology Tower, 61-m Level

Direction	0-2 m/s	2-4 m/s	4-6 m/s	6-8 m/s	8-12 m/s	<12 m/s	TOTAL
N	.00385	.01215	.01528	.00216	.00084	.00000	.03428
NNE	.00541	.01227	.01612	.00890	.00180	.00000	.04450
NE	.00529	.01034	.01732	.00890	.00084	.00000	.04270
ENE	.00517	.01371	.01311	.00782	.00180	.00000	.04162
E	.00794	.01479	.01119	.00204	.00012	.00036	.03644
ESE	.00589	.01227	.01191	.00265	.00000	.00012	.03284
SE	.00469	.01299	.01756	.00337	.00000	.00000	.03861
SSE	.00313	.01600	.04330	.00926	.00096	.00000	.07265
S	.00277	.02045	.05376	.00986	.00060	.00000	.08744
SSW	.00421	.02682	.04258	.01455	.00229	.00000	.09045
SW	.00493	.02718	.04222	.01516	.00373	.00012	.09334
WSW	.00469	.02682	.04847	.01961	.00926	.00060	.10945
W	.00421	.02875	.04065	.01780	.01227	.00096	.10464
WNW	.00517	.02117	.03199	.01083	.00962	.00000	.07878
NW	.00674	.02201	.01660	.00241	.00012	.00000	.04787
NNW	.00770	.02321	.01034	.00301	.00012	.00000	.04438
TOTAL	.08179	.30094	.43240	.13832	.04438	.00216	1.00000

Appendix A-5. Occurrence Frequencies of Wind Direction Sector by Wind Speed Category for the Summer 1996, Central Climatology Tower, 61-m Level

Direction	0-2 m/s	2-4 m/s	4-6 m/s	6-8 m/s	8-12 m/s	<12 m/s	TOTAL
N	.00622	.00576	.00345	.00299	.00046	.00000	.01889
NNE	.00622	.01221	.00737	.00415	.00081	.00000	.03075
NE	.00610	.02476	.02522	.00760	.00000	.00000	.06369
ENE	.00806	.03133	.02211	.00265	.00000	.00000	.06415
E	.00818	.03017	.02142	.00115	.00000	.00000	.06092
ESE	.00910	.02269	.01831	.00058	.00000	.00000	.05067
SE	.01025	.02511	.01474	.00196	.00000	.00000	.05206
SSE	.01221	.03282	.02948	.00357	.00012	.00000	.07820
S	.01071	.04261	.03616	.00161	.00023	.00000	.09133
SSW	.00806	.04964	.03040	.00104	.00023	.00000	.08937
SW	.00864	.05908	.04653	.00323	.00012	.00000	.11759
WSW	.01060	.05447	.04952	.00633	.00092	.00000	.12185
W	.00806	.04088	.02937	.00518	.00012	.00000	.08361
WNW	.00714	.02084	.00875	.00173	.00012	.00012	.03870
NW	.00691	.01290	.00265	.00035	.00012	.00000	.02292
NNW	.00518	.00703	.00230	.00069	.00012	.00000	.01532
TOTAL	.13164	.47230	.34781	.04480	.00334	.00012	1.00000

Appendix A-6. Occurrence Frequencies of Wind Direction Sector by Wind Speed Category for the Fall 1996, Central Climatology Tower, 61-m Level

Direction	0-2 m/s	2-4 m/s	4-6 m/s	6-8 m/s	8-12 m/s	>12 m/s	TOTAL
N	.01007	.02390	.01735	.00400	.00061	.00000	.05594
NNE	.01201	.03737	.03228	.00752	.00316	.00000	.09234
NE	.01007	.04393	.04890	.01420	.00170	.00000	.11880
ENE	.00813	.02755	.02961	.00680	.00036	.00000	.07244
E	.00862	.02318	.02912	.00133	.00000	.00000	.06225
ESE	.01116	.01796	.02488	.00158	.00012	.00000	.05570
SE	.00959	.01711	.02876	.00182	.00000	.00000	.05727
SSE	.00752	.02208	.02876	.00886	.00012	.00000	.06735
S	.00825	.01662	.01990	.00510	.00049	.00000	.05036
SSW	.00667	.01408	.00983	.00303	.00036	.00000	.03398
SW	.00789	.01505	.01699	.00510	.00012	.00000	.04514
WSW	.00510	.01456	.02245	.01092	.00121	.00000	.05424
W	.00534	.02026	.02985	.01614	.00534	.00000	.07693
WNW	.00631	.01796	.02755	.01007	.00316	.00000	.06504
NW	.00983	.02269	.01929	.00146	.00000	.00000	.05327
NNW	.01031	.01529	.01031	.00303	.00000	.00000	.03895
TOTAL	.13688	.34959	.39582	.10096	.01675	.00000	1.00000

Appendix A-7. Occurrence Frequencies of Wind Direction Sector by Wind Speed Category - Winter 1987-91, H-Area Tower (supplemented), 61-m Level

Direction	0-2 m/s	2-4 m/s	4-6 m/s	6-8 m/s	8-12 m/s	>12 m/s	TOTAL
N	.00553	.01520	.01042	.00159	.00000	.00000	.03274
NNE	.00765	.03189	.02540	.00181	.00000	.00000	.06675
NE	.00861	.05028	.03784	.00255	.00021	.00000	.09949
ENE	.00648	.02817	.02211	.00149	.00000	.00000	.05825
E	.00638	.01956	.01201	.00043	.00000	.00000	.03837
ESE	.00606	.01966	.00925	.00011	.00000	.00000	.03508
SE	.00627	.01552	.01297	.00021	.00000	.00000	.03497
SSE	.00404	.01818	.02179	.00234	.00000	.00000	.04634
S	.00468	.02360	.04326	.00733	.00085	.00000	.07972
SSW	.00500	.02583	.03008	.00617	.00244	.00000	.06952
SW	.00659	.02838	.03848	.00723	.00064	.00000	.08131
WSW	.00521	.03370	.04156	.00670	.00117	.00000	.08833
W	.00563	.03635	.03922	.01116	.00468	.00000	.09705
WNW	.00627	.03646	.03083	.01201	.00404	.00011	.08971
NW	.00532	.02434	.01403	.00340	.00074	.00000	.04783
NNW	.00521	.02083	.00797	.00053	.00000	.00000	.03454
TOTAL	.09492	.42793	.39722	.06505	.01477	.00011	1.00000

**Appendix A-8. Occurrence Frequencies of Wind Direction Sector by Wind Speed Category-Spring
1987-91, H-Area Tower (supplemented), 61-m Level**

Direction	0-2 m/s	2-4 m/s	4-6 m/s	6-8 m/s	8-12 m/s	>12 m/s	TOTAL
N	.00362	.01449	.01033	.00081	.00000	.00000	.02926
NNE	.00417	.01884	.02201	.00272	.00009	.00000	.04783
NE	.00408	.02853	.02554	.00272	.00009	.00000	.06096
ENE	.00552	.03143	.02274	.00100	.00009	.00000	.06078
E	.00417	.02482	.01812	.00027	.00000	.00000	.04737
ESE	.00435	.02364	.01993	.00217	.00000	.00000	.05009
SE	.00507	.02926	.02473	.00199	.00000	.00000	.06105
SSE	.00489	.03442	.04312	.00652	.00127	.00000	.09022
S	.00580	.03324	.04601	.00770	.00109	.00000	.09384
SSW	.00552	.02880	.03360	.00471	.00045	.00000	.07310
SW	.00462	.03207	.03768	.00697	.00145	.00000	.08279
WSW	.00435	.03360	.03505	.00716	.00127	.00000	.08143
W	.00471	.03542	.02609	.00815	.00308	.00000	.07745
WNW	.00507	.02600	.02699	.01105	.00399	.00000	.07310
NW	.00435	.01712	.01259	.00245	.00000	.00000	.03650
NNW	.00562	.01839	.00969	.00036	.00018	.00000	.03424
TOTAL	.07591	.43007	.41422	.06676	.01304	.00000	1.00000

Appendix A-9. Occurrence Frequencies of Wind Direction Sector by Wind Speed Category-Summer 1987-91, H-Area Tower (supplemented), 61-m Level

Direction	0-2 m/s	2-4 m/s	4-6 m/s	6-8 m/s	8-12 m/s	>12 m/s	TOTAL
N	.00707	.01205	.00272	.00036	.00000	.00000	.02219
NNE	.00743	.02174	.01087	.00045	.00000	.00000	.04049
NE	.00888	.04112	.01232	.00063	.00000	.00000	.06295
ENE	.00815	.04203	.01404	.00063	.00000	.00000	.06486
E	.00752	.03496	.01069	.00045	.00009	.00000	.05371
ESE	.00670	.03813	.01196	.00027	.00000	.00000	.05707
SE	.00824	.03496	.01341	.00027	.00000	.00000	.05688
SSE	.00806	.03804	.02554	.00054	.00000	.00000	.07219
S	.00978	.05462	.03460	.00127	.00009	.00000	.10036
SSW	.00833	.05643	.02917	.00217	.00018	.00000	.09629
SW	.01015	.06295	.02817	.00072	.00018	.00000	.10217
WSW	.00806	.07237	.02591	.00172	.00000	.00000	.10806
W	.00833	.04764	.01685	.00054	.00000	.00000	.07337
WNW	.00806	.02563	.01005	.00036	.00018	.00000	.04429
NW	.00652	.01486	.00245	.00009	.00000	.00000	.02391
NNW	.00788	.01078	.00217	.00036	.00000	.00000	.02119
TOTAL	.12917	.60833	.25091	.01087	.00072	.00000	1.00000

Appendix A-10. Occurrence Frequencies of Wind Direction Sector by Wind Speed Category - Fall 1987-91, H-Area Tower (supplemented), 61-m Level

Direction	0-2 m/s	2-4 m/s	4-6 m/s	6-8 m/s	8-12 m/s	>12 m/s	TOTAL
N	.00568	.01914	.01612	.00174	.00018	.00000	.04286
NNE	.00668	.03040	.03791	.00659	.00037	.00000	.08196
NE	.00751	.06016	.05861	.00504	.00009	.00000	.13141
ENE	.00833	.05852	.04039	.00275	.00009	.00000	.11007
E	.00678	.03581	.02811	.00037	.00009	.00000	.07116
ESE	.00687	.02509	.01648	.00018	.00018	.00000	.04881
SE	.00678	.02418	.02005	.00073	.00000	.00000	.05174
SSE	.00659	.02079	.01886	.00119	.00009	.00000	.04753
S	.00531	.02308	.02180	.00275	.00027	.00000	.05321
SSW	.00467	.01804	.01465	.00229	.00046	.00000	.04011
SW	.00678	.02344	.02033	.00201	.00018	.00000	.05275
WSW	.00769	.03214	.02665	.00302	.00037	.00009	.06996
W	.00870	.02729	.02317	.00375	.00092	.00000	.06383
WNW	.00769	.02866	.01832	.00302	.00146	.00000	.05916
NW	.00760	.02115	.00925	.00119	.00027	.00000	.03947
NNW	.00714	.01950	.00733	.00146	.00055	.00000	.03599
TOTAL	.11081	.46740	.37802	.03809	.00559	.00009	1.00000

**Appendix A-11. Occurrence Frequencies of Wind Direction Sector by Wind Speed Category for 1996,
A-Area Tower, 61-m Level**

Direction	0-2 m/s	2-4 m/s	4-6 m/s	6-8 m/s	8-12 m/s	>12 m/s	TOTAL
N	.00519	.01686	.00773	.00110	.00012	.00000	.03100
NNE	.00367	.01479	.01591	.00427	.00068	.00000	.03932
NE	.00367	.02092	.03239	.01031	.00095	.00000	.06824
ENE	.00385	.02421	.03025	.00681	.00038	.00000	.06552
E	.00486	.02726	.02729	.00136	.00000	.00000	.06078
ESE	.00521	.02625	.01917	.00154	.00003	.00000	.05221
SE	.00720	.02350	.01926	.00462	.00083	.00003	.05544
SSE	.00628	.02560	.02373	.00791	.00293	.00012	.06658
S	.00581	.02376	.02658	.00578	.00139	.00003	.06335
SSW	.00510	.03369	.02901	.00613	.00065	.00003	.07462
SW	.00519	.03452	.03787	.00605	.00104	.00000	.08466
WSW	.00539	.03689	.04249	.00687	.00201	.00003	.09370
W	.00495	.03354	.03426	.01378	.00572	.00012	.09237
WNW	.00441	.02302	.02765	.01331	.00699	.00000	.07538
NW	.00516	.01467	.01882	.00439	.00122	.00006	.04430
NNW	.00462	.01381	.01162	.00169	.00015	.00000	.03188
TOTAL	.08057	.39331	.40404	.09592	.02510	.00042	.99935

**Appendix A-12. Occurrence Frequencies of Wind Direction Sector by Wind Speed Category for 1996,
C-Area Tower, 61-m Level**

Direction	0-2 m/s	2-4 m/s	4-6 m/s	6-8 m/s	8-12 m/s	>12 m/s	TOTAL
N	.00468	.01360	.00889	.00210	.00027	.00000	.02954
NNE	.00540	.01927	.01843	.00627	.00153	.00003	.05094
NE	.00579	.02786	.03756	.01579	.00141	.00000	.08841
ENE	.00753	.03065	.01960	.00201	.00012	.00000	.05992
E	.00594	.02471	.02293	.00249	.00003	.00003	.05614
ESE	.00477	.01522	.01867	.00345	.00009	.00000	.04221
SE	.00618	.01696	.02183	.00555	.00036	.00000	.05088
SSE	.00591	.01852	.02870	.01258	.00183	.00000	.06754
S	.00663	.02486	.03362	.00759	.00144	.00000	.07415
SSW	.00633	.02693	.02585	.00657	.00093	.00003	.06664
SW	.00612	.03584	.04194	.01642	.00264	.00009	.10306
WSW	.00534	.02996	.04032	.01336	.00537	.00048	.09483
W	.00624	.03434	.03317	.01282	.00747	.00024	.09429
WNW	.00390	.01873	.02315	.00817	.00489	.00009	.05893
NW	.00378	.01228	.01558	.00315	.00087	.00000	.03566
NNW	.00465	.01000	.00967	.00153	.00015	.00003	.02603
TOTAL	.08925	.35973	.39990	.11987	.02942	.00102	.99919

**Appendix A-13. Occurrence Frequencies of Wind Direction Sector by Wind Speed Category for 1996,
D-Area Tower, 61-m Level**

Direction	0-2 m/s	2-4 m/s	4-6 m/s	6-8 m/s	8-12 m/s	>12 m/s	TOTAL
N	.01039	.02089	.00492	.00057	.00006	.00000	.03683
NNE	.00865	.02614	.01000	.00304	.00054	.00000	.04837
NE	.00919	.03133	.02495	.00546	.00054	.00003	.07150
ENE	.01015	.03133	.01650	.00206	.00021	.00000	.06025
E	.01000	.02790	.00991	.00036	.00000	.00000	.04817
ESE	.00928	.02417	.00880	.00033	.00006	.00000	.04265
SE	.01104	.03193	.01740	.00233	.00024	.00000	.06294
SSE	.01071	.03557	.02432	.00573	.00233	.00006	.07873
S	.01158	.03128	.01256	.00337	.00155	.00006	.06040
SSW	.01218	.03447	.01522	.00367	.00072	.00000	.06625
SW	.01116	.03519	.02080	.00465	.00069	.00000	.07249
WSW	.00925	.03325	.02671	.00469	.00119	.00000	.07508
W	.01164	.03826	.02122	.00719	.00349	.00006	.08186
WNW	.01021	.03026	.02701	.01113	.00457	.00000	.08317
NW	.01051	.02492	.01955	.00624	.00197	.00000	.06318
NNW	.01080	.02426	.01086	.00128	.00003	.00000	.04724
TOTAL	.16673	.48116	.27073	.06210	.01818	.00021	.99911

**Appendix A-14. Occurrence Frequencies of Wind Direction Sector by Wind Speed Category for 1996,
D-Area Tower, 61-m Level**

Direction	0-2 m/s	2-4 m/s	4-6 m/s	6-8 m/s	8-12 m/s	>12 m/s	TOTAL
N	.00447	.01051	.00779	.00169	.00022	.00000	.02469
NNE	.00476	.01708	.01699	.00576	.00250	.00000	.04709
NE	.00814	.04506	.03520	.01286	.00147	.00000	.10272
ENE	.00682	.02566	.02716	.00839	.00197	.00000	.07000
E	.00557	.02206	.02212	.00200	.00003	.00003	.05182
ESE	.00513	.01849	.01608	.00128	.00006	.00000	.04105
SE	.00635	.01787	.01946	.00313	.00003	.00000	.04684
SSE	.00688	.02162	.02700	.00729	.00091	.00006	.06377
S	.00691	.02466	.03066	.00623	.00119	.00000	.06965
SSW	.00657	.02206	.02422	.00569	.00100	.00003	.05958
SW	.00738	.03589	.03996	.01245	.00109	.00000	.09678
WSW	.00676	.03623	.04362	.01264	.00250	.00016	.10191
W	.00720	.03066	.03730	.01464	.00842	.00034	.09856
WNW	.00510	.01949	.02422	.00914	.00460	.00000	.06255
NW	.00397	.01270	.01596	.00288	.00053	.00006	.03611
NNW	.00441	.01026	.01023	.00157	.00003	.00000	.02650
TOTAL	.09644	.37032	.39798	.10764	.02656	.00069	.99963

**Appendix A-15. Occurrence Frequencies of Wind Direction Sector by Wind Speed Category for 1996,
H-area Tower, 61-m Level**

Direction	0-2 m/s	2-4 m/s	4-6 m/s	6-8 m/s	8-12 m/s	>12 m/s	TOTAL
N	.00569	.01508	.01071	.00175	.00018	.00006	.03349
NNE	.00733	.02315	.02065	.00412	.00055	.00000	.05580
NE	.00806	.03977	.02598	.00320	.00018	.00000	.07719
ENE	.00637	.02921	.01745	.00197	.00000	.00000	.05500
E	.00668	.02792	.02007	.00068	.00009	.00000	.05543
ESE	.00585	.01967	.01816	.00120	.00000	.00000	.04488
SE	.00523	.02019	.02222	.00182	.00034	.00000	.04980
SSE	.00656	.02188	.02496	.00692	.00157	.00003	.06193
S	.00686	.02980	.03650	.00711	.00126	.00000	.08154
SSW	.00612	.02936	.02853	.00619	.00058	.00000	.07079
SW	.00628	.03841	.04121	.00899	.00135	.00000	.09625
WSW	.00548	.03961	.04131	.00856	.00286	.00009	.09791
W	.00523	.03413	.03013	.01305	.00403	.00012	.08671
WNW	.00486	.02428	.02493	.00920	.00292	.00000	.06621
NW	.00514	.01545	.01373	.00206	.00068	.00000	.03706
NNW	.00563	.01493	.00745	.00135	.00006	.00000	.02943
TOTAL	.09739	.42285	.38401	.07818	.01668	.00031	.99941

**Appendix A-16. Occurrence Frequencies of Wind Direction Sector by Wind Speed Category for 1996,
K-Area Tower, 61-m Level**

Direction	0-2 m/s	2-4 m/s	4-6 m/s	6-8 m/s	8-12 m/s	>12 m/s	TOTAL
N	.00635	.01481	.01282	.00161	.00018	.00000	.03577
NNE	.00673	.02594	.02907	.00351	.00012	.00009	.06546
NE	.00913	.04921	.03692	.00264	.00012	.00000	.09801
ENE	.00682	.03495	.03372	.00556	.00032	.00000	.08139
E	.00676	.02925	.02535	.00272	.00032	.00000	.06440
ESE	.00621	.02521	.01581	.00196	.00053	.00000	.04971
SE	.00667	.02682	.02576	.00533	.00117	.00015	.06590
SSE	.00615	.02602	.02292	.00410	.00108	.00006	.06033
S	.00679	.02869	.02207	.00208	.00070	.00003	.06036
SSW	.00676	.02889	.02193	.00351	.00059	.00000	.06168
SW	.00635	.02626	.02418	.00591	.00061	.00006	.06338
WSW	.00662	.02380	.02354	.00697	.00126	.00003	.06221
W	.00796	.02219	.02740	.01443	.00609	.00053	.07860
WNW	.00755	.02037	.02158	.01265	.00609	.00064	.06888
NW	.00817	.02237	.01382	.00383	.00146	.00000	.04965
NNW	.00700	.01408	.01107	.00173	.00035	.00003	.03425
TOTAL	.11203	.41886	.36796	.07855	.02099	.00161	1.00000

**Appendix A-17. Occurrence Frequencies of Wind Direction Sector by Wind Speed Category for 1996,
L-Area Tower, 61-m Level**

Direction	0-2 m/s	2-4 m/s	4-6 m/s	6-8 m/s	8-12 m/s	>12 m/s	TOTAL
N	.00545	.01359	.01006	.00247	.00009	.00000	.03166
NNE	.00449	.01792	.01853	.00587	.00166	.00000	.04847
NE	.00563	.02756	.03952	.01931	.00108	.00000	.09311
ENE	.00467	.02711	.02964	.00675	.00033	.00006	.06855
E	.00542	.02352	.02286	.00108	.00012	.00000	.05301
ESE	.00518	.01497	.01509	.00096	.00003	.00000	.03624
SE	.00566	.01765	.01901	.00247	.00048	.00000	.04527
SSE	.00569	.02118	.02401	.00473	.00129	.00000	.05690
S	.00699	.03422	.02892	.00413	.00132	.00000	.07558
SSW	.00777	.04380	.02949	.00952	.00208	.00000	.09265
SW	.00723	.03654	.03190	.01166	.00283	.00009	.09024
WSW	.00578	.03214	.03452	.01211	.00440	.00036	.08931
W	.00569	.03479	.03024	.01229	.00455	.00000	.08756
WNW	.00419	.02084	.02621	.00846	.00395	.00003	.06368
NW	.00416	.01328	.01533	.00352	.00030	.00003	.03663
NNW	.00512	.01286	.01075	.00154	.00012	.00000	.03039
TOTAL	.08913	.39197	.38607	.10687	.02464	.00057	.99925

**Appendix A-18. Occurrence Frequencies of Wind Direction Sector by Wind Speed Category for 1996,
P-Area Tower, 61-m Level**

Direction	0-2 m/s	2-4 m/s	4-6 m/s	6-8 m/s	8-12 m/s	<12 m/s	TOTAL
N	.00477	.01198	.00949	.00288	.00036	.00000	.02947
NNE	.00451	.01746	.01939	.00557	.00148	.00000	.04841
NE	.00652	.02879	.03703	.01551	.00252	.00000	.09036
ENE	.00768	.03786	.02155	.00231	.00009	.00003	.06952
E	.00634	.02152	.02016	.00083	.00006	.00003	.04895
ESE	.00543	.01767	.01358	.00095	.00003	.00000	.03765
SE	.00560	.01802	.01826	.00237	.00018	.00000	.04444
SSE	.00655	.01797	.02289	.00457	.00107	.00000	.05304
S	.00596	.02493	.03824	.00910	.00243	.00000	.08067
SSW	.00587	.02621	.03712	.00818	.00128	.00000	.07865
SW	.00459	.03214	.04494	.01230	.00110	.00000	.09507
WSW	.00454	.02873	.04227	.01272	.00279	.00000	.09104
W	.00483	.02659	.03774	.01651	.00697	.00012	.09276
WNW	.00371	.01969	.02638	.01313	.00617	.00009	.06916
NW	.00323	.01242	.01788	.00599	.00175	.00006	.04132
NNW	.00356	.01112	.01079	.00341	.00018	.00006	.02911
TOTAL	.08369	.35308	.41770	.11633	.02843	.00039	.99962