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SUSQUEHANNA

STEAM ELECTRIC STATION

2005 Meteorological Summary

Submitted to

PPL Susquehanna LLC

Prepared by

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EXECUTIVE SUMMARY

This report summarizes the meteorological conditions at the PPL Susquehanna Steam Electric Station (SSES) for the year 2005. The station is located in the Susquehanna Valley near the town of Berwick, PA and the borough of Nescopeck, PA. The report will provide summaries for several meteorological parameters as measured at the primary meteorological tower located on the SSES site. Additionally, the report will provide atmospheric dispersion estimates of relative concentrations of radionuclides (X/Q) for several offsite areas. These dispersion estimates were derived using the XDCALC and WINDOW programs which follow the Nuclear Regulatory Commission (NRC) technical guidance.

Section 1 summarizes the meteorological data collection program currently in operation at SSES. Section 1.1 describes the onsite meteorological measurements program. Section 1.2 provides a brief climatological summary for the area surrounding SSES. Section 1.3 provides a summary of the following measured parameters: wind direction, wind speed, temperature, dew point temperature (a measure of atmospheric water vapor), atmospheric stability, and precipitation. In-depth tables and figures are presented to help the reader better understand the various meteorological conditions and the climatological environment at the station as well as Pennsylvania's northern Susquehanna Valley.

An established data review quality assurance program at ABS Consulting, Inc. (ABS) substantiates the quality of data obtained from the meteorological monitoring program at the SSES. This review includes daily interrogation, evaluation and validation of the data by meteorologists specializing in air quality. The meteorological data are then compiled on a monthly, quarterly and annual basis. Data from the primary meteorological tower are validated by crosschecks with data from an independent, backup meteorological tower located on the SSES site. Additional checks are made to a supplemental meteorological tower located offsite in the Susquehanna River plain. Meteorological data from the SSES meteorological monitoring program are also compared to offsite meteorological data at the regional National Weather Service observing sites in Williamsport, PA and Avoca, PA. With the exception of an underestimation of precipitation, the program data are representative of the meteorological conditions at the SSES site.

The NRC recommends an annual data recovery for wind direction, wind speed and atmospheric stability of at least 90 percent for a height level that represents the effluent release point. This recommended recovery of 90 percent was again exceeded during 2005 with the actual recovery percentages presented in Table 1.

Section 2 describes the long-term (routine) and short-term (accident) atmospheric dispersion estimates that were computed using onsite meteorological data for 2005. The 2005 dispersion estimates are compared to estimates from previous years that were reported in the SSES Final Safety Analysis Report (FSAR) and subsequent annual meteorological summaries. The dispersion estimates for 2005 are within the range of previous years. Evaluation of flooding estimates based on the years precipitation is also within the range quoted in the SSES FSAR.

Dispersion calculations only use the terrain/recirculation factors for the long-term calculation of X/Qs. This was to be consistent with the regulatory position on the calculation of short-term X/Qs where recirculation factors are not used. No changes to the site boundary distances occurred in 2005.

This report summarizes and documents the meteorological parameters at SSES. It also serves as input to an ongoing climatological database for the SSES site and surrounding areas.

1.1 INTRODUCTION

The purpose of this report is to provide a summary of the 2005 meteorological data at the Susquehanna Steam Electric Station (SSES). The report uses several calculation programs from the Meteorological Information and Dose Assessment Software (MIDAS) suite of programs to generate tables and figures included in the report. All of the calculations used hourly meteorological data from SSES meteorological towers (primary and backup). The hourly averaged data came from the onsite CR21X data loggers.

1.2 INPUT DATA

1.2.1 Meteorological Data

Meteorological data have been collected at the SSES site since the early 1970s. At the present time, the meteorological system is based on a 200 ft high tower located approximately 1000 ft to the southeast of the plant. Wind sensors are mounted at the 10m and 60m elevations on this tower. Vertical temperature differential is measured with redundant sensor pairs between the 10m and 60m levels. Sigma theta (the standard deviation of horizontal wind direction) is calculated from wind direction at both levels. Dew point and ambient temperature sensors are present at the 10m level. Precipitation is measured at ground level.

An onsite backup meteorological tower was erected in 1982. It is a 10m tower providing alternative measurements of wind speed, wind direction and sigma theta. A 10m supplemental downriver meteorological tower is also available. This tower measures wind speed, wind directions, sigma theta, temperature and dew point.

SSES meteorological data are transmitted to the plant Control Room, Technical Support Center, and Emergency Operations Facility for emergency response availability. The data are also transmitted via telephone data line directly to the ABS office in Rockville, Maryland.

The onsite CR21X data loggers at SSES generated the meteorological data used in all calculations. The data are hourly averages with the exception of the rainfall data that is the total rainfall for the hour. These data were transmitted to ABS Consulting on a daily basis using the Campbell Scientific PC-208W program. Once the data was received, an ABS Meteorologist reviewed it. Data were compared between tower levels and between the primary, backup and downriver towers. When discrepancies were found bad data were edited out of the database. These periods of bad or missing data were left out of all calculations.

1.3. METHODOLOGY

1.3.1 MIDAS Software Calculations

The calculations performed for this report used MIDAS programs to generate tables and figures. All calculations used a final set of hourly meteorological data generated by ABS Consulting. The MIDAS programs used in the calculations have been previously validated in The Verification and Validation of MIDAS (Meteorological Information and Dose Assessment System), Volumes 1 and 2, December 1988 (Reference 9).

The following MIDAS programs were run to generate this report:

MIDMT – Meteorological Trend Plot
MIDEM – Edit Meteorological Data
MIDJF – Joint Frequency Distribution Table
MIDBD – Data Recovery Percentage Table
MIDRO – Wind Rose Plot
MIDMA – Meteorological Average Data Table
XDCALC – X/Q Calculations
XQINTR – X/Q Results at Specific Locations

Long-term dispersion modeling for effluents from normal operation of SSES is done using the MIDAS system XDCALC program, a straight-line Gaussian plume model designed to estimate average relative concentration. The model was developed in accordance with U.S. NRC Regulatory Guide 1.111 (Reference 3). For periods when the 10m wind speed is calm, the actual wind direction that occurred is used.

XDCALC and the XQINTR program that interpolates X/Q values to exact locations both use terrain correction factors to account for the temporal and spatial variations in the airflow in the region. A straight-line trajectory model assumes that a constant mean wind transports and diffuses effluents in the direction of airflow at the release point within the entire region of interest. The SSES terrain correction factors were taken from SSES FSAR Table 2.3-128 Reference 5).

The WINDOW program was used for short-term diffusion estimates for 0-2 hour up to 30-day periods. The methodology used in WINDOW is described in NRC Regulatory Guide 1.145 (1982) (Reference 4). Allowances are made for plume meander during light winds and stable atmospheric conditions. The WINDOW methodology is distance and direction dependent.

2.0 METEOROLOGY

2.1 ONSITE METEOROLOGICAL MEASUREMENTS PROGRAM

The onsite meteorological program is designed to provide accurate and complete meteorological monitoring of the SSES site area. The program also produces accurate, summarized, hourly meteorological data for use as input in atmospheric dispersion estimate computer programs. Onsite meteorological data are processed and analyzed by air quality meteorologists using statistical computer programs. The output from these programs is then used as data input by atmospheric dispersion estimate computer programs. Atmospheric dispersion estimates provide valuable information to safety planners for both routine and accidental radioactive releases. This information is also used when estimating the possible consequences of hypothetical accident scenarios. Analysis of meteorological data provides an assessment of the diffusion patterns characteristic to the site.

2.1.1 Meteorological Towers

In November 1972, a 300 ft steel framed primary meteorological tower was erected at the SSES site approximately 1000 ft southeast of the Unit 1/Unit 2 Reactor Building. Recorded meteorological data from the tower's sensors are used to define the stability and movement of the layer of air into which the effluent from the facility would be released. In late June 1981, a major modification to the primary tower was performed by moving the wind and temperature sensors to 10 meters (33 ft) and 60 meters (197 ft). The rain gauge was left at the base of the tower. Also in 1981, a backup tower was erected to provide comparative meteorological data to the primary tower and to serve as a secondary data source in the event of sensor failure on the primary tower. This backup tower is used to measure wind speed and wind direction at the 10-meter level. The variability of wind direction (sigma theta) is also derived at this level and can be used to gauge atmospheric stability. The backup tower is located approximately 1600 ft north-northeast of the primary tower (see Figure 16). A 60-meter tower replaced the primary tower in November 2001, located about 25 ft southwest of the original tower. All of the instrumentation from the original 300 ft. tower was transferred to the new 60m tower at their same locations.

Two supplemental 10-meter towers were erected in 1985. In reference to their positions relative to the SSES site, these towers were named the "upriver" tower and the "downriver" tower. Figure 16 shows the location of the upriver tower that is used for the purpose of measuring the effects of the Susquehanna River Valley on atmospheric dispersion and transport of site airborne effluents. Wind speed and wind direction are measured at both towers with temperature and dew point temperature measured at the downriver tower. Variability of wind direction is derived at the 10-meter level at both tower locations. Meteorological data validation at the upriver tower was terminated on October 1, 1994. No data from the upriver tower is included in this report.

2.1.2 Instrumentation

New meteorological instrumentation was installed on the primary and backup towers in early October 1988. This instrumentation along with the downriver supplemental tower instrumentation is described in Appendix A. Model numbers, sensor heights and a brief description of instrument characteristics are provided.

Calibration and maintenance are conducted semi-annually on the primary, backup and downriver tower systems in accordance with the frequencies and procedures prescribed in the manufacturer's operating and maintenance manuals.

2.1.3 Data Reduction

Since April 1, 1992, the primary method of compiling the hourly meteorological data record was by transmission of the data via telephone line from the SSES meteorological shelters. These data now go directly to the ABS office in Rockville, Maryland. Prior to April 1992, data were received for review via electronic media from the PPL corporate computer in Allentown, Pennsylvania. This modification was made to eliminate duplication of the data (and the potential for error) by creating one validated meteorological database. The digital meteorological data are inspected daily by meteorologists to identify periods of questionable or missing data. Digital meteorological data that are questionable or missing are compared to data obtained via analog strip charts, maintained by the PPL staff at SSES. The analog strip chart data are used to replace questionable or missing digital data as necessary.

The meteorological parameters required by atmospheric diffusion estimate computer models are wind speed, wind direction and atmospheric stability. Atmospheric stability is determined by measuring the change in temperature with respect to height at the two levels of 10 and 60 meters. The summarized hourly data are used as input to two atmospheric dispersion estimate computer programs: the short-term (accident) atmospheric dispersion model (WINDOW) and the long-term (annual average) atmospheric dispersion model (XDCALC).

2.1.4 Data Recovery

Data recovery for all of the meteorological parameters measured at the primary, backup and downriver towers during 2005 is included in Table 1. The joint data recovery during 2005 for the meteorological parameters measured at the primary tower was very good with recoveries of 99% or greater for all parameters, with the exception of the 60m wind direction (83%) and the rain gage (95%). With the exception of the 60m wind direction this is well above the 90 percent level recommended in NRC Regulatory Guide 1.23 (Reference 2).

2.2 <u>REGIONAL CLIMATOLOGY</u>

The regional climatology near the SSES site is profoundly influenced by the surrounding mountains and the Susquehanna River Valley, which is oriented from southwest to northeast. The topography influences the temperature, winds and precipitation amounts year round. The prevailing westerly winds that affect Pennsylvania carry most weather systems to the SSES vicinity from the west and southwest. Precipitation is fairly evenly distributed throughout the year; however, Atlantic coastal storms result in the heaviest rain and snowfalls during the fall, winter and spring months. Heavy rainfall occasionally affects central Pennsylvania from the outer fringes or remnants of Atlantic tropical storms during the summer and early fall months. The majority of summer precipitation occurs from showers and thunderstorms. Temperatures usually range between 0 and 100 degrees Fahrenheit over the course of a year.

2.3 LOCAL METEOROLOGY

2.3.1 Normal and Extreme Values of Meteorological Parameters

2.3.1.1 Wind Direction and Wind Speed

The wind direction classification system recommended by the NRC for annual meteorological summaries are the standard sixteen 22.5 degree wind direction sectors as depicted in Figure 1. **Wind directions always refer to the sector that the wind is coming from.** Specifically, a southwest wind is defined as a wind that originates from the southwest sector blowing toward the northeast sector.

During 2005, the 10-meter wind direction with the greatest frequency was from the east-northeast sector (15.3% of the time) with the average wind speed from this sector of 2.4 mph. This was the twenty-first consecutive year that the east-northeast sector had the greatest frequency of wind. The most frequent 60-meter wind direction during 2005 was from the north-northeast sector (16.9% of the time) with the average wind speed originating from that sector of 6.4 mph. Table 2 summarizes the 2005 average wind speed and wind direction frequencies at the primary tower from both the 10 and 60m levels. The wind direction at 60m was out-of service from the end of May until the beginning of August due to a broken wind vane. A few periods with high wind speeds during that period register good wind direction values. The remainder of the period was not used in the 2005 database.

Table 3 lists annual hourly averages for wind directions and wind speeds at the 10 and 60-meter levels. This table clearly shows that wind speeds at night are less than daytime wind speeds. On average, the daytime winds flow "up the valley" and the lighter, overnight winds flow "down the valley." Extreme wind speeds at the SSES site usually occur with the passage of vigorous cold fronts and the subsequent onset of high pressure or during violent thunderstorms. The peak hourly average wind speed at the 10 and 60m levels were 19.9 mph and 29.9 mph respectively during 2005.

Tables 4 and 5 provide the 2005 wind direction persistence at the 10 and 60-meter levels. **Wind direction persistence is defined as the number of consecutive hours for which the wind direction originated from the same sector**. It is useful in determining predominance of wind direction at the SSES site and the probability of wind direction continuing from any given sector for consecutive hours. In 2005, the maximum 10-meter wind direction persistence was 12 hours from the southwest, west-southwest and east-northeast sectors. The maximum 60-meter wind direction persistence was 17 hours, from the west-southwest sector. From a historical perspective, the greatest periods of wind persistence at SSES site are generally from the north-northeast, east-northeast, or southwest sectors. When winds are blowing from these sectors, there is a higher than normal probability that winds will continue from these sectors, especially in the nighttime hours. These tend to also be the predominant wind directions for east coast storms that can last for long periods of time. Figures 2 through 5 provide wind rose data at 10 and 60 meters on the primary tower, 10m on the backup tower and 10m on the downriver tower. **Wind roses display the frequency, in percent, of average wind direction and the wind speed**

groups from those directions. The data is also presented in Table 2 for the primary tower 10 and 60m levels.

The diurnal variations of wind speed and direction at the 10 and 60-meter levels are presented in Table 3. Figures 6 through 9 provide the reader with a graphical presentation of these data.

Table 6 puts the primary tower 10-meter wind speed and direction data for 2005 into historical perspective. During 2005 the wind direction with the greatest frequency (as measured at the primary tower) was from the east-northeast sector. The second greatest wind direction frequency was from the southwest sector. At the primary tower, winds from the 10-meter level have predominated from the east-northeast sector for 22 of the past 27 years including the last 21 years in a row. At the 60m level the predominate direction in 2005 was from the north-northeast. During the last 20 years the predominate wind direction has either been from the north-northeast or southwest

2.3.1.2 Temperature and Atmospheric Water Vapor

Table 7 provides annual averages for each hour of the day for the ambient air temperature and the dew point temperature from the primary tower. Figures 10a, 10b, 11a and 11b graphically summarize the diurnal variation of the ambient and dew point temperatures from the primary and downriver towers. The dew point temperature on both the primary and downriver towers functioned normally during most of 2005. There were some time periods when they were reading too low, particularly during periods of rainfall and when the temperatures were below freezing. Figures 12 and 13 show the average of the daily maximums, minimums and averages of temperature and dew point by month.

The temperatures during 2005 were a little above average. The winter temperatures were about three degrees cooler than normal, the spring about normal, the summer was quite warm averaging more than 4.5 degrees above normal. There were 13 days when temperatures reached above 90°F. This was well above the average, which is about 8 days per year. The remainder of the year averaged about normal. During 2005, the greatest average hourly temperature of 95.8°F occurred on August 13. The highest hourly average dew point temperature of 69.4°F occurred on July 27. The lowest hourly average temperature of –7.0°F occurred on the morning of January 28, 2005. The temperature dropped to below zero on five days during 2005.

Table 8 presents a summary of mean annual values of temperature, wet bulb temperature, and relative humidity at SSES since 1973. The mean annual temperature at SSES during 2005 was 49.7°F. July 2005 was the warmest month of the year with an average temperature of 73.2°F. January was the coldest month of 2005 with an average temperature of 25.8°F. The weather pattern during 2005 was somewhat irregular with longer than normal stretches of cold weather during the winter and warm weather during the summer. There were about 46 days when the temperature failed to get above 32°F, compared with the 27 days in a normal year. There were several prolonged warm periods during 2005. These were from June 6-9, June 25-28, July 10-13, July 18-21, August 1-5 and August 10-15 2005. Temperatures were particularly cold from January 21-24, January 27 through February 2 and December 13-15 2005. The data used in this comparison were the 2005 SSES site data and 30-year average (1971-2000) NOAA data from Scranton-Wilkes-Barre (measured at the Avon, PA airport).

2.3.1.3 Stability

The atmospheric stability at SSES is categorized using the Pasquill stability categories "A" through "G"(Reference 1). Atmospheric stability is measured by the vertical air temperature difference between the upper (60 meter level) and lower (10 meter level) temperature sensors at the primary tower.

Stability Classification	Pasquill Category	Temperature Change with Height (°C/50m)
Extremely unstable	A	$\Delta T/\Delta Z \leq -0.95$
Moderately unstable	B	$-0.95 < \Delta T/\Delta Z \leq -0.85$
Slightly unstable	C	$-0.84 < \Delta T/\Delta Z \leq -0.75$
Neutral	D	$-0.74 < \Delta T/\Delta Z \leq -0.25$
Slightly stable	E	$-0.24 < \Delta T/\Delta Z \leq 0.75$
Moderately stable	F	$0.76 < \Delta T/\Delta Z \leq 2.0$
Extremely stable	G	$2.0 < \Delta T/\Delta Z$

Table 9 presents the occurrence of Pasquill stability classes for each season of the year. During 2005, the greatest frequency of extremely unstable conditions (A) occurred in the summer. The greatest frequency of extremely stable conditions (G) occurred during the fall. This pattern was different than in recent years. There was a much higher percentage of "A" stability (about 12%). This was probably caused by the high number of warm, sunny days. There were more hours of stable ("G" stability) than in recent years. Figure 14 shows a diurnal plot of delta temperature by the time-of-day. Figure 15 shows a plot of the percent of stability category by time-of-day.

As required by the NRC, annual Joint Frequency Distributions (JFD) were computed for wind speeds, wind directions, and stability categories. The annual JFD at 10 meters is presented in Table 10 while the annual JFD at 60 meters is presented in Table 11. At the 10-meter level, the greatest frequency of unstable conditions (stability Class A) occurred primarily with winds from the southwest sector. This would be a daytime phenomenon when southwest winds are prevalent. The greatest frequency of stable conditions (stability Class G) occurred with very light nighttime winds from the east-northeast sector. At the 60-meter level, the greatest frequency of unstable conditions (stability Class A) also occurred with southwest sector winds. The greatest frequency of stable conditions (stability Class G) occurred with winds from the north-northeast sector.

Pasquill stability class persistence is defined as the number of consecutive hours the stability class remains the same. The most consecutive occurrences of any Pasquill stability class were 48 hours of neutral stability (D) and slightly stable (E). The most consecutive occurrences of extremely stable (G) conditions were 17 hours.

As with the wind and temperature data, the Pasquill stability class data for 2005 are put into historical context in Table 12 that lists the percent occurrence of Pasquill stability classes for each year since 1977. The 2005 Pasquill stability class distributions were somewhat different than in recent years. This resulted in conditions that were different than the 25 years of site history. There was about 19% unstable hours in 2005 compared to an overall average of about 12%. Neutral hours occurred 31% of the time compared with a long-term average of 37%. Stable hours occurred about 49% of the time versus a long-term average of about 51% of the time. Overall the differences in the stability categories had little affect on the dispersion estimates since there was an increase in "A" stability class (extremely unstable) as well "G" stability class (extremely stable) which tended to offset each other.

2.3.1.4 Precipitation

In central Pennsylvania, the 30-year average (1971-2000) annual precipitation values range from 41.59 inches in Williamsport, PA to 37.56 inches at Wilkes-Barre/Scranton Airport in Avoca, PA. The annual precipitation total during 2005 was 48.12 inches in Williamsport and 36.68 inches in Avoca. The annual precipitation total as measured at the SSES site was 34.08 inches. The difference between the two NWS sites was mainly due to summertime hit and miss thunderstorms and the passage of a tropical storm that had a much greater affect on Williamsport than Avoca or SSES. The precipitation for the year started somewhat above average for the first four months of the year. However, the next five months were below normal with September rainfall being a record monthly low for the last 30 years of 0.80 inches. The last three months of the year had above average rain and snowfall. At SSES, the precipitation totals for 2005 were also below normal as they were at Avoca. There was a period from the end of August through the end of October when the rain gage was not functioning properly. Data from the two nearby NWS sites were used to substitute for the missing period. Precipitation at SSES tends to be lower than the NWS sites particularly in the winter because the snow is difficult to collect and melt, and during summer thunderstorms windblown rain may not end up in the tipping bucket. The greatest one-day total at SSES was 1.65 inches on October 7, 2005. There were ten days with one inch or more of rain. Table 13 shows daily, monthly and annual precipitation at SSES. Table 14 shows the normal and 2005 monthly and annual precipitation totals at Williamsport and Avoca.

3.0 DIFFUSION ESTIMATES

The detailed methodology of diffusion estimates is described in three NRC publications: Regulatory Guide 1.3, Revision 2 (June 1974) (Reference 11), Regulatory Guide 1.111 (March 1976) (Reference 3) and Regulatory Guide 1.145, Revision 1 (November 1982) (Reference 4). The atmospheric dispersion programs (XDCALC and WINDOW) follow the criteria set forth by Regulatory Guides 1.111 and 1.145, respectively. Meteorological input data for 2005 SSES short-term and long-term diffusion estimates were provided in English units. The approach and calculation of diffusion estimates are presented below.

3.1 SHORT-TERM (ACCIDENT) DIFFUSION ESTIMATES

This section provides conservative estimates of atmospheric diffusion at both the Exclusion Area Boundary (EAB) and the Low Population Zone (LPZ) for appropriate time periods up to 30 days. The diffusion evaluations for short-term accidents were based on the assumption of a ground level release; that is, no credit was taken for reduction in ground level concentrations due to an elevated plume. The 2005 meteorological data from the primary tower at SSES were used in the diffusion calculations.

3.1.1 Diffusion Model for 0 to 2 Hours

The WINDOW computer code analytical procedure is used for evaluating the 0 to 2-hour accident period. Allowances are made for plume meander during light winds and stable atmospheric conditions. The methodology used in WINDOW is described in NRC Regulatory Guide 1.145 (1982).

The WINDOW methodology is distance and direction dependent. Variability of wind direction frequency was considered in determining the relative concentration (X/Q) values. The hourly X/Q values were determined as described below.

During neutral and stable conditions when the wind speed at the lower (10 meter) level is less than 6 m/sec, the relative concentration is computed as:

$$\frac{X}{Q} = \frac{1}{u\pi\Sigma_y\sigma_z} \qquad (1)$$

provided it is less than the greatest value calculated from either Equation 2 or 3

$$\frac{X}{Q} = \frac{1}{u(\sigma_y\sigma_z + cA)} \qquad (2)$$

or

$$\frac{X}{Q} = \frac{1}{u(3\pi\sigma_y\sigma_z)} \qquad (3)$$

where

X/Q	=	relative concentration at ground level (sec/m^3)
π	=	3.14159
$\bar{u}$	=	hourly average wind speed at the 10 meter (33 ft) level above plant grade (m/sec)
Σ_y	=	lateral plume spread with meander and building wake effects, in m, a function of atmospheric stability, wind speed, and downwind distance. For distances less than or equal to 800 meters, $\Sigma_y = M\sigma_y$, where M is a function of atmospheric stability and wind speed. For distances greater than 800 meters

$$\sum_y = (M-1)\sigma_{y(800m)} + \sigma_y$$

A	=	smallest vertical plane, cross-sectional area of the building from which the effluent is released (2973 m^2)
c	=	building shape factor (0.5)
σ_y	=	lateral plume spread (m) at a given distance and stability
σ_z	=	vertical plume spread (m) at a given distance and stability

During all other atmospheric stability and/or wind speed conditions, X/Q is the greater value calculated from Equations 2 and 3.

Plume meander was accounted for by modifying the lateral diffusion coefficient, σ_y. The meander function (M) is evaluated as follows:

(1) For Pasquill stability classes A to C at all wind speeds or all stability classes when the wind speed is greater than 6 m/sec, M equals 1.

(2) For wind speeds less than or equal to 2 m/sec, M assumes the following values: 2 for D stability, 3 for E stability, 4 for F stability and 6 for G stability.

(3) For wind speeds between 2 m/sec and 6 m/sec, M is linearly interpolated between 1 and the stability dependent values given in (2).

An hourly observation is considered to be calm if the wind speed is less than the threshold of the wind instruments. For calm conditions a wind speed is assigned equal to the vane or anemometer starting speed, whichever is higher. During 2005, there were 13 hours of calm wind measured at the primary tower 10-meter level. Invalid data are not considered.

3.1.1.1 Exclusion Area Boundary and Low Population Zone

The X/Q values at the Exclusion Area Boundary (EAB) and Low Population Zone (LPZ) are determined for each sector. These are defined as the X/Q values that are exceeded 0.5 percent of the total time (NRC, 1982). To extract this value, the hourly X/Qs are sorted according to sector and magnitude. A cumulative probability distribution of X/Q values can easily be constructed as:

$$P(X/Q) = \frac{\text{rank of X/Q}}{\text{X/Q population size}} \qquad (4)$$

where P(X/Q) is the probability of being exceeded. For example, the tenth largest value of a population of 100 values has a probability of being exceeded of 10/100, or 10 percent. The greatest of the 16 sector X/Q values is defined as the maximum sector X/Q value.

For longer averaging times, these hourly X/Q values are used to represent the 2-hour X/Q value. Sector X/Q values are then determined for the EAB and LPZ for 8, 16, 72, and 624 hours by a logarithmic interpolation between the 2-hour X/Q value in each sector and the annual average X/Q (see Section 3.2) at the same point. The highest of the 16 sector X/Q values are then identified for each time period.

3.1.1.2 Five Percent Overall Site X/Q Values

The X/Q values which are exceeded no more than 5 percent of the total time at the EAB and the LPZ are determined in a manner similar to the sector X/Q values. All of the hourly X/Q values are sorted according to magnitude (independent of direction) and the 5 percent value chosen. The 5 percent overall site X/Q values are also determined for 8, 16, 72, and 624 hours by logarithmic interpolation between the maximum annual average X/Q value and the 2-hour 5 percent overall site X/Q value.

3.1.2 Results of Short-Term Diffusion Estimates

The 0.5% sector X/Q and maximum sector X/Q values for the EAB and LPZ are given in Tables 15 and 16, respectively. Figures 17 and 18 are plots at the EAB and LPZ of each of the 16 direction sectors for the five (2, 8, 16, 72 and 624 hour) time periods. Tables 17 and 18 present the 5 percent overall site X/Q values for the EAB and LPZ for the years 1978 through 2005. Figures 19 and 20 show the 2005 5% overall X/Q for each of the five time periods at the EAB and LPZ. The values for 8, 16, 72, and 624 hours reflect a logarithmic interpolation between the 2-hour sector X/Qs and the annual average X/Qs for the same sector.

3.2 LONG-TERM (ROUTINE) DIFFUSION ESTIMATES

The long-term diffusion characteristics for the SSES were estimated in accordance with the criteria set forth in NRC Regulatory Guide 1.111 (1977). The analysis was performed using the onsite meteorological data recorded at the primary tower for January through December 2005 (see Section 1.2) and the atmospheric diffusion computer model, XDCALC.

3.2.1 Atmospheric Diffusion Models

3.2.1.1 Straight-Line Airflow Model

A ground level release model based on meteorological data and plant parameters was used to calculate the annual average atmospheric relative concentration (X/Q) values. Depletion factors are computed directly from depletion curves from Regulatory Guide 1.111 as the relative deposition rates. For long-term, ground level relative concentrations, the plume is assumed to diffuse evenly over a 22.5-degree sector.

The hourly relative concentration values are calculated in the sector defined by the wind direction using the following equation:

$$X/Q = \frac{2.032}{\sigma_z \bar{u} x} \qquad (5)$$

where

X/Q = ground level relative concentration (sec/m^3)

σ_z = vertical standard deviation of the plume (m)

$\bar{u}$ = average wind speed (m/sec)

x = distance from the source (m)

However, with consideration of the turbulent wake effect, Equation 5 is revised as follows:

$$X/Q = \frac{2.032}{\sqrt{\sigma_z^2 + cV^2/\pi}\,\bar{u} x} \qquad (6)$$

Where

c = building shape factor

V = vertical height of the highest adjacent building

The wake factor (cV^2/π) is limited, close to the source, to a factor of $2\sigma_z^2$.

If $\sqrt{3} < \sigma_z < \sqrt{\sigma_z^2 + c\frac{V^2}{\pi}}$, the equation is

$$X/Q = \frac{2.032}{\sqrt{3}\sigma_z \bar{u} x} \qquad (7)$$

(i.e., X/Q is calculated to be the larger of Equations 6 and 7). The total relative concentration at each sector and distance is then divided by the total number of hours in the database.

3.2.1.2 Methods of Depletion and Deposition Calculation

Depleted X/Q values are computed by applying the depletion factors provided in Figure 2 of Regulatory Guide 1.111 to the calculated X/Q values. Relative deposition rates were calculated using the following equation:

$$D/Q = \frac{DEP_j}{x * 0.3927} * T_f \qquad (8)$$

where

D/Q	=	deposition rate at ground level (m^{-2})
DEP_j	=	relative deposition rate at ground level (m^{-1}) for the distance j interpolated from Table 2.2.5.5.1-3 of the MIDAS documentation (derived from Regulatory Guide 1.111 curves for program XDCALC.
0.3927	=	radians per 22.5 degree direction sector
x	=	distance from the source (m)
T_f	=	terrain/recirculation correction factor (TCF)

3.2.1.3 Terrain/Recirculation Correction Factors

The straight-line trajectory, Gaussian diffusion model assumes that a constant mean wind transports and diffuses plume effluents in the direction of airflow at the release point within the entire region of interest. In other words, the wind speed and atmospheric stability at the release point are assumed to determine the atmospheric dispersion characteristics in the direction of the mean wind at all distances.

The PUFF model described in the SSES FSAR approximates a continuous release by dividing the plume into a sufficient number of plume elements to represent a continuous plume. Each plume element can be modified or advected independently according to the meteorological conditions (wind direction, wind speed, and atmospheric stability) of its immediate location. The X/Q values calculated by the PUFF model would, therefore, account for the temporal and spatial variations in the airflow in the site region.

The terrain/recirculation correction factors (T_f) are determined as the ratio between the puff advection X/Q estimates and the straight-line X/Q estimates in the form:

$$Tf(x,y) = \frac{\frac{X}{Q}(x,y)_p}{\frac{X}{Q}(x,y)_s} \qquad (9)$$

Where

$T_f(x,y)$ = terrain/recirculation correction factor at the point (x,y)

$X/Q(x,y)_p$ = the annual average relative concentration at point (x,y) using a puff advection modeling scheme

$X/Q(x,y)_s$ = the annual average relative concentration at point (x,y) using a straight-line modeling scheme

As noted in the SSES FSAR, 1973-1976 data were used to compute the TCFs. The TCFs for the SB are listed in Table 19. The TCFs for standard distances are available in the SSES FSAR (1978). Terrain/recirculation correction factors and distances to the nearest residence, garden, dairy animal, and production animal in each sector are presented in Table 20.

3.2.2 Results of Long-Term Diffusion Estimates

The terrain/recirculation corrected annual average undecayed and undepleted relative concentration (X/Q) values calculated for the EAB and SB using the 2005 SSES meteorological data are presented in Tables 21 and 22. These two tables also present the annual average 2.26-day decayed and undepleted and 8-day decayed and depleted X/Qs as well as deposition rates (D/Q). Similar calculations were also made for the nearest residences, gardens, dairy animals, production animals, and two special locations within 1 mile of the SSES site. These calculations can be found in Tables 23 and 24. Annual average X/Qs for standard distances in each sector are presented in Tables 25 through 28.

4.0 REFERENCES

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5. Susquehanna Steam Electric Station FSAR, Section 2.

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7. SSES 2005 Land Use Census, Ecology III, Inc., SSES Environmental Laboratory, November 2005.

8. NOAA, National Climate Data Center, Local Climatological Data for Avoca, Wilkes-Barre-Scranton, PA and Williamsport, PA, 2005.

9. MIDAS Programs, Verification and Validation of MIDAS Software Volumes 1 and 2, December 1988.

10. Certification of Computer Program, WINDOW, Version 5.4.1, June 07, 2001.

11. Nuclear Regulatory Commission Regulatory Guide 1.3, Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Boiling Water Reactors, Revision 2, June 1974.

12. Calculation C-1288497-0607 Program output from Window, XDCALC and Wetnes.

TABLE 1. SSES METEOROLOGICAL DATA RECOVERY FOR 2005	
PARAMETER	**PERCENT VALID DATA RECOVERY**
Wind Speed 10m - Primary (1) Wind Speed 60m – Primary Wind Speed 10m – Backup (2) Wind Speed 10m – Downriver (3)	99.1 99.1 100.0 100.0
Wind Direction 10m - Primary Wind Direction 60m – Primary Wind Direction 10m – Backup Wind Direction 10m – Downriver	99.1 82.7 100.0 100.0
Temperature 10m – Primary Dew Point 10m – Primary	99.0 98.7
Delta Temperature 60m – Primary	99.0
Sigma Theta 10m – Primary Sigma Theta 60m – Primary Sigma Theta 10m – Backup Sigma Theta 10m – Downriver	99.1 82.7 100.0 100.0
Precipitation – Primary	95.9
Composite Parameters	
Wind Speed and Direction 10m, Delta Temperature 60-10m	99.0
Wind Speed and Direction 60m, Delta Temperature 60-10m	82.6

(1) SSES “Primary” meteorological tower
(2) SSES “Backup” meteorological tower
(3) SSES “Downriver” meteorological tower

TABLE 2. 2005 AVERAGE WIND SPEED AND DIRECTION FREQUENCIES BY SECTOR PRIMARY TOWER: 10 AND 60 METER LEVELS				
Direction From	**10 Meter**		**60 Meter**	
	Frequency (%)	**Speed (mph)**	**Frequency (%)**	**Speed (mph)**
N	6.3	6.3	7.7	7.4
NNE	7.6	4.7	16.9	6.4
NE	9.4	3.2	9.5	5.3
ENE	15.3	2.4	4.3	4.6
E	7.1	2.3	3.2	4.6
ESE	4.1	2.5	3.3	4.5
SE	5.0	3.5	4.5	5.6
SSE	4.5	4.4	4.4	7.5
S	5.7	4.3	4.3	7.2
SSW	7.7	5.0	7.1	8.2
SW	9.6	6.8	8.9	8.3
WSW	4.9	7.8	10.0	11.6
W	2.8	7.5	4.5	10.4
WNW	2.4	7.6	3.0	10.3
NW	3.5	8.6	4.4	10.5
NNW	4.0	7.7	3.9	9.7
Calm	0.02		0.0	

This table presents the frequency in percent that the winds originated from a given sector. The average wind speed from that sector is also reported. During 2005, winds at the 10-meter level originating from the East-Northeast sector were the most predominant, originating from this sector 15.3 % of the time. The average wind speed recorded from this sector during 2005 was 2.4 miles per hour.

TABLE 3. 2005 HOURLY MEANS, EXTREMES, AND DIURNAL VARIATIONS WIND SPEED AND DIRECTION PRIMARY TOWER: 10 AND 60 METER LEVELS				
	10 Meter		**60 Meter**	
Hours	**Wind Speed (mph)**	**Direction (sector)**	**Wind Speed (mph)**	**Direction (sector)**
1:00 am	3.6	ENE	6.3	NNE
2:00 am	3.5	ENE	6.2	NNE
3:00 am	3.4	ENE	5.9	NNE
4:00 am	3.4	ENE	5.8	NNE
5:00 am	3.4	ENE	5.9	NNE
6:00 am	3.4	ENE	5.9	NNE
7:00 am	3.4	ENE	5.6	NNE
8:00 am	3.5	ENE	5.6	NNE
9:00 am	4.0	E	5.9	NNE
10:00 am	4.9	SW	6.8	SW
11:00 am	5.6	SW	7.7	SW
Noon	6.4	SW	8.6	SW
1:00 pm	6.8	SW	9.4	SW
2:00 pm	7.2	SW	9.9	SW
3:00 pm	7.2	SW	10.0	SW
4:00 pm	7.0	SW	9.8	SW
5:00 pm	6.5	SW	9.5	SW
6:00 pm	5.9	SSW	9.1	WSW
7:00 pm	5.1	SSW	8.6	SW
8:00 pm	4.4	N	7.7	NNE
9:00 pm	4.0	ENE	7.1	NNE
10:00 pm	3.7	ENE	6.6	NNE
11:00 pm	3.6	ENE	6.4	NNE
Midnight	3.7	ENE	6.5	NNE
24 Hour Average	4.7	*	7.6	*
Absolute Max	19.2	*	29.9	*
Absolute Min	0.3	*	0.8	*
Total Observation	8678	8681	8682	7240

This table presents the mean values for wind speed and direction for each hour of the day. For example, the shaded value of 3.4 in Row 3 means that during 2005, the average wind speed at 3:00 a.m. was 3.4 mph. Maximum values, minimum values, and the 24-hour mean (denoted by asterisks) are not computed for wind direction. The wind direction sector shown for each hour reflects the primary sector for the hour over the year.

TABLE 4. 2005 WIND DIRECTION PERSISTENCE PRIMARY TOWER: 10 METER LEVEL

Number of Consecutive Hours

Sector	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
N	250	53	23	11	3	5	3	1	0	0	0	0	0	0	0	0
NNE	309	78	18	12	4	4	3	2	0	1	0	0	0	0	0	0
NE	464	93	32	7	2	1	2	1	0	0	0	0	0	0	0	0
ENE	506	137	54	26	18	11	6	5	3	0	0	1	0	0	0	0
E	470	47	11	3	0	1	0	0	0	0	0	0	0	0	0	0
ESE	287	26	4	2	0	0	0	0	0	0	0	0	0	0	0	0
SE	284	41	13	5	2	0	0	0	0	0	0	0	0	0	0	0
SSE	249	26	10	4	3	1	2	0	1	0	0	0	0	0	0	0
S	308	44	16	6	3	1	0	0	1	0	0	0	0	0	0	0
SSW	350	96	20	7	5	1	1	0	0	0	0	0	0	0	0	0
SW	366	86	35	20	3	6	2	2	1	1	0	1	0	0	0	0
WSW	239	45	10	7	2	2	1	0	0	0	0	1	0	0	0	0
W	139	31	12	1	0	1	0	0	0	0	0	0	0	0	0	0
WNW	99	23	10	5	1	1	0	0	0	0	0	0	0	0	0	0
NW	119	25	12	7	3	5	0	0	2	0	1	0	0	0	0	0
NNW	160	36	11	11	5	1	1	0	0	0	0	0	0	0	0	0
Total	**4599**	**887**	**291**	**134**	**54**	**41**	**21**	**11**	**8**	**2**	**1**	**3**	**0**	**0**	**0**	**0**

This table presents the number of occurrences that the wind direction persisted from a given sector. For example, the shaded value (23) in the north sector means that 23 times during 2005 the winds persisted from the north for three consecutive hours.

TABLE 5. 2005 WIND DIRECTION PERSISTENCE PRIMARY TOWER: 60 METER LEVEL

Number of Consecutive Hours

Sector	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
N	227	63	28	11	5	4	4	0	0	0	0	0	0	0	0
NNE	430	132	53	24	11	10	7	7	3	1	0	0	0	0	0
NE	342	82	22	10	2	4	2	2	0	1	0	0	0	0	0
ENE	210	34	4	3	1	1	0	0	0	0	0	0	0	0	0
E	163	22	3	1	2	0	0	0	0	0	0	0	0	0	0
ESE	167	23	5	1	0	1	0	0	0	0	0	0	0	0	0
SE	169	25	8	14	3	0	1	1	0	0	0	0	0	0	0
SSE	158	33	15	3	2	2	2	0	0	0	0	0	0	0	0
S	200	32	11	0	1	2	0	0	0	0	0	0	0	0	0
SSW	271	57	18	8	1	2	3	1	0	0	0	0	0	0	0
SW	303	76	21	11	3	5	3	1	0	1	0	0	0	0	0
WSW	269	77	23	16	9	3	1	1	2	0	0	0	2	0	2
W	156	39	9	4	4	2	1	1	0	0	0	0	0	0	0
WNW	96	27	4	6	2	3	0	0	0	0	0	0	0	0	0
NW	127	25	16	3	1	4	3	1	0	0	1	1	0	0	0
NNW	106	34	13	9	2	0	2	1	0	0	0	0	0	0	0
Total	**4185**	**781**	**253**	**124**	**49**	**43**	**29**	**16**	**5**	**3**	**1**	**1**	**2**	**0**	**2**

This table presents the number of occurrences that the wind direction persisted from a given sector.

TABLE 5. (Continued) 2005 WIND DIRECTION PERSISTENCE PRIMARY TOWER: 60 METER LEVEL

Number of Consecutive Hours

Sector	16	17
N	0	0
NNE	1	0
NE	0	0
ENE	0	0
E	0	0
ESE	0	0
SE	0	0
SSE	0	0
S	0	0
SSW	0	0
SW	0	0
WSW	0	1
W	0	0
WNW	0	0
NW	0	0
NNW	0	0
Total	**1**	**1**

This table presents the number of occurrences that the wind direction persisted from a given sector

TABLE 6. 2005 PREDOMINANT WIND DIRECTIONS, 1973-2005
PRIMARY TOWER: 10 METER LEVEL

Year	Highest Frequency		Second Highest Frequency	
	Direction From	Percent Occurrence	Direction From	Percent Occurrence
1973-1976	WSW	10.77	W	10.68
1977	W	13.98	WSW	13.00
1978	W	13.42	ENE	13.32
1979	ENE	11.64	E	10.59
1980	W	10.49	ENE	9.92
1981	W	11.58	E	9.54
1982	ENE	12.17	WSW	10.15
1983	NE	12.88	SW	10.83
1984	SW	13.17	SW	11.82
1985	ENE	13.14	ENE	11.72
1986	ENE	11.01	SW	10.71
1987	ENE	14.72	NE	10.69
1988	ENE	13.79	SW	9.80
1989	ENE	15.29	SW	9.91
1990	ENE	15.30	SW	10.90
1991	ENE	16.12	SW	10.36
1992	ENE	15.02	NE	9.55
1993	ENE	15.33	NE	9.92
1994	ENE	16.73	SW	10.90
1995	ENE	14.37	SW	11.01
1996	ENE	14.83	SW	10.59
1997	ENE	15.37	SW	11.58
1998	ENE	17.09	NE	10.01
1999	ENE	16.16	SW	10.23
2000	ENE	16.13	SW	9.86
2001	ENE	16.98	SW	10.49
2002	ENE	14.46	SW	11.47
2003	ENE	14.14	NE	10.96
2004	ENE	13.60	NE	11.39
2005	ENE	15.26	SW	9.63

This table presents the first and second most predominant wind directions at the SSES site. In 2005 winds were most frequent from the East-northeast, originating from that sector 15.26% of the time.

TABLE 7. 2005 HOURLY MEANS AND EXTREMES OF AMBIENT TEMPERATURE AND DEW POINT TEMPERATURE PRIMARY TOWER: 10 METER LEVEL		
Hours	**Ambient Temperature Primary (Degrees F)**	**Dew Point Temperature Primary (Degrees F)**
1:00 AM	47.02	35.25
2:00 AM	46.08	35.00
3:00 AM	45.30	34.73
4:00 AM	44.70	34.48
5:00 AM	44.19	34.15
6:00 AM	43.73	33.90
7:00 AM	43.67	33.81
8:00 AM	44.72	34.12
9:00 AM	46.99	34.62
10:00 AM	49.78	35.01
11:00 AM	52.53	35.22
NOON	54.73	35.14
1:00 PM	56.45	34.98
2:00 PM	57.64	34.95
3:00 PM	58.32	34.97
4:00 PM	58.57	34.88
5:00 PM	58.42	34.91
6:00 PM	57.53	34.63
7:00 PM	56.08	34.70
8:00 PM	54.16	35.05
9:00 PM	52.10	35.48
10:00 PM	50.33	35.71
11:00 PM	49.03	35.66
MIDNIGHT	47.97	35.49
HOURLY MEAN	49.7	34.4
AVG DAILY MAX	59.5	39.4
AVG DAILY MIN	40.2	29.6
ABSOLUTE MAX	95.8	69.4
ABSOLUTE MIN	-7.0	-15.3
TOTAL OBSERVATIONS	8673	8647

TABLE 8. ANNUAL MEAN VALUES OF AMBIENT TEMPERATURE, WET BULB TEMPERATURE, AND RELATIVE HUMIDITY, 1973-2005			
Year	**Ambient Temperature (degrees F)**	**Wet Bulb Temperature (degrees F)**	**Relative Humidity (percent)**
1973-1976	48.7	44.4	70.0
1977	48.6	42.4	55.4
1978	46.6	41.0	61.7
1979	49.1	44.1	64.6
1980	48.2	42.1	58.8
1981	47.3	40.6	55.1
1982	49.1	41.0	60.5
1983	49.3	43.7	63.8
1984	48.4	45.1	68.3
1985	49.5	43.3	61.0
1986	49.6	39.2	60.3
1987	48.9	42.4	57.9
1988	49.1	42.4	56.8
1989	48.0	43.3	67.6
1990	51.3	45.1	63.3
1991	51.3	45.1	63.2
1992	48.8	43.0	63.3
1993	49.6	42.1	60.3
1994	49.2	41.8	53.2
1995	50.0	44.4	66.3
1996	48.8	44.0	69.0
1997	49.3	35.3	61.1
1998	52.6	46.6	64.7
1999	50.9	46.2	74.2
2000	48.8	39.5	53.7
2001	50.6	43.7	61.3
2002	51.2	43.4	57.1
2003	48.6	42.4	61.9
2004	49.6	43.5	62.9
2005	49.7	42.5	55.6
The 49.7°F temperature represents the average temperature for 2005. It was near the longtime average of 49.3 over the 33 years of data collection.			

TABLE 9. 2005 PASQUILL STABILITY CLASS OCCURRENCE BY SEASON (PERCENT) USING DELTA TEMPERATURE 60-10							
	Pasquill Stability Classes (Percent of Occurrence)						
Season	**A**	**B**	**C**	**D**	**E**	**F**	**G**
Winter	4.26	3.66	4.72	40.76	30.71	8.90	6.99
Spring	21.13	4.51	4.04	22.16	25.22	14.35	8.59
Summer	22.49	3.67	4.08	15.92	28.44	18.73	6.67
Fall	1.81	1.44	1.86	43.38	31.10	9.34	11.07

This table provides a summary (in percent) of the hourly Pasquill stability class occurrences by season. For example, stability class "A" occurred 21.13% of the time during spring 2005.

TABLE 10. SSES JOINT FRQUENCY DISTRIBUTION OF WIND SPEED AND WIND DIRECTION 10m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF JANUARY 1, 2005 THROUGH DECEMBER 31, 2005

Hours at Each Wind Speed and Direction

Period of Record = 01/01/05 1:00 12/31/05 23:00 Total Period

Elevation: **Speed:** 10M SPD **Direction:** 10M WD **Lapse:** DT60-10

Stability Class A Delta Temperature Extremely Unstable

	Wind Speed (mph)						
Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
N	0	17	34	5	0	0	56
NNE	4	38	27	0	0	0	69
NE	14	39	6	0	0	0	59
ENE	14	19	0	0	0	0	33
E	18	20	0	0	0	0	38
ESE	27	13	0	0	0	0	40
SE	20	31	1	0	0	0	52
SSE	13	41	5	1	0	0	60
S	19	63	7	1	0	0	90
SSW	11	114	25	0	0	0	150
SW	14	161	92	4	0	0	271
WSW	9	28	50	1	0	0	88
W	3	8	16	0	0	0	27
WNW	1	8	4	0	0	0	13
NW	1	12	3	0	0	0	16
NNW	2	12	5	1	0	0	20
Total	170	624	275	13	0	0	1082

Number of Calm Hours for this Table	2
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	88
Number of Valid Hours for this Table	1082
Total Hours for the Period	8759

TABLE 10 (Continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/05 1:00 - 12/31/05 23:00 Total Period

Elevation: **Speed:** 10M SPD **Direction:** 10M WD **Lapse:** DT60-10

Stability Class B Delta Temperature Moderately Unstable

Wind Speed (mph)

Wind Direction	**1 - 4**	**4 - 8**	**8 - 13**	**13 - 19**	**19 - 25**	**≥ 25**	**Total**
N	1	8	4	3	0	0	16
NNE	0	14	9	1	0	0	24
NE	8	8	1	0	0	0	17
ENE	2	4	0	0	0	0	6
E	13	3	0	0	0	0	16
ESE	11	2	0	0	0	0	13
SE	4	8	0	0	0	0	12
SSE	4	10	2	0	0	0	16
S	10	7	2	0	0	0	19
SSW	3	16	4	0	0	0	23
SW	3	16	17	2	0	0	38
WSW	0	10	12	1	0	0	23
W	0	4	13	0	0	0	17
WNW	1	1	8	0	0	0	10
NW	1	7	7	1	0	0	16
NNW	1	4	16	1	0	0	22
Total	62	122	95	9	0	0	288

Number of Calm Hours for this Table	2
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	88
Number of Valid Hours for this Table	288
Total Hours for the Period	8759

TABLE 10 (Continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/05 1:00 12/31/05 23:00 Total Period

Elevation: **Speed:** 10M SPD **Direction:** 10M WD **Lapse:** DT60-10

Stability Class C Delta Temperature Slightly Unstable

	Wind Speed (mph)						
Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
N	1	9	17	1	0	0	28
NNE	4	10	2	0	0	0	16
NE	5	6	0	0	0	0	11
ENE	3	5	0	0	0	0	8
E	13	5	1	0	0	0	19
ESE	13	3	0	0	0	0	16
SE	4	5	3	0	0	0	12
SSE	4	2	1	0	0	0	7
S	5	7	2	0	0	0	14
SSW	6	14	4	0	0	0	24
SW	3	32	18	2	0	0	55
WSW	0	10	22	3	0	0	35
W	1	5	15	0	0	0	21
WNW	0	4	4	0	0	0	8
NW	0	2	13	3	0	0	18
NNW	1	7	18	1	0	0	27
Total	63	126	120	10	0	0	319

Number of Calm Hours for this Table	2
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	88
Number of Valid Hours for this Table	319
Total Hours for the Period	8759

TABLE 10 (Continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/05 1:00 - 12/31/05 23:00 Total Period

Elevation: **Speed:** 10M SPD **Direction:** 10M WD **Lapse:** DT60-10

Stability Class D Delta Temperature Neutral

Wind Direction	Wind Speed (mph) 1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
N	35	142	84	5	0	0	266
NNE	62	114	30	0	0	0	206
NE	53	79	1	0	0	0	133
ENE	58	24	2	0	0	0	84
E	69	16	2	0	0	0	87
ESE	40	22	1	0	0	0	63
SE	46	61	18	3	0	0	128
SSE	29	61	17	8	0	0	115
S	50	81	11	4	0	0	146
SSW	43	144	22	1	0	0	210
SW	31	123	121	17	0	0	292
WSW	16	66	95	29	3	0	209
W	5	56	68	12	0	0	141
WNW	8	53	74	7	0	0	142
NW	8	37	143	25	0	0	213
NNW	14	74	104	14	1	0	207
Total	567	1153	793	125	4	0	2642

Number of Calm Hours for this Table	2
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	88
Number of Valid Hours for this Table	2642
Total Hours for the Period	8759

TABLE 10 (Continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/05 1:00 12/31/05 23:00 Total Period

Elevation: **Speed:** 10M SPD **Direction:** 10M WD **Lapse:** DT60-10

Stability Class E Delta Temperature Slightly Stable

Wind Direction	Wind Speed (mph) 1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
N	58	77	27	0	0	0	162
NNE	134	147	14	0	0	0	295
NE	218	102	5	0	0	0	326
ENE	235	17	2	0	0	0	254
E	180	13	5	2	0	0	200
ESE	116	20	3	0	0	0	139
SE	143	22	2	3	0	0	170
SSE	113	26	9	5	0	0	153
S	122	38	11	5	0	0	176
SSW	113	99	17	0	0	0	229
SW	42	77	34	3	0	0	156
WSW	19	37	9	0	0	0	65
W	12	25	1	0	0	0	38
WNW	7	18	6	1	0	0	32
NW	5	29	6	0	0	0	40
NNW	14	42	11	0	0	0	67
Total	1531	789	162	19	0	0	2502

Number of Calm Hours for this Table	2
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	88
Number of Valid Hours for this Table	2501
Total Hours for the Period	8759

TABLE 10 (Continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/05 1:00 - 12/31/05 23:00 Total Period

Elevation: **Speed:** 10M SPD **Direction:** 10M WD **Lapse:** DT60-10

Stability Class F Delta Temperature Moderately Stable

Wind Direction	Wind Speed (mph) 1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
N	8	2	0	0	0	0	10
NNE	40	3	0	0	0	0	43
NE	134	3	0	0	0	0	137
ENE	471	9	0	0	0	0	480
E	189	0	0	0	0	0	189
ESE	68	0	0	0	0	0	68
SE	50	0	0	0	0	0	50
SSE	25	1	0	0	0	0	26
S	44	0	0	0	0	0	44
SSW	23	5	0	0	0	0	28
SW	18	3	0	0	0	0	21
WSW	6	2	0	0	0	0	8
W	3	0	0	0	0	0	3
WNW	1	0	0	0	0	0	1
NW	3	1	0	0	0	0	4
NNW	2	2	0	0	0	0	4
Total	1085	31	0	0	0	0	1116

Number of Calm Hours for this Table	2
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	88
Number of Valid Hours for this Table	1116
Total Hours for the Period	8759

TABLE 10 (Continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/05 1:00 - 12/31/05 23:00 Total Period

Elevation: Speed: 10M SPD **Direction:** 10M WD **Lapse:** DT60-10
Stability Class G Delta Temperature Extremely Stable

	Wind Speed (mph)						
Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
N	3	1	0	0	0	0	5
NNE	4	1	0	0	0	0	5
NE	126	3	0	0	0	0	129
ENE	452	6	0	0	0	0	458
E	66	0	0	0	0	0	66
ESE	19	1	0	0	0	0	20
SE	11	0	0	0	0	0	11
SSE	13	0	0	0	0	0	13
S	9	0	0	0	0	0	9
SSW	2	2	0	0	0	0	4
SW	1	1	0	0	0	0	2
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Total	706	15	0	0	0	0	722

Number of Calm Hours for this Table	2
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	88
Number of Valid Hours for this Table	721
Total Hours for the Period	8759

TABLE 10 (Continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/05 1:00 12/31/05 23:00 Total Period

Elevation: Speed: 10M SPD **Direction:** 10M WD **Lapse:** DT60-10
Summary of All Stability Classes Delta Temperature

Wind Direction	Wind Speed (mph) 1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
N	106	256	166	14	0	0	543
NNE	248	327	82	1	0	0	658
NE	558	240	13	0	0	0	812
ENE	1235	84	4	0	0	0	1323
E	548	57	8	2	0	0	615
ESE	294	61	4	0	0	0	359
SE	278	127	24	6	0	0	435
SSE	201	141	34	14	0	0	390
S	259	196	33	10	0	0	498
SSW	201	394	72	1	0	0	668
SW	112	413	282	28	0	0	835
WSW	50	153	188	34	3	0	428
W	24	98	113	12	0	0	247
WNW	18	84	96	8	0	0	206
NW	18	88	172	29	0	0	307
NNW	34	141	154	17	1	0	347
Total	4184	2860	1445	176	4	0	8671

Number of Calm Hours for this Table	2
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	88
Number of Valid Hours for this Table	8669
Total Hours for the Period	8759

TABLE 11. SSES JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION 60M VERSUS DELTA TEMPERATURE 60-10M FOR THE PERIOD OF JANUARY 1, 2005 THROUGH DECEMBER 31, 2005

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/05 1:00 - 12/31/05 23:00 Total Period

Elevation: **Speed:** 60M SPD **Direction:** 60M WD **Lapse:** DT60-10

Stability Class A Delta Temperature Extremely Unstable

	Wind Speed (mph)						
Wind Direction	**1 - 4**	**4 - 8**	**8 - 13**	**13 - 19**	**19 - 25**	**≥ 25**	**Total**
N	1	3	16	6	2	0	28
NNE	4	18	41	17	0	0	80
NE	12	33	17	2	0	0	64
ENE	9	17	14	2	0	0	42
E	6	9	2	0	0	0	17
ESE	12	9	0	0	0	0	21
SE	9	20	16	0	0	0	45
SSE	3	19	11	2	0	0	35
S	4	20	14	3	2	0	43
SSW	7	43	33	13	0	0	96
SW	7	42	65	30	1	0	145
WSW	2	10	36	25	0	0	73
W	0	0	12	2	0	0	14
WNW	1	0	7	0	0	0	8
NW	0	6	5	0	0	0	11
NNW	0	4	4	0	0	0	8
Total	77	253	293	102	5	0	730

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1528
Number of Valid Hours for this Table	730
Total Hours for the Period	8759

Table 11 (continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/05 1:00 12/31/05 23:00 Total Period

Elevation: **Speed:** 60M SPD **Direction:** 60M WD **Lapse:** DT60-10

Stability Class B Delta Temperature Moderately Unstable

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
N	0	4	3	5	1	0	13
NNE	1	5	9	7	0	0	22
NE	3	15	4	1	0	0	23
ENE	3	5	1	1	0	0	10
E	4	3	2	0	0	0	9
ESE	7	2	1	0	0	0	10
SE	2	1	5	0	0	0	8
SSE	3	6	3	2	0	0	14
S	3	1	2	0	1	0	7
SSW	4	6	7	1	1	0	19
SW	0	12	8	3	2	0	25
WSW	0	2	8	12	1	0	23
W	0	4	6	7	0	0	17
WNW	0	1	9	0	0	0	10
NW	1	3	9	1	0	0	14
NNW	1	1	7	5	0	0	14
Total	32	71	84	45	6	0	238

Wind Speed (mph)

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1528
Number of Valid Hours for this Table	238
Total Hours for the Period	8759

Table 11 (continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/05 1:00 - 12/31/05 23:00 Total Period

Elevation: **Speed:** 60M SPD **Direction:** 60M WD **Lapse:** DT60-10

Stability Class C Delta Temperature Slightly Unstable

	Wind Speed (mph)						
Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
N	0	2	7	5	0	0	14
NNE	4	6	9	2	0	0	21
NE	3	5	3	0	0	0	11
ENE	6	8	4	0	0	0	18
E	3	0	2	0	0	0	5
ESE	5	0	3	0	0	0	8
SE	1	2	3	1	0	0	7
SSE	3	1	1	0	0	0	5
S	1	0	1	2	0	0	4
SSW	4	7	4	8	0	0	23
SW	2	10	12	7	1	0	32
WSW	0	8	12	24	2	0	46
W	0	1	9	10	0	0	20
WNW	0	0	7	3	0	0	10
NW	0	1	11	4	0	0	16
NNW	0	1	9	9	0	0	19
Total	32	52	97	75	3	0	259

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1528
Number of Valid Hours for this Table	259
Total Hours for the Period	8759

Table 11 (continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/05 1:00 12/31/05 23:00 Total Period

Elevation: **Speed:** 60M SPD **Direction:** 60M WD **Lapse:** DT60-10
Stability Class D Delta Temperature Neutral

Wind Direction	Wind Speed (mph) 1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
N	17	46	105	31	3	0	202
NNE	27	84	94	36	0	0	241
NE	32	46	39	1	0	0	118
ENE	23	26	17	1	0	0	67
E	17	22	5	2	0	0	46
ESE	13	21	10	2	0	0	46
SE	25	33	37	7	2	0	104
SSE	14	27	35	16	10	2	104
S	20	12	39	7	1	3	82
SSW	19	36	49	33	7	2	146
SW	16	68	72	38	6	0	200
WSW	8	33	106	164	31	6	348
W	4	30	82	69	11	0	196
WNW	1	20	61	54	2	0	138
NW	7	9	120	67	4	0	207
NNW	4	26	100	42	5	0	177
Total	247	539	971	570	82	13	2422

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1528
Number of Valid Hours for this Table	2422
Total Hours for the Period	8759

Table 11 (continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/05 1:00 - 12/31/05 23:00 Total Period

Elevation: **Speed:** 60M SPD **Direction:** 60M WD **Lapse:** DT60-10
Stability Class E Delta Temperature Slightly Stable

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
	Wind Speed (mph)						
N	34	73	36	9	0	0	152
NNE	58	164	95	32	1	0	350
NE	70	89	68	13	0	0	240
ENE	38	41	12	0	0	0	91
E	32	43	12	4	1	0	92
ESE	32	37	17	2	1	1	90
SE	47	40	15	3	2	0	107
SSE	41	36	23	6	7	2	115
S	37	35	26	10	5	3	116
SSW	40	51	51	22	5	3	172
SW	35	63	62	13	4	0	177
WSW	14	56	71	56	1	0	198
W	5	30	29	0	0	0	64
WNW	3	20	13	5	0	0	41
NW	1	14	34	3	0	0	52
NNW	9	9	30	3	0	0	51
Total	496	801	594	181	27	9	2108

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1528
Number of Valid Hours for this Table	2108
Total Hours for the Period	8759

Table 11 (continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/05 1:00 - 12/31/05 23:00 Total Period

Elevation: **Speed:** 60M SPD **Direction:** 60M WD **Lapse:** DT60-10

Stability Class F Delta Temperature Moderately Stable

Wind Direction	Wind Speed (mph) 1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
N	13	55	4	0	0	0	72
NNE	83	197	3	0	0	0	283
NE	72	39	2	0	0	0	113
ENE	34	7	0	0	0	0	41
E	24	14	0	0	0	0	38
ESE	30	11	0	0	0	0	41
SE	30	5	1	0	0	0	36
SSE	19	6	1	0	0	0	26
S	24	10	3	0	0	0	37
SSW	10	23	5	1	0	0	39
SW	12	27	5	0	0	0	44
WSW	5	5	19	1	0	0	30
W	4	7	1	0	0	0	12
WNW	4	2	0	0	0	0	6
NW	4	7	2	0	0	0	13
NNW	3	2	1	0	0	0	6
Total	371	417	47	2	0	0	837

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1528
Number of Valid Hours for this Table	837
Total Hours for the Period	8759

Table 11 (continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/05 1:00 - 12/31/05 23:00 Total Period

Elevation: **Speed:** 60M SPD **Direction:** 60M WD **Lapse:** DT60-10

Stability Class G Delta Temperature Extremely Stable

Wind Direction	Wind Speed (mph) 1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
N	10	65	2	0	0	0	77
NNE	46	174	5	0	0	0	225
NE	63	52	2	0	0	0	117
ENE	34	10	0	0	0	0	44
E	21	2	0	0	0	0	23
ESE	19	3	0	0	0	0	22
SE	15	7	0	0	0	0	22
SSE	12	6	0	0	0	0	18
S	12	12	0	0	0	0	24
SSW	6	11	4	1	0	0	22
SW	3	15	5	0	0	0	23
WSW	1	1	4	1	0	0	7
W	1	0	0	0	0	0	1
WNW	1	0	0	0	0	0	1
NW	0	5	0	0	0	0	5
NNW	4	2	0	0	0	0	6
Total	248	365	22	2	0	0	637

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1528
Number of Valid Hours for this Table	637
Total Hours for the Period	8759

Table 11 (continued)

Hours at Each Wind Speed and Direction

Period of Record = 01/01/05 1:00 - 12/31/05 23:00 Total Period

Elevation: **Speed:** 60M SPD **Direction:** 60M WD **Lapse:** DT60-10
Summary of All Stability Classes Delta Temperature

Wind Direction	Wind Speed (mph) 1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
N	75	248	173	56	6	0	558
NNE	223	648	256	94	1	0	1222
NE	255	279	135	17	0	0	686
ENE	147	114	48	4	0	0	313
E	107	93	23	6	1	0	230
ESE	118	83	31	4	1	1	238
SE	129	108	77	11	4	0	329
SSE	95	101	74	26	17	4	317
S	101	90	85	22	9	6	313
SSW	90	177	153	79	13	5	517
SW	75	237	229	91	14	0	646
WSW	30	115	256	283	35	6	725
W	14	72	139	88	11	0	324
WNW	10	43	97	62	2	0	214
NW	13	45	181	75	4	0	318
NNW	21	45	151	59	5	0	281
Total	1503	2498	2108	977	123	22	7231

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1528
Number of Valid Hours for this Table	7231
Total Hours for the Period	8759

TABLE 12. ANNUAL PASQUILL STABILITY CLASS OCCURRENCES PRIMARY TOWER 1973-2005 (in percent)

YEAR	A	B	C	D	E	F	G
1973-1976	16.23	7.64	4.24	30.72	26.17	10.51	4.49
1977	6.62	3.29	1.45	34.03	38.52	11.49	4.59
1978	1.38	1.82	0.79	34.72	44.72	12.33	4.23
1979	1.36	1.72	1.44	38.18	41.27	11.46	4.56
1980	5.68	4.02	2.41	41.84	27.37	12.34	6.34
1981	11.29	3.45	2.82	32.80	29.29	11.38	8.97
1982	15.68	3.48	2.83	23.41	29.99	14.00	11.59
1983	4.35	3.30	5.02	39.32	28.69	12.02	7.30
1984	3.57	2.72	4.23	34.36	33.51	13.50	8.10
1985	5.36	3.50	3.98	35.44	33.36	12.05	6.30
1986	5.62	3.13	3.67	32.92	35.78	11.26	7.62
1987	9.33	2.53	3.61	34.09	28.72	13.43	8.29
1988	13.83	3.60	4.19	31.10	27.26	12.74	7.28
1989	4.57	3.00	4.51	40.90	30.01	10.72	6.28
1990	3.37	2.53	3.59	39.34	29.79	13.93	7.44
1991	5.25	3.75	4.55	39.38	25.28	14.24	7.55
1992	3.06	2.91	4.80	47.76	26.26	11.09	4.11
1993	3.78	3.56	4.11	39.33	26.68	12.19	7.34
1994	6.24	3.18	4.43	34.25	29.55	13.26	9.08
1995	5.34	3.48	4.62	41.06	27.08	11.29	7.14
1996	2.17	2.22	3.94	44.42	30.79	11.13	5.33
1997	4.98	3.66	5.49	38.80	28.05	12.87	6.16
1998	2.88	2.94	4.08	35.15	30.97	15.58	8.39
1999	5.63	3.35	4.05	38.27	27.24	11.94	9.52
2000	2.65	3.08	4.63	44.92	25.47	11.86	7.39
2001	4.55	3.82	5.22	37.39	27.47	13.49	8.06
2002	3.21	3.71	4.93	40.47	26.43	13.28	7.97
2003	4.10	1.70	2.89	43.99	30.15	11.08	6.09
2004	3.51	3.30	5.24	39.42	32.38	11.56	4.89
2005	12.48	3.32	3.68	30.47	28.85	12.87	8.33

Pasquill stability class assignments were based on the temperature difference between the 90-meter and 10-meter levels from 1973 through July 1981. From July 1981 to present, the stability class assignment is based on the temperature difference between the 60-meter and 10-meter levels.

TABLE 13. SSES DAILY, MONTHLY AND ANNUAL PRECIPITATION

TOTALS FOR 2005

Date	Amount (inches)	Date	Amount (inches)	Date	Amount (inches)	Date	Amount (inches)	Date	Amount (inches)	Date	Amount (inches)
Jan		Feb		Mar		Apr		May		June	
		8	1.00	1	0.22	2	1.54	2	0.02	3	0.27
3	0.57	9	0.30	8	0.16	3	1.02	14	0.30	4	0.07
4	0.07	14	0.20	11	0.02	22	0.08	15	0.01	6	0.21
5	0.26	16	0.24	20	0.04	23	0.61	20	0.15	15	0.17
6	0.89	17	0.01	21	0.23	24	0.06	28	0.12	16	0.16
8	0.35	20	0.04	23	0.41	30	0.11	29	0.02	22	0.03
11	0.35	21	0.14	24	0.21			30	0.06	28	0.30
12	0.02	22	0.06	27	0.11	**Total**	**3.42**	22	0.09	29	0.39
13	0.07	23	0.06	28	1.37						
14	1.53	24	0.01	29	0.23			**Total**	**0.75**	**Total**	**1.60**
24	0.01	25	0.14								
25	0.30	26	0.01	**Total**	**3.00**						
26	0.04	28	0.03								
Total	**4.46**	**Total**	**2.24**								

Date	Amount (inches)	Date	Amount (inches)	Date	Amount (inches)	Date	Amount (inches)	Date	Amount (inches)	Date	Amount (inches)
Jul		Aug		Sep		Oct		Nov		Dec	
5	1.15	5	0.62	17	0.28	7	1.65	1	0.11	4	0.21
8	0.46	7	0.11	26	0.28	8	1.58	6	0.29	9	0.21
9	0.07	8	0.01	29	0.20	11	0.15	9	0.26	10	0.07
11	0.95	12	0.10			12	1.00	15	0.23	11	0.13
13	0.01	16	0.03	**Total**	**0.76***	13	0.55	16	0.41	12	0.02
16	0.05	19	0.43			14	0.25	22	0.21	15	0.15
17	0.08	27	0.02			15	0.02	29	1.16	16	0.57
19	0.07	28	0.17			18	0.10			23	0.01
25	0.15	29	0.03			22	0.84	**Total**	**2.67**	25	0.36
26	0.05	30	0.40			23	0.02			29	0.37
27	0.06	31	0.75			24	0.10			31	0.09
						25	0.96				
Total	**3.10**	**Total**	**2.67***							**Total***	**2.19**
						Total+	**7.22***				

Annual Total = 34.08

*Data substituted from Williamsport and Wilkes-Barre/Scranton, PA for the period of August 13-October 29, 2005..

TABLE 14. NORMAL AND ACTUAL (2005) PRECIPITATION DATA FOR WILLIAMSPORT AND AVOCA, PA (inches)				
	WILLIAMSPORT		AVOCA	
MONTH	NORMAL*	2005	NORMAL*	2005
JAN	2.85	4.46	2.46	5.35
FEB	2.61	2.25	2.08	1.70
MAR	3.21	3.88	2.69	3.28
APR	3.49	4.59	3.28	4.02
MAY	3.79	1.74	3.69	1.26
JUN	4.45	1.80	3.97	2.07
JUL	4.08	6.33	3.74	2.21
AUG	3.38	6.36	3.10	2.17
SEP	3.98	1.78	3.86	0.80
OCT	3.19	5.89	3.02	7.66
NOV	3.62	6.77	3.12	3.40
DEC	2.94	2.27	2.55	2.76
Total inches	41.59	48.12	37.56	36.68

* Normal values are for the 30 year period from 1961 – 1990

TABLE 15. 2005 EXCLUSION AREA BOUNDARY SHORT-TERM (ACCIDENT) DISPERSION ESTIMATES X/Q VALUES (sec/meter3)

Affected Sector	Distance (Miles)	Time Period				
		0-2 hours	0-8 hours	8-24 hours	1-4 days	4-30 days
N	0.34	2.53E-04	1.30E-04	5.10E-05	2.11E-05	1.00E-05
NNE	0.34	2.02E-04	9.92E-05	4.56E-05	2.16E-05	1.50E-05
NE	0.34	1.52E-04	7.78E-05	3.55E-05	1.84E-05	8.50E-06
ENE	0.34	1.06E-04	5.22E-05	2.34E-05	1.50E-05	5.00E-06
E	0.34	8.68E-05	4.42E-05	2.02E-05	1.50E-05	4.00E-06
ESE	0.34	7.52E-05	5.00E-05	1.93E-05	1.50E-05	4.00E-06
SE	0.34	8.56E-05	5.11E-05	2.00E-05	1.50E-05	4.00E-06
SSE	0.34	1.04E-04	6.38E-05	2.45E-05	1.50E-05	7.00E-06
S	0.34	1.64E-04	9.07E-05	4.24E-05	2.58E-05	1.00E-05
SSW	0.34	2.35E-04	1.33E-04	6.59E-05	3.18E-05	2.00E-05
SW	0.34	4.74E-04	2.94E-04	1.21E-04	5.89E-05	3.50E-05
WSW	0.34	7.25E-04	5.31E-04	2.32E-04	1.70E-04	7.00E-05
W	0.34	5.42E-04	2.86E-04	1.12E-04	6.00E-05	3.00E-05
WNW	0.34	3.47E-04	1.77E-04	6.45E-05	3.28E-05	1.50E-05
NW	0.34	3.25E-04	1.48E-04	6.27E-05	3.00E-05	1.50E-05
NNW	0.34	2.83E-04	1.31E-04	5.00E-05	2.33E-05	9.79E-06

The shaded values denote the maximum relative short-term concentration values (X/Q) for each time period as generated by the dispersion estimate modeling program, WINDOW, with no terrain/recirculation factors included.

TABLE 16. 2005 LOW POPULATION ZONE SHORT-TERM (ACCIDENT) DISPERSION ESTIMATES X/Q VALUES (sec/meter^3)

Affected Sector	Distance (Miles)	Time Period				
		0-2 hours	0-8 hours	8-24 hours	1-4 days	4-30 days
N	3.0	2.37E-05	1.28E-05	3.00E-06	9.25E-07	4.80E-07
NNE	3.0	1.74E-05	8.27E-06	2.01E-06	8.83E-07	4.80E-07
NE	3.0	1.18E-05	6.70E-06	1.46E-06	7.92E-07	2.20E-07
ENE	3.0	7.12E-06	3.39E-06	9.28E-07	4.21E-07	2.20E-07
E	3.0	4.92E-06	3.28E-06	7.92E-07	7.00E-07	2.20E-07
ESE	3.0	4.18E-06	2.79E-06	7.82E-07	4.33E-07	1.50E-07
SE	3.0	4.73E-06	2.91E-06	8.01E-07	3.94E-07	1.50E-07
SSE	3.0	6.19E-06	3.88E-06	9.82E-07	4.80E-07	2.20E-07
S	3.0	1.17E-05	7.64E-06	1.83E-06	8.60E-07	4.80E-07
SSW	3.0	2.05E-05	1.27E-05	2.89E-06	2.00E-06	1.00E-06
SW	3.0	5.47E-05	3.39E-05	4.71E-06	3.00E-06	1.50E-06
WSW	3.0	8.50E-05	6.17E-05	8.62E-06	7.00E-06	3.00E-06
W	3.0	5.65E-05	2.97E-05	4.91E-06	3.00E-06	1.50E-06
WNW	3.0	3.67E-05	1.82E-05	2.70E-06	1.34E-06	7.00E-07
NW	3.0	3.52E-05	1.50E-05	2.90E-06	1.50E-06	4.80E-07
NNW	3.0	2.67E-05	1.30E-05	1.98E-06	9.35E-07	4.80E-07

The shaded values denote the maximum relative short-term concentration values (X/Q) for each time period as generated by the dispersion estimate modeling program, WINDOW, with no terrain/recirculation factors included.

TABLE 17. COMPARISON OF FIVE PERCENT OVERALL X/Q VALUES FOR THE EXCLUSION AREA BOUNDARY, 1978-2005 (sec/meter3)

EXCLUSION AREA BOUNDARY					
Year	5% OVERALL RELATIVE CONCENTRATIONS X/Q (sec/meter^3)				
	0-2 hours	0-8 hours	8-24 hours	1-4 days	4-30 days
1978	5.0 E-04	2.7 E-04	2.2 E-04	1.4 E-04	7.7 E-05
1979	3.9 E-04	2.1 E-04	1.7 E-04	1.1 E-04	5.6 E-05
1980	3.5 E-04	2.3 E-04	1.8 E-04	1.2 E-04	6.0 E-05
1981	4.4 E-04	2.9 E-04	2.4 E-04	1.5 E-04	7.9 E-05
1982	4.8 E-04	3.2 E-04	2.6 E-04	1.7 E-04	8.8 E-05
1983	3.5 E-04	2.5 E-04	2.1 E-04	1.5 E-04	8.9 E-05
1984	3.5 E-04	2.5 E-04	2.1 E-04	1.4 E-04	8.2 E-05
1985	2.7 E-04	1.7 E-04	1.3 E-04	8.1 E-04	3.9 E-05
1986	3.5 E-04	2.2 E-04	1.7 E-04	1.0 E-04	4.8 E-05
1987	3.4 E-04	2.3 E-04	1.9 E-04	1.2 E-04	6.4 E-05
1988	3.1 E-04	2.0 E-04	1.6 E-04	1.0 E-04	5.2 E-05
1989	2.8 E-04	1.9 E-04	1.5 E-04	9.6 E-05	5.0 E-05
1990	2.8 E-04	1.7 E-04	1.4 E-04	8.1 E-05	3.8 E-05
1991	3.3 E-04	2.0 E-04	1.5 E-04	8.8 E-05	4.0 E-05
1992	1.3 E-04	8.7 E-05	7.2 E-05	4.8 E-05	2.7 E-05
1993	1.4 E-04	9.5 E-05	7.9 E-05	5.2 E-05	2.9 E-05
1994	1.3 E-04	8.8 E-05	7.2 E-05	4.8 E-05	2.6 E-05
1995	1.3 E-04	1.0 E-04	9.3 E-05	7.4 E-05	5.3 E-05
1996	1.3 E-04	1.0 E-04	9.2 E-05	7.2 E-05	5.1 E-05
1997	1.4 E-04	9.1 E-05	7.4 E-05	4.8 E-05	2.5 E-05
1998	4.9 E-04	3.6 E-04	3.1 E-04	2.2 E-04	1.4 E-04
1999	6.5 E-04	4.2 E-04	3.4 E-04	2.0 E-04	9.4 E-05
2000	4.8 E-04	3.2 E-04	2.7 E-04	1.7 E-04	8.6 E-05
2001	6.6 E-04	4.2 E-04	3.3 E-04	2.0 E-04	1.0 E-04
2002	6.6 E-04	4.1 E-04	3.3 E-04	2.0 E-04	9.4 E-05
2003	6.0E-04	3.7E-04	2.9E-04	1.7E-04	8.2E-05
2004	6.0E-04	3.7E-04	2.9E-04	1.7E-04	8.1E-05
2005	6.5E-04	4.1E-04	3.3E-04	2.0E-04	9.6E-05

The above values were calculated using the WINDOW atmospheric dispersion model, with no terrain/recirculation factors included. Used the peak annual average from all directions.

TABLE 18. COMPARISON OF FIVE PERCENT OVERALL X/Q VALUES FOR THE LOW POPULATION ZONE, 1978-2005 (sec/meter3)

LOW POPULATION ZONE					
Year	**5% OVERALL RELATIVE CONCENTRATIONS X/Q (sec/meter^3)**				
	0-2 hours	**0-8 hours**	**8-24 hours**	**1-4 days**	**4-30 days**
1978	7.2 E-05	2.9 E-05	2.1 E-05	1.1 E-05	4.1 E-06
1979	6.6 E-05	2.6 E-05	1.9 E-05	9.6 E-06	3.6 E-06
1980	7.3 E-05	4.1 E-05	3.1 E-05	1.7 E-05	6.9 E-06
1981	9.7 E-05	5.4 E-05	4.1 E-05	2.2 E-05	8.6 E-06
1982	1.1 E-04	6.6 E-05	5.0 E-05	2.9 E-05	1.3 E-05
1983	8.4 E-05	4.8 E-05	3.6 E-05	1.9 E-05	8.0 E-06
1984	7.6 E-05	4.4 E-05	3.3 E-05	1.8 E-05	7.4 E-06
1985	5.8 E-05	3.4 E-05	2.6 E-05	1.4 E-05	5.8 E-06
1986	7.0 E-05	4.0 E-05	3.0 E-05	1.6 E-05	6.8 E-06
1987	7.9 E-05	4.7 E-05	3.7 E-05	2.1 E-05	9.5 E-06
1988	7.3 E-05	4.3 E-05	3.3 E-05	1.8 E-05	7.9 E-06
1989	6.7 E-05	4.0 E-05	3.1 E-05	1.7 E-05	7.7 E-06
1990	6.7 E-05	4.0 E-05	3.1 E-05	1.8 E-05	8.0 E-06
1991	6.2 E-05	3.8 E-05	3.0 E-05	1.7 E-05	7.8 E-06
1992	4.2 E-05	2.7 E-05	2.2 E-05	1.4 E-05	6.9 E-06
1993	5.4 E-05	3.4 E-05	2.7 E-05	1.6 E-05	7.9 E-06
1994	6.1 E-05	3.8 E-05	3.0 E-05	1.8 E-05	8.9 E-06
1995	5.1 E-05	3.2 E-05	2.6 E-05	1.6 E-05	7.7 E-06
1996	4.7 E-05	3.0 E-05	2.4 E-05	1.5 E-05	7.5 E-06
1997	4.8 E-05	3.1 E-05	2.5 E-05	1.5 E-05	7.7 E-06
1998	5.8 E-05	3.7 E-05	3.0 E-05	1.8 E-05	9.1 E-06
1999	7.4 E-05	3.9 E-05	2.8 E-05	1.3 E-05	5.0 E-06
2000	5.2 E-05	2.9 E-05	2.3 E-05	1.2 E-05	4.6 E-06
2001	7.4 E-05	3.9 E-05	2.9 E-05	1.5 E-05	5.5 E-06
2002	7.4 E-05	3.9 E-05	2.8 E-05	1.4 E-05	5.2 E-06
2003	7.4 E-05	3.6 E-05	2.6 E-05	1.3 E-05	4.2 E-06
2004	6.0E-05	3.2E-05	2.3E-05	1.2E-05	4.4E-06
2005	8.3E-05	4.3E-05	3.1E-05	1.5E-05	5.6E-06

The above values were calculated using the WINDOW atmospheric dispersion model, with no terrain/recirculation factors included. Used the peak annual average from all directions.

TABLE 19. TERRAIN AND RECIRCULATION CORRECTION FACTORS USED IN DISPERSION MODELS AT THE SITE BOUNDARY

	Site Boundary		Exclusion Area Boundary	
Affected Sector	**Distance (miles)**	**Recirculation Factor**	**Distance (miles)**	**Recirculation Factor**
N	0.59	2.20	0.34	2.18
NNE	0.78	2.37	0.34	2.00
NE	0.7	2.31	0.34	2.15
ENE	0.86	2.52	0.34	2.36
E	0.8	2.33	0.34	2.30
ESE	0.5	2.58	0.34	2.79
SE	0.43	2.44	0.34	2.46
SSW	0.41	2.57	0.34	2.49
S	0.38	2.35	0.34	2.30
SSW	0.39	2.30	0.34	2.32
SW	0.61	2.05	0.34	1.89
WSW	1.22	2.31	0.34	1.68
W	1.03	2.22	0.34	2.27
WNE	0.61	2.66	0.34	2.54
NW	0.66	3.02	0.34	3.00
NNW	0.59	2.53	0.34	2.26

The SSES Final Safety Analysis Report has terrain/recirculation correction factors assigned for standard distances. During 1997, real estate purchases in and around the SSES area caused site boundary distances to change. As a result, the terrain/recirculation values listed in this table were re-calculated using the SSES 1997 Site Boundary Distances and the original terrain/recirculation factors quoted in the SSES-FSAR. No changes to the Site Boundary distances occurred during 2005.

TABLE 20. DISTANCES AND TERRAIN/RECIRCULATION CORRECTION FACTORS FOR SSES 2005 LAND USE CENSUS LOCATIONS

RESIDENCE			GARDEN		
AFFECTED SECTOR	MILES	Terrain Correction Factor	AFFECTED SECTOR	MILES	Terrain Correction Factor
N	1.3	2.15	N	3.2	2.19
NNE	1	2.50	NNE	2.3	2.55
NE	0.9	2.33	NE	2.7	2.47
ENE	2.1	2.42	ENE	2.4	2.48
E	1.4	2.09	E	1.8	2.07
ESE	0.5	2.58	ESE	2.5	2.00
SE	0.5	2.43	SE	0.6	2.44
SSE	0.6	2.71	SSE	1.6	2.44
S	1	2.46	S	1.1	2.43
SSW	0.9	2.39	SSW	1.2	2.35
SW	1.5	2.14	SW	1.9	2.11
WSW	1.3	2.32	WSW	1.3	2.32
W	1.2	2.18	W	1.2	2.18
WNW	0.8	2.74	WNW	1.3	2.59
NW	0.8	3.30	NW	1.8	3.06
NNW	0.6	2.53	NNW	4	2.40

PRODUCTION ANIMAL			DAIRY ANIMAL		
AFFECTED SECTOR	MILES	Terrain Correction Factor	AFFECTED SECTOR	MILES	Terrain Correction Factor
NNE	2.3	2.55	E	4.5	1.80
ENE	2.4	2.48	ESE	2.7	1.96
E	1.8	2.07	ESE	4.2	1.58
SSW	3	2.35	SSW	3	2.11
SSW	3.5	1.88	SSW	3.1	2.06
NW	0.8	3.30	SSW	3.5	1.88
NW	1.8	3.06	SSW	14.01	1.03
			WSW	1.7	2.34
			W	5	1.46
			NNW	4.2	2.4

Distances to the nearest garden, residence, dairy animal and production animal in each of the affected sectors was provided by the 2005 SSES Land Use Census(Reference 7). The terrain/recirculation correction factors listed for the distances in the above tables were mathematically interpolated from the terrain/recirculation factors quoted for standard distances in the SSES Final Safety Analysis Report.

TABLE 21. 2005 ANNUAL AVERAGE RELATIVE CONCENTRATION (sec/meter^3) AND DEPOSITION (meter^{-2}) ESTIMATES AT THE EXCLUSION AREA BOUNDARY

Affected Sector		Relative Concentration (sec/meter^3)			Deposition
	Distance (miles	No Decay Undepleted	2.26 Days of Decay Undepleted	8.0 Days of Decay Depleted	D/Q (meter^{-2})
N	0.34	1.18E-05	1.18E-05	1.11E-05	4.88E-08
NNE	0.34	1.02E-05	1.01E-05	9.52E-06	6.01E-08
NE	0.34	8.24E-06	8.24E-06	7.73E-06	8.06E-08
ENE	0.34	4.59E-06	4.58E-06	4.30E-06	4.55E-08
E	0.34	2.83E-06	2.83E-06	2.65E-06	2.56E-08
ESE	0.34	2.83E-06	2.82E-06	2.65E-06	2.58E-08
SE	0.34	3.27E-06	3.27E-06	3.07E-06	3.40E-08
SSE	0.34	4.35E-06	4.34E-06	4.08E-06	3.88E-08
S	0.34	8.90E-06	8.89E-06	8.35E-06	5.61E-08
SSW	0.34	1.50E-05	1.49E-05	1.40E-05	6.87E-08
SW	0.34	3.02E-05	3.01E-05	2.83E-05	6.89E-08
WSW	0.34	7.01E-05	7.00E-05	6.57E-05	9.97E-08
W	0.34	3.71E-05	3.71E-05	3.48E-05	6.28E-08
WNW	0.34	1.85E-05	1.85E-05	1.74E-05	4.11E-08
NW	0.34	1.99E-05	1.99E-05	1.86E-05	5.87E-08
NNW	0.34	1.13E-05	1.13E-05	1.06E-05	3.97E-08

The above values were calculated using the XDCALC atmospheric dispersion model with terrain/recirculation factors included.

TABLE 22. 2005 ANNUAL AVERAGE RELATIVE CONCENTRATION (sec/meter^3) AND DEPOSITION (meter^{-2}) ESTIMATES AT THE SITE BOUNDARY					
Affected Sector		**Relative Concentration (sec/meter^3)**			**Deposition**
	Distance (miles	**No Decay Undepleted**	**2.26 Days of Decay Undepleted**	**8.0 Days of Decay Depleted**	**D/Q (meter^{-2})**
N	0.59	5.34E-06	5.32E-06	4.83E-06	1.93E-08
NNE	0.78	3.61E-06	3.59E-06	3.20E-06	1.74E-08
NE	0.58	3.93E-06	3.92E-06	3.55E-06	3.43E-08
ENE	0.49	2.69E-06	2.69E-06	2.46E-06	2.47E-08
E	0.48	1.71E-06	1.71E-06	1.57E-06	1.44E-08
ESE	0.5	1.48E-06	1.48E-06	1.35E-06	1.25E-08
SE	0.43	2.30E-06	2.29E-06	2.12E-06	2.27E-08
SSE	0.41	3.41E-06	3.41E-06	3.16E-06	2.93E-08
S	0.38	7.72E-06	7.71E-06	7.18E-06	4.74E-08
SSW	0.39	1.22E-05	1.22E-05	1.14E-05	5.43E-08
SW	0.61	1.36E-05	1.35E-05	1.22E-05	2.78E-08
WSW	1.22	1.33E-05	1.32E-05	1.14E-05	1.56E-08
W	1.03	6.94E-06	6.88E-06	6.02E-06	9.32E-09
WNW	0.61	8.22E-06	8.17E-06	7.40E-06	1.59E-08
NW	0.66	7.65E-06	7.61E-06	6.85E-06	1.92E-08
NNW	0.59	5.65E-06	5.63E-06	5.10E-06	1.75E-08
The above values were calculated using the XDCALC atmospheric dispersion model with terrain/recirculation factors included.					

TABLE 23. 2005 ANNUAL ATMOSPHERIC DISPERSION ESTIMATES FOR NEAREST RESIDENCE AND GARDEN*

NEAREST RESIDENCE WITHIN A 5-MILE RADIUS OF SSES BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	*NAME*	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
1	N	H.Burd	1.3	1.64E-06	1.63E-06	1.40E-06	4.90E-09
2	NNE	E.Ashbridge III	1	2.65E-06	2.64E-06	2.31E-06	1.20E-08
3	NE	W.Tuggle	0.9	2.10E-06	2.09E-06	1.84E-06	1.67E-08
4	ENE	D.Barberi	2.1	3.35E-07	3.32E-07	2.75E-07	2.40E-09
5	E	L.Kozlowski/ W. Witts	1.4	3.13E-07	3.12E-07	2.67E-07	2.09E-09
6	ESE	R.Panetta	0.5	1.48E-06	1.48E-06	1.35E-06	1.24E-08
7	SE	J.Futoma	0.5	1.82E-06	1.82E-06	1.66E-06	1.75E-08
8	SSE	J.Naunczek	0.6	2.04E-06	2.04E-06	1.84E-06	1.61E-08
9	S	S.Slusser	1	1.95E-06	1.94E-06	1.70E-06	9.57E-09
10	SSW	S.Molnar	0.9	3.79E-06	3.77E-06	3.32E-06	1.35E-08
11	SW	F.Michael	1.5	3.62E-06	3.59E-06	3.06E-06	6.24E-09
12	WSW	F.Michael	1.3	1.20E-05	1.19E-05	1.03E-05	1.41E-08
13	W	F. Hummel	1.2	5.40E-06	5.35E-06	4.64E-06	7.03E-09
14	WNW	R.Orlando	0.8	5.66E-06	5.62E-06	5.00E-06	1.03E-08
15	NW	H. Long	0.8	6.30E-06	6.26E-06	5.57E-06	1.51E-08
16	NNW	G. John	0.6	5.52E-06	5.49E-06	4.97E-06	1.70E-08

NEAREST GARDEN WITHIN A 5-MILE RADIUS OF SSES BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	*NAME*	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
1	N	J.Wojcik	3.2	4.41E-07	4.33E-07	3.45E-07	1.10E-09
2	NNE	R.Chapin	2.3	7.91E-07	7.83E-07	6.44E-07	3.14E-09
3	NE	Yokum	2.7	4.27E-07	4.23E-07	3.42E-07	2.89E-09
4	ENE	G.Dennis	2.4	2.80E-07	2.78E-07	2.27E-07	2.00E-09
5	E	W.Daily	1.8	2.11E-07	2.10E-07	1.76E-07	1.39E-09
6	ESE	L.Travelpiece	2.5	1.00E-07	9.96E-08	8.12E-08	6.68E-10
7	SE	F.Scholl	0.6	1.39E-06	1.39E-06	1.26E-06	1.28E-08
8	SSE	M.Zaletko	1.6	4.26E-07	4.24E-07	3.59E-07	2.75E-09
9	S	A. Kadir	1.1	1.68E-06	1.67E-06	1.45E-06	8.05E-09
10	SSW	S.Bodnar	1.2	2.46E-06	2.44E-06	2.11E-06	8.15E-09
11	SW	R. Brody	1.9	2.55E-06	2.52E-06	2.11E-06	4.25E-09
12	WSW	F.Michael	1.3	1.20E-05	1.19E-05	1.03E-05	1.41E-08
13	W	F.Hummel	1.2	5.40E-06	5.35E-06	4.64E-06	7.03E-09
14	WNW	P.Moskaluk	1.3	2.61E-06	2.58E-06	2.23E-06	4.26E-09
15	NW	D.Goff	1.8	1.79E-06	1.77E-06	1.49E-06	3.59E-09
16	NNW	P.Culver	4	3.21E-07	3.13E-07	2.44E-07	6.28E-10

1	X/Q	RELATIVE CONCENTRATION (SEC/M^3)
2	X/Q DEC	DECAYED AND UNDEPLETED, HALF-LIFE 2.26 DAYS (SEC/M^3)
3	X/Q DEC+DEP	DECAYED AND DEPLETED, HALF-LIFE 8 DAYS (SEC/M^3)
4	DEPOSITION	RELATIVE DEPOSITION RATE ($1/M^2$)

*2005 Land Use Census Locations

TABLE 24. 2005 ANNUAL ATMOSPHERIC DISPERSION ESTIMATES FOR NEAREST MEAT ANIMAL, DAIRY LOCATIIONS AND SPECIAL RECEPTORS*

NEAREST ANIMAL RAISED FOR MEAT CONSUMPTION WITHIN A 5-MILE RADIUS OF SSES BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	*NAME*	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
2	NNE	R.Chapin	2.3	7.91E-07	7.83E-07	6.44E-07	3.14E-09
4	ENE	G.Dennis	2.4	2.80E-07	2.78E-07	2.27E-07	2.00E-09
5	E	W.Daily	1.8	2.11E-07	2.10E-07	1.76E-07	1.39E-09
10	SSW	R. & C. Ryman	3	5.63E-07	5.55E-07	4.44E-07	1.59E-09
10	SSW	C.K.Drasher	3.5	3.96E-07	3.89E-07	3.06E-07	1.06E-09
15	NW	H. Long	0.8	6.30E-06	6.26E-06	5.57E-06	1.51E-08
15	NW	D. Goff	1.8	1.79E-06	1.77E-06	1.49E-06	3.59E-09

ALL DAIRY LOCATIONS NEAR SSES

SECTOR NUMBER	AFFECTED SECTOR	*NAME*	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
5	E	W.Bloss	4.5	4.44E-08	4.37E-08	3.33E-08	2.42E-10
6	ESE	D.Moyer	2.7	8.65E-08	8.58E-08	6.93E-08	5.64E-10
6	ESE	F.Rinehimer	4.2	3.48E-08	3.44E-08	2.63E-08	2.01E-10
10	SSW	R. & C. Ryman	3	5.63E-07	5.55E-07	4.44E-07	1.59E-09
10	SSW	R.Ryman	3.1	5.24E-07	5.16E-07	4.12E-07	1.46E-09
10	SSW	C.K.Drasher	3.5	3.96E-07	3.89E-07	3.06E-07	1.06E-09
10	SSW	K.Davis	14.01	3.26E-08	3.05E-08	2.03E-08	5.64E-11
12	WSW	T. & M. Berger	1.7	8.22E-06	8.12E-06	6.87E-06	9.17E-09
13	W	J. Dent	5	4.96E-07	4.76E-07	3.63E-07	4.06E-10
16	NNW	H.Shoemaker	4.2	3.01E-07	2.93E-07	2.27E-07	5.77E-10

SPECIAL RECEPTOR LOCATIONS

AFFECTED SECTOR	LOCATION	MILES	X/Q(1)	X/Q DEC(2)	X/Q DEC+DEP(3)	DEPOSITION(4)
3 / NE	Riverlands / EIC	0.7	3.03E-06	3.03E-06	2.71E-06	2.55E-08
12 / WSW	Tower's Club	0.5	4.19E-05	4.18E-05	3.83E-05	5.63E-08
5 / E	East Gate	0.5	1.61E-06	1.61E-06	1.47E-06	1.34E-08

1	**X/Q**	**RELATIVE CONCENTRATION (SEC/M^3)**
2	**X/Q DEC**	**DECAYED AND UNDEPLETED, HALF-LIFE 2.26 DAYS (SEC/M^3)**
3	**X/Q DEC+DEP**	**DECAYED AND DEPLETED, HALF-LIFE 8 DAYS (SEC/M^3)**
4	**DEPOSITION**	**RELATIVE DEPOSITION RATE (1/M^2)**

*2005 Land Use Census Locations

TABLE 25. 2005 SSES ANNUAL RELATIVE CONCENTRATIONS NO DECAY, UNDEPLETED X/Q (sec/m^3)

DATES OF LAST X/Q ACCUMULATION ARE FROM 5 1 1 1 0 TO 5123124 0
X/Q ACCUMULATION FOR GROUND AVERAGE SEC/M3
FOR RELEASE POINT 1

	MILES									
DIRECTION FROM	.0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10 - 20	20 - 30	30 - 40	40 - 50
N	5.32E-06	1.02E-06	4.28E-07	2.27E-07	1.47E-07	5.54E-08	1.55E-08	7.57E-09	4.79E-09	3.42E-09
NNE	8.41E-06	1.75E-06	7.89E-07	4.24E-07	2.75E-07	1.03E-07	2.87E-08	1.42E-08	9.07E-09	6.51E-09
NE	1.91E-05	3.56E-06	1.62E-06	9.32E-07	6.23E-07	2.50E-07	7.71E-08	3.91E-08	2.52E-08	1.84E-08
ENE	5.28E-05	9.58E-06	4.66E-06	2.79E-06	1.87E-06	7.48E-07	2.20E-07	1.07E-07	6.98E-08	5.14E-08
E	2.04E-05	3.72E-06	1.65E-06	9.40E-07	6.29E-07	2.56E-07	8.15E-08	4.15E-08	2.69E-08	1.96E-08
ESE	1.05E-05	2.04E-06	9.33E-07	5.26E-07	3.51E-07	1.43E-07	4.00E-08	1.77E-08	1.15E-08	8.34E-09
SE	1.15E-05	2.29E-06	1.06E-06	6.03E-07	4.02E-07	1.65E-07	4.18E-08	1.56E-08	1.00E-08	7.24E-09
SSE	8.16E-06	1.59E-06	7.08E-07	4.01E-07	2.72E-07	1.19E-07	3.17E-08	1.14E-08	7.33E-09	5.31E-09
S	6.34E-06	1.33E-06	6.57E-07	3.86E-07	2.66E-07	1.25E-07	3.52E-08	1.22E-08	7.85E-09	5.66E-09
SSW	7.13E-06	1.45E-06	6.73E-07	3.84E-07	2.55E-07	1.07E-07	2.81E-08	1.08E-08	6.89E-09	4.94E-09
SW	4.80E-06	9.70E-07	4.70E-07	2.73E-07	1.85E-07	8.25E-08	2.19E-08	7.50E-09	4.80E-09	3.44E-09
WSW	2.76E-06	5.44E-07	2.59E-07	1.54E-07	1.06E-07	5.14E-08	1.66E-08	6.36E-09	3.31E-09	1.83E-09
W	1.46E-06	2.82E-07	1.23E-07	6.81E-08	4.50E-08	1.87E-08	5.21E-09	2.15E-09	1.35E-09	9.57E-10
WNW	1.34E-06	2.49E-07	1.00E-07	5.26E-08	3.36E-08	1.25E-08	3.42E-09	1.63E-09	1.01E-09	7.07E-10
NW	1.89E-06	3.52E-07	1.42E-07	7.27E-08	4.64E-08	1.69E-08	4.54E-09	2.18E-09	1.36E-09	9.52E-10
NNW	2.51E-06	4.80E-07	2.04E-07	1.09E-07	6.90E-08	2.44E-08	6.19E-09	2.98E-09	1.87E-09	1.31E-09

TABLE 26. 2005 SSES ANNUAL RELATIVE CONCENTRATIONS 2.26-DAY DECAY, UNDEPLETED X/Q (sec/m^3)

DATES OF LAST X/Q ACCUMULATION ARE FROM 5 1 1 1 0 TO 5123124 0
X/Q ACCUMULATION FOR GROUND DECAYED S.AVG SEC/M3
FOR RELEASE POINT 1

	MILES									
DIRECTION FROM	.0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10 - 20	20 - 30	30 - 40	40 - 50
N	5.31E-06	1.02E-06	4.24E-07	2.24E-07	1.44E-07	5.36E-08	1.45E-08	6.77E-09	4.09E-09	2.79E-09
NNE	8.39E-06	1.73E-06	7.80E-07	4.17E-07	2.69E-07	9.95E-08	2.67E-08	1.26E-08	7.65E-09	5.23E-09
NE	1.91E-05	3.53E-06	1.60E-06	9.13E-07	6.06E-07	2.39E-07	7.04E-08	3.36E-08	2.04E-08	1.41E-08
ENE	5.26E-05	9.49E-06	4.59E-06	2.73E-06	1.82E-06	7.13E-07	2.00E-07	9.14E-08	5.57E-08	3.85E-08
E	2.03E-05	3.68E-06	1.62E-06	9.14E-07	6.07E-07	2.42E-07	7.24E-08	3.41E-08	2.04E-08	1.38E-08
ESE	1.05E-05	2.02E-06	9.15E-07	5.12E-07	3.39E-07	1.35E-07	3.57E-08	1.47E-08	8.80E-09	5.94E-09
SE	1.14E-05	2.27E-06	1.04E-06	5.88E-07	3.89E-07	1.57E-07	3.76E-08	1.31E-08	7.84E-09	5.28E-09
SSE	8.13E-06	1.57E-06	6.97E-07	3.92E-07	2.64E-07	1.13E-07	2.87E-08	9.69E-09	5.82E-09	3.95E-09
S	6.33E-06	1.32E-06	6.48E-07	3.79E-07	2.60E-07	1.20E-07	3.23E-08	1.06E-08	6.47E-09	4.41E-09
SSW	7.11E-06	1.44E-06	6.66E-07	3.78E-07	2.50E-07	1.03E-07	2.63E-08	9.67E-09	5.91E-09	4.06E-09
SW	4.79E-06	9.65E-07	4.66E-07	2.70E-07	1.82E-07	8.03E-08	2.07E-08	6.85E-09	4.23E-09	2.93E-09
WSW	2.76E-06	5.42E-07	2.56E-07	1.52E-07	1.05E-07	5.01E-08	1.58E-08	5.84E-09	2.93E-09	1.57E-09
W	1.46E-06	2.80E-07	1.22E-07	6.73E-08	4.43E-08	1.83E-08	4.93E-09	1.96E-09	1.19E-09	8.10E-10
WNW	1.34E-06	2.47E-07	9.94E-08	5.20E-08	3.32E-08	1.22E-08	3.27E-09	1.51E-09	9.12E-10	6.17E-10
NW	1.89E-06	3.51E-07	1.41E-07	7.21E-08	4.58E-08	1.66E-08	4.36E-09	2.03E-09	1.23E-09	8.41E-10
NNW	2.51E-06	4.77E-07	2.02E-07	1.08E-07	6.79E-08	2.37E-08	5.88E-09	2.73E-09	1.66E-09	1.13E-09

TABLE 27. 2005 SSES ANNUAL RELATIVE CONCENTRATIONS 8-DAY DECAY, DEPLETED X/Q (sec/m^3)

DATES OF LAST X/Q ACCUMULATION ARE FROM 5 1 1 1 0 TO 5123124 0
X/Q ACCUMULATION FOR DECAYED DEPLETION SEC/M3
FOR RELEASE POINT 1

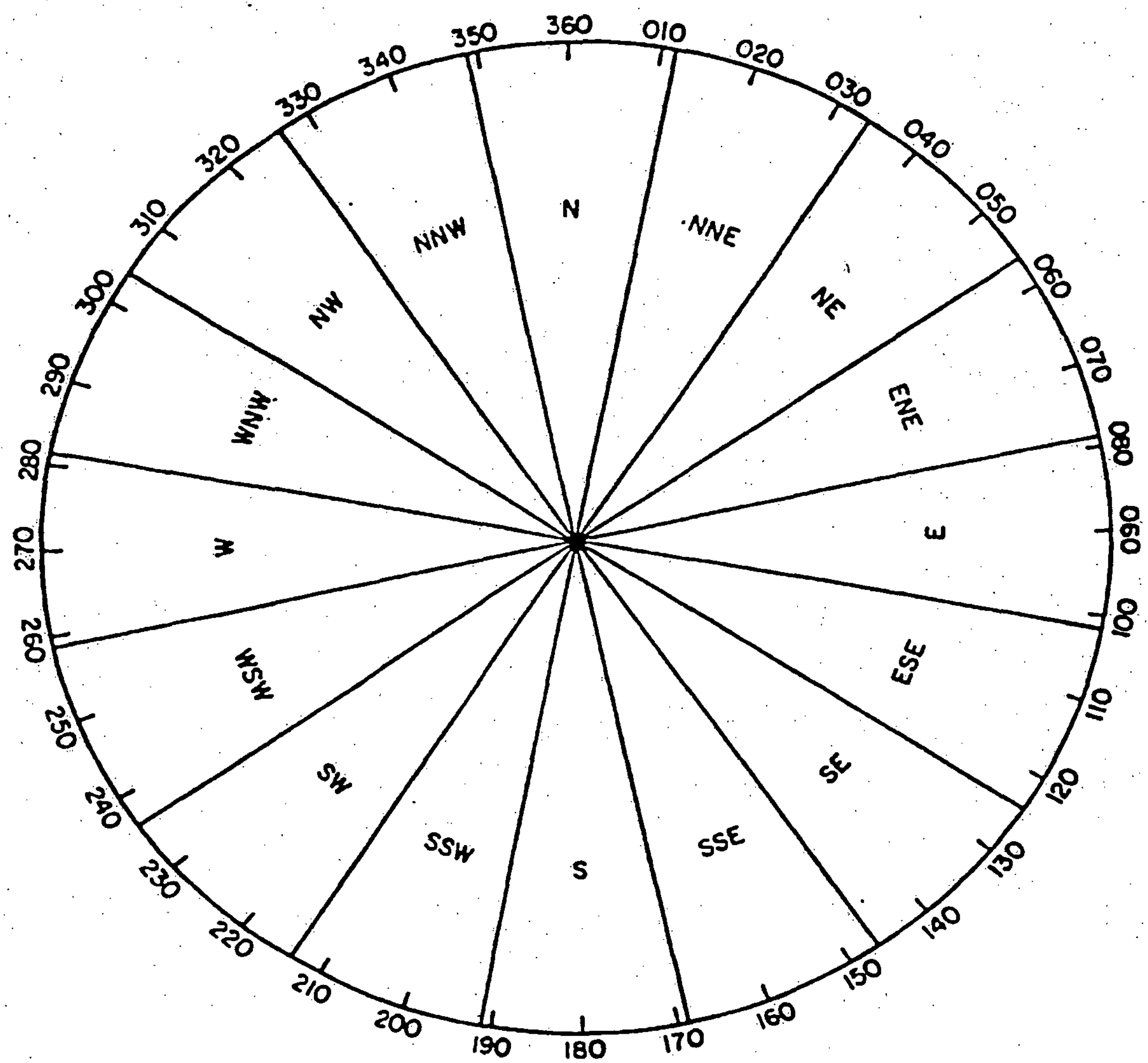
	MILES									
DIRECTION FROM	.0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10 - 20	20 - 30	30 - 40	40 - 50
N	4.86E-06	8.67E-07	3.46E-07	1.76E-07	1.10E-07	3.85E-08	9.51E-09	4.05E-09	2.29E-09	1.48E-09
NNE	7.68E-06	1.48E-06	6.38E-07	3.29E-07	2.06E-07	7.16E-08	1.76E-08	7.59E-09	4.33E-09	2.81E-09
NE	1.75E-05	3.01E-06	1.31E-06	7.21E-07	4.65E-07	1.73E-07	4.70E-08	2.07E-08	1.19E-08	7.85E-09
ENE	4.82E-05	8.11E-06	3.76E-06	2.15E-06	1.40E-06	5.17E-07	1.34E-07	5.67E-08	3.28E-08	2.18E-08
E	1.86E-05	3.15E-06	1.33E-06	7.25E-07	4.69E-07	1.77E-07	4.94E-08	2.17E-08	1.25E-08	8.16E-09
ESE	9.60E-06	1.72E-06	7.52E-07	4.06E-07	2.61E-07	9.83E-08	2.43E-08	9.29E-09	5.33E-09	3.48E-09
SE	1.05E-05	1.94E-06	8.56E-07	4.66E-07	3.00E-07	1.14E-07	2.54E-08	8.19E-09	4.68E-09	3.04E-09
SSE	7.45E-06	1.34E-06	5.72E-07	3.10E-07	2.03E-07	8.21E-08	1.93E-08	6.03E-09	3.44E-09	2.24E-09
S	5.79E-06	1.13E-06	5.31E-07	2.99E-07	1.99E-07	8.65E-08	2.15E-08	6.50E-09	3.72E-09	2.42E-09
SSW	6.51E-06	1.23E-06	5.44E-07	2.97E-07	1.91E-07	7.42E-08	1.73E-08	5.78E-09	3.30E-09	2.15E-09
SW	4.38E-06	8.22E-07	3.80E-07	2.12E-07	1.39E-07	5.74E-08	1.35E-08	4.04E-09	2.32E-09	1.51E-09
WSW	2.53E-06	4.61E-07	2.09E-07	1.19E-07	7.98E-08	3.58E-08	1.03E-08	3.43E-09	1.60E-09	8.06E-10
W	1.34E-06	2.39E-07	9.97E-08	5.28E-08	3.37E-08	1.30E-08	3.21E-09	1.16E-09	6.53E-10	4.19E-10
WNW	1.23E-06	2.11E-07	8.10E-08	4.08E-08	2.52E-08	8.70E-09	2.12E-09	8.82E-10	4.92E-10	3.12E-10
NW	1.73E-06	2.98E-07	1.15E-07	5.64E-08	3.48E-08	1.18E-08	2.81E-09	1.18E-09	6.62E-10	4.22E-10
NNW	2.29E-06	4.06E-07	1.65E-07	8.43E-08	5.17E-08	1.70E-08	3.82E-09	1.61E-09	9.04E-10	5.78E-10

TABLE 28. 2005 SSES ANNUAL RELATIVE DEPOSITION – D/Q (meters-2)

DATES OF LAST X/Q ACCUMULATION ARE FROM 5 1 1 1 0 TO 5123124 0
X/Q ACCUMULATION FOR DEPOSITION 1/M2
FOR RELEASE POINT 1

	MILES									
DIRECTION FROM	.0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10 - 20	20 - 30	30 - 40	40 - 50
N	3.13E-08	4.61E-09	1.89E-09	8.97E-10	5.30E-10	1.68E-10	4.02E-11	1.48E-11	7.90E-12	4.96E-12
NNE	3.57E-08	5.54E-09	2.40E-09	1.14E-09	6.72E-10	2.09E-10	4.88E-11	1.80E-11	9.60E-12	6.03E-12
NE	4.11E-08	6.20E-09	2.65E-09	1.28E-09	7.61E-10	2.45E-10	6.01E-11	2.21E-11	1.18E-11	7.42E-12
ENE	7.13E-08	1.11E-08	4.93E-09	2.41E-09	1.43E-09	4.51E-10	1.03E-10	3.60E-11	1.92E-11	1.21E-11
E	3.21E-08	4.70E-09	1.91E-09	9.13E-10	5.45E-10	1.80E-10	4.55E-11	1.68E-11	8.94E-12	5.62E-12
ESE	2.16E-08	3.27E-09	1.39E-09	6.73E-10	4.02E-10	1.33E-10	3.03E-11	9.78E-12	5.22E-12	3.28E-12
SE	3.13E-08	4.76E-09	2.08E-09	1.03E-09	6.16E-10	2.08E-10	4.33E-11	1.19E-11	6.33E-12	3.97E-12
SSE	2.67E-08	3.98E-09	1.70E-09	8.37E-10	5.10E-10	1.83E-10	4.01E-11	1.07E-11	5.69E-12	3.57E-12
S	2.43E-08	3.89E-09	1.83E-09	9.39E-10	5.85E-10	2.27E-10	5.29E-11	1.36E-11	7.24E-12	4.55E-12
SSW	3.91E-08	5.99E-09	2.69E-09	1.36E-09	8.23E-10	2.87E-10	6.38E-11	1.82E-11	9.71E-12	6.10E-12
SW	4.41E-08	7.00E-09	3.29E-09	1.70E-09	1.05E-09	3.96E-10	8.94E-11	2.28E-11	1.22E-11	7.64E-12
WSW	2.58E-08	3.97E-09	1.86E-09	9.94E-10	6.32E-10	2.61E-10	7.33E-11	2.12E-11	9.27E-12	4.55E-12
W	1.24E-08	1.87E-09	8.08E-10	4.03E-10	2.46E-10	8.80E-11	2.15E-11	6.73E-12	3.59E-12	2.26E-12
WNW	1.15E-08	1.67E-09	6.71E-10	3.21E-10	1.90E-10	6.17E-11	1.52E-11	5.61E-12	3.00E-12	1.88E-12
NW	1.85E-08	2.71E-09	1.08E-09	5.05E-10	2.98E-10	9.47E-11	2.27E-11	8.36E-12	4.46E-12	2.80E-12
NNW	2.11E-08	3.13E-09	1.32E-09	6.39E-10	3.74E-10	1.14E-10	2.57E-11	9.45E-12	5.05E-12	3.17E-12

FIGURE 1. THE SIXTEEN STANDARD
22.5 DEGREE WIND DIRECTION SECTORS



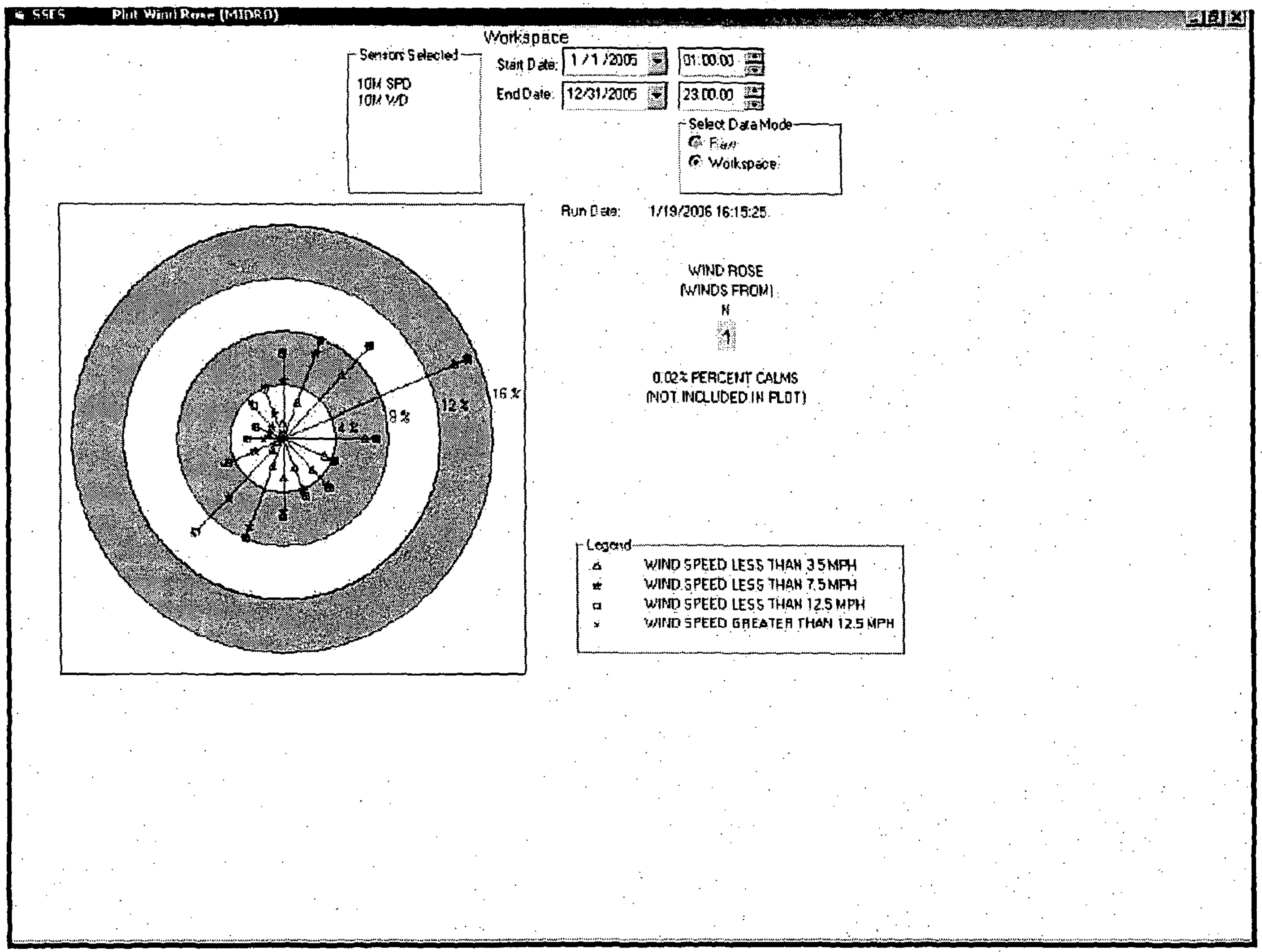


Figure 2. SSES 2005 ANNUAL WIND ROSE
10M LEVEL – PRIMARY TOWER

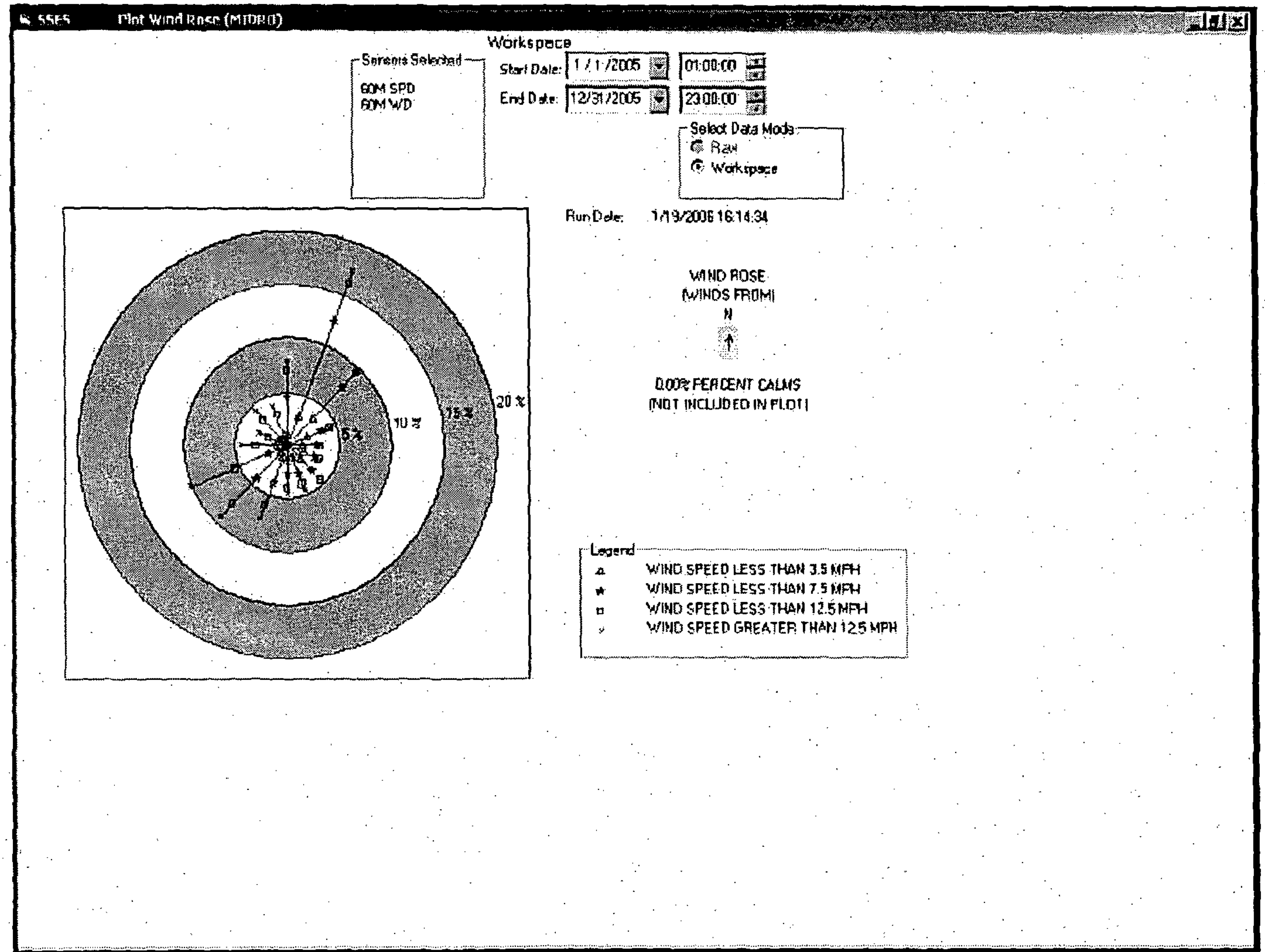


Figure 3. SSES 2005 ANNUAL WIND ROSE
60M LEVEL – PRIMARY TOWER

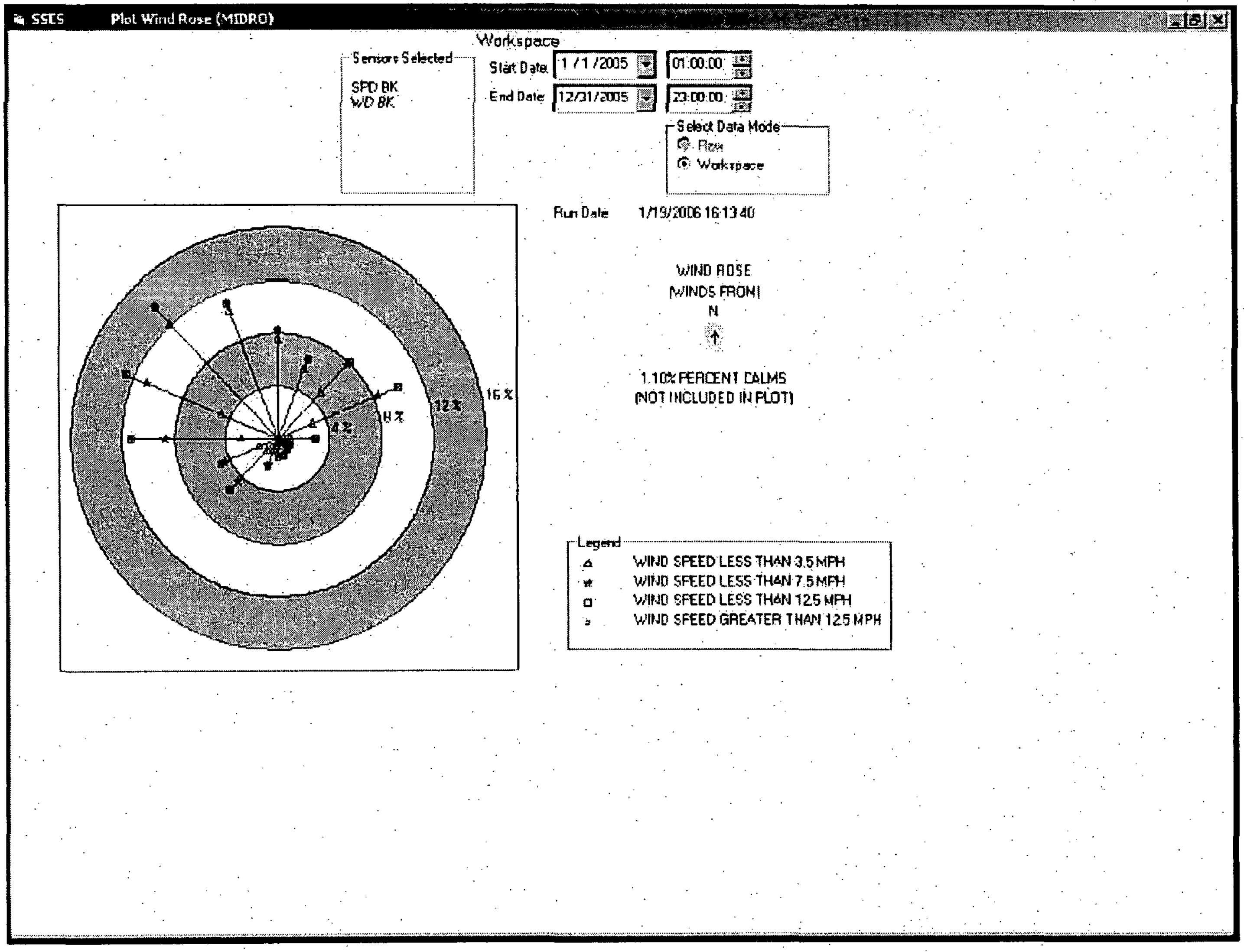


Figure 4. SSES 2005 ANNUAL WIND ROSE
10M LEVEL – BACKUP TOWER

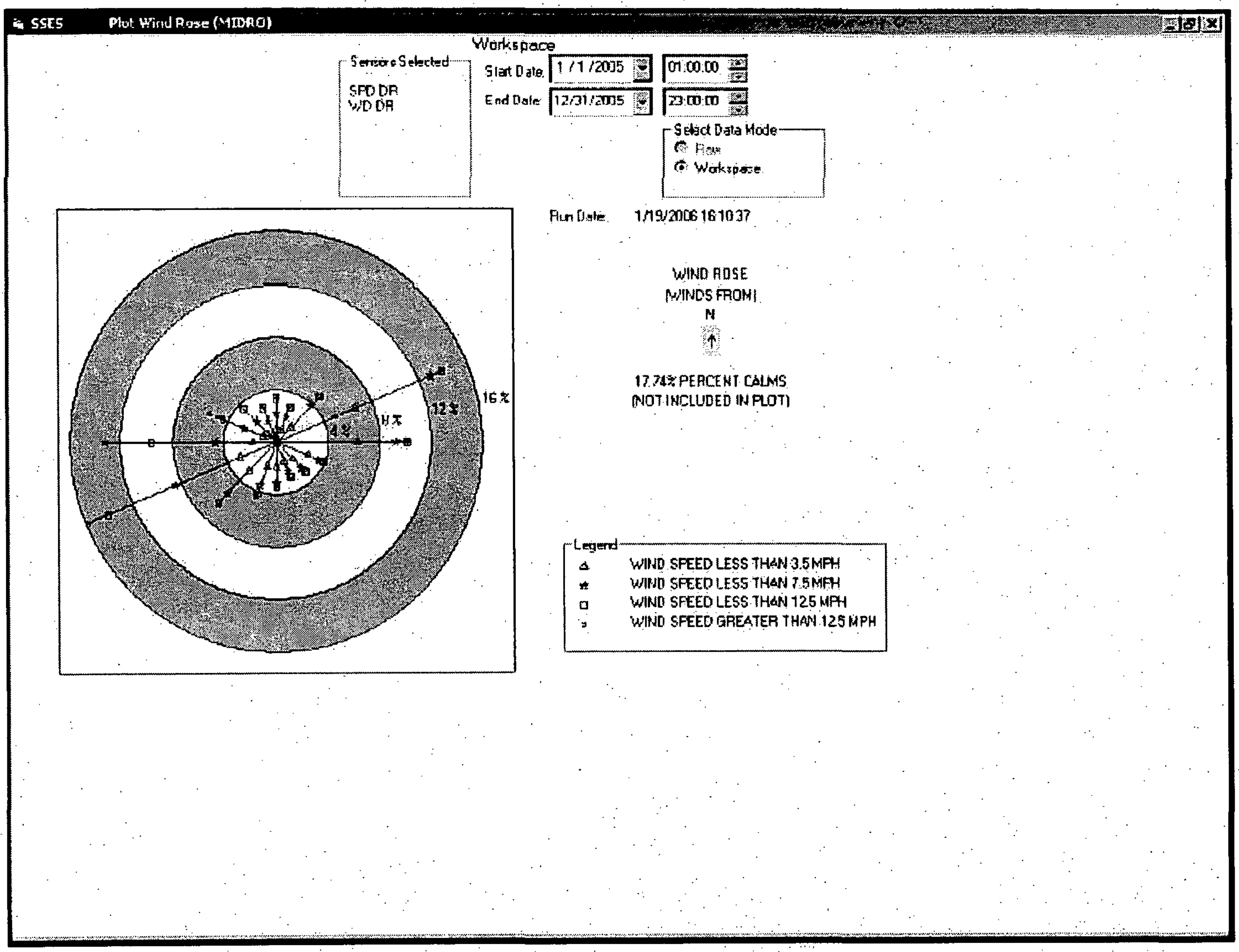
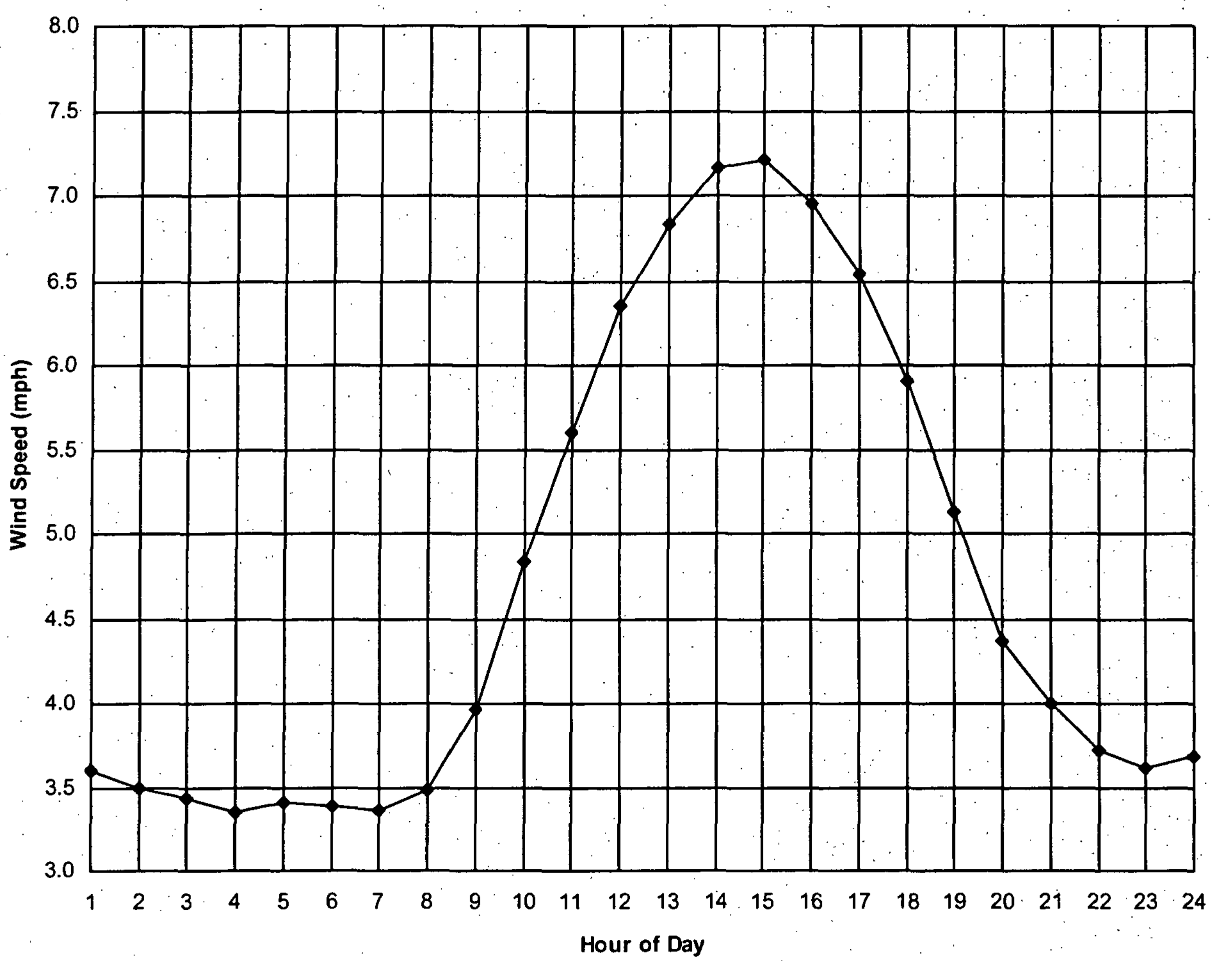


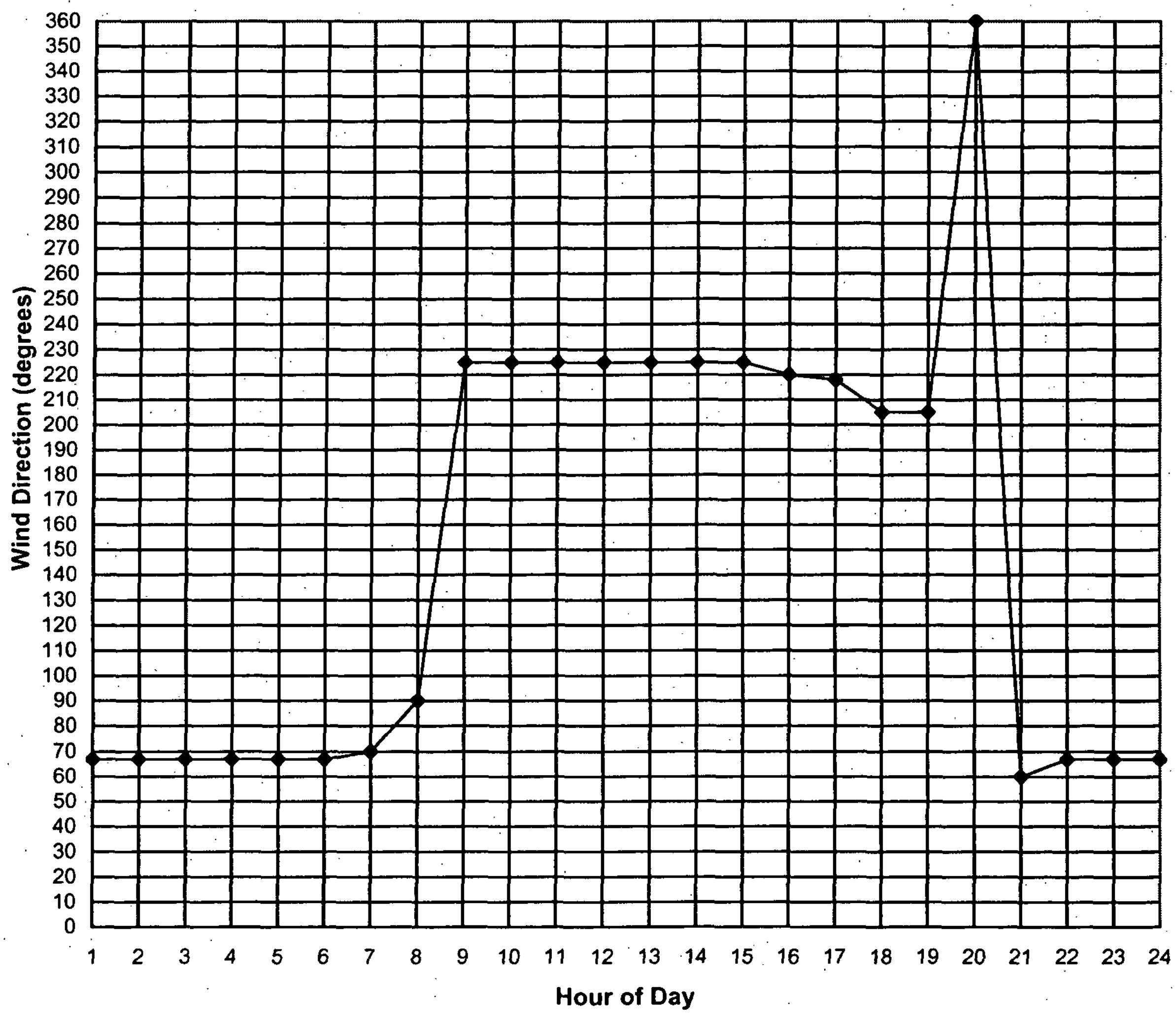
Figure 5. SSES 2005 ANNUAL WIND ROSE
10M LEVEL – DOWNRIVER TOWER

Figure 6. 2005 Diurnal Variation of Average Wind Speed
Primary Tower - 10 Meter Level



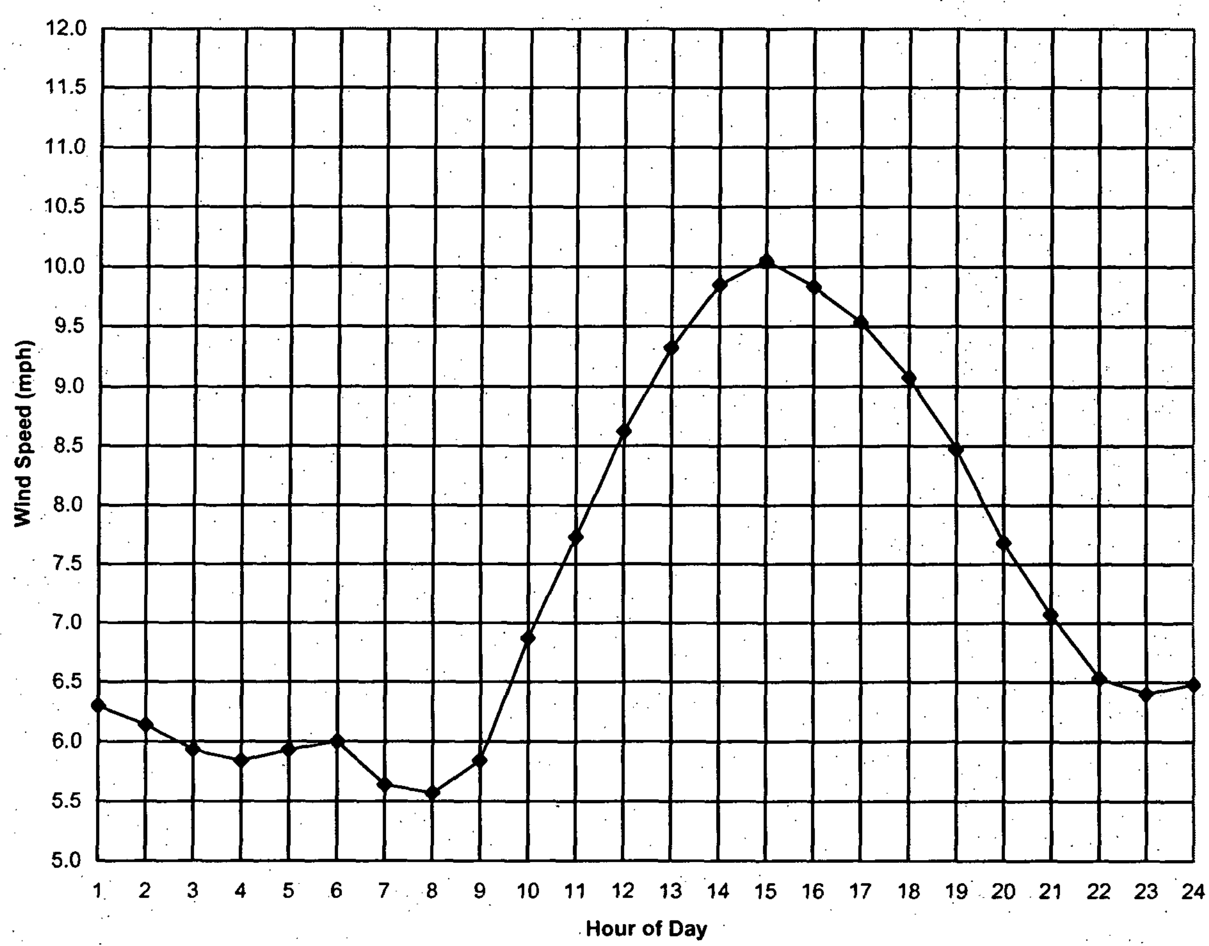
This plot shows how the wind speed varies with the time-of-day. Radiational heating during the day causes more mixing which makes for higher overall daytime wind speeds.

Figure 7. 2005 Diurnal Variation of Average Wind Direction
Primary Tower - 10 Meter Level



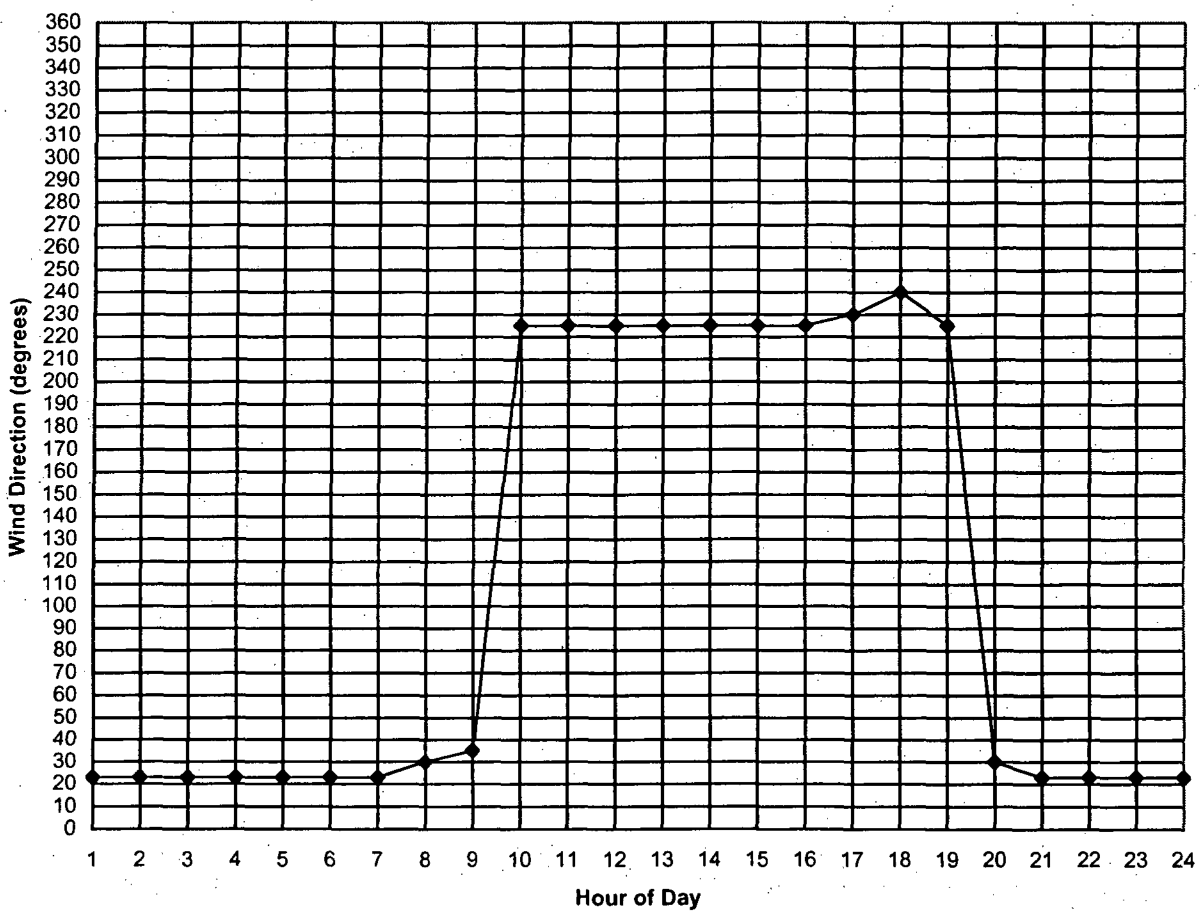
This plot shows the variation of wind direction with the time-of-day. This is primarily caused by the heating and subsequent cooling of the ground which promotes wind flow up and down the Susquehanna River valley.

Figure 8. 2005 Diurnal Variation of Average Wind Speed
Primary Tower - 60 Meter Level



This plot shows how the wind speed varies with the time-of-day. Radiational heating during the day causes more mixing which makes for higher overall daytime wind speeds.

Figure 9. 2005 Diurnal Variation of Average Wind Direction
Primary Tower - 60 Meter Level



This plot shows the variation of wind direction with the time-of-day. This is primarily caused by the heating and subsequent cooling of the ground that promotes wind flow up and down the Susquehanna River valley.

Figure 10a. 2005 Diurnal Variation of Average Ambient Temperature
Primary Tower - 10 Meter Level

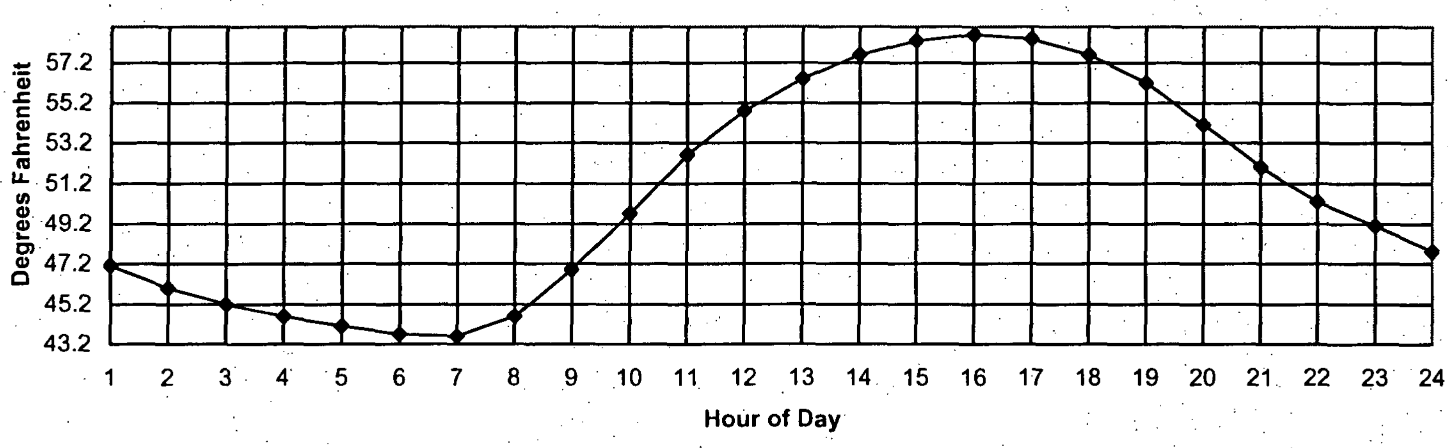


Figure 10b 2005 Diurnal Variation of Average Dew Point Temperature
Primary Tower - 10 Meter Level

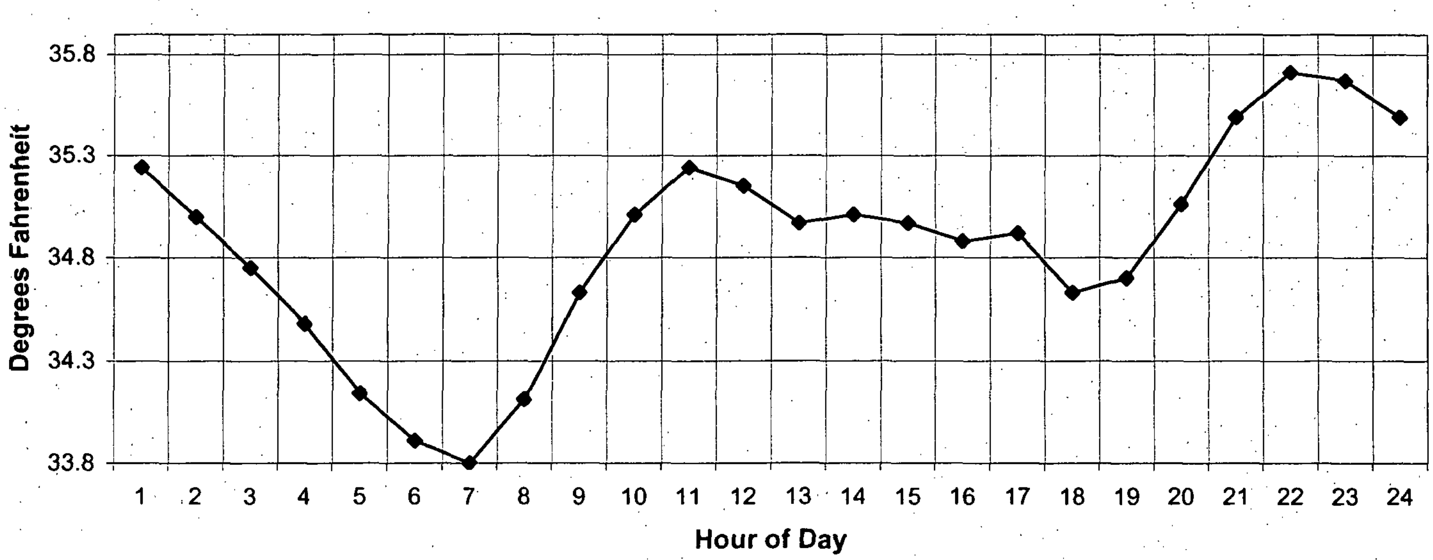


Figure 11a. 2005 Diurnal Variation of Average
Dew Point Temperature
Primary Tower - 10 Meter Level

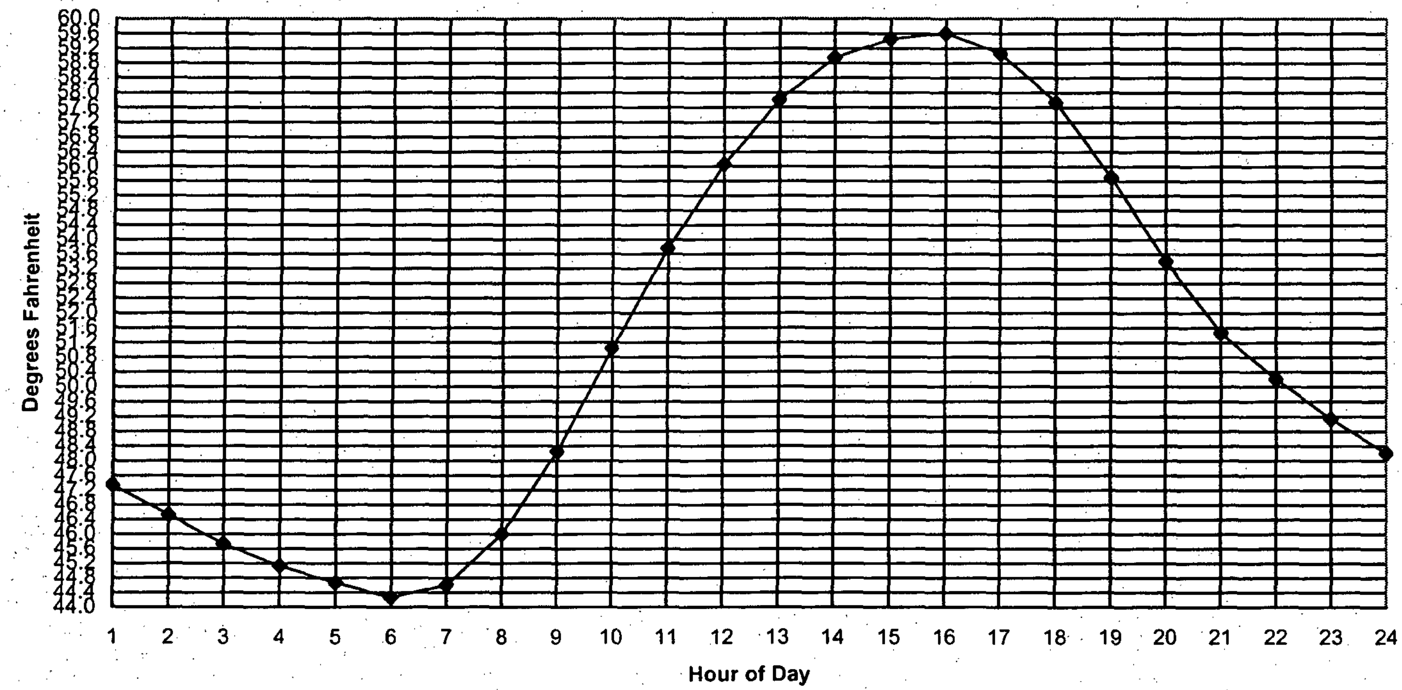
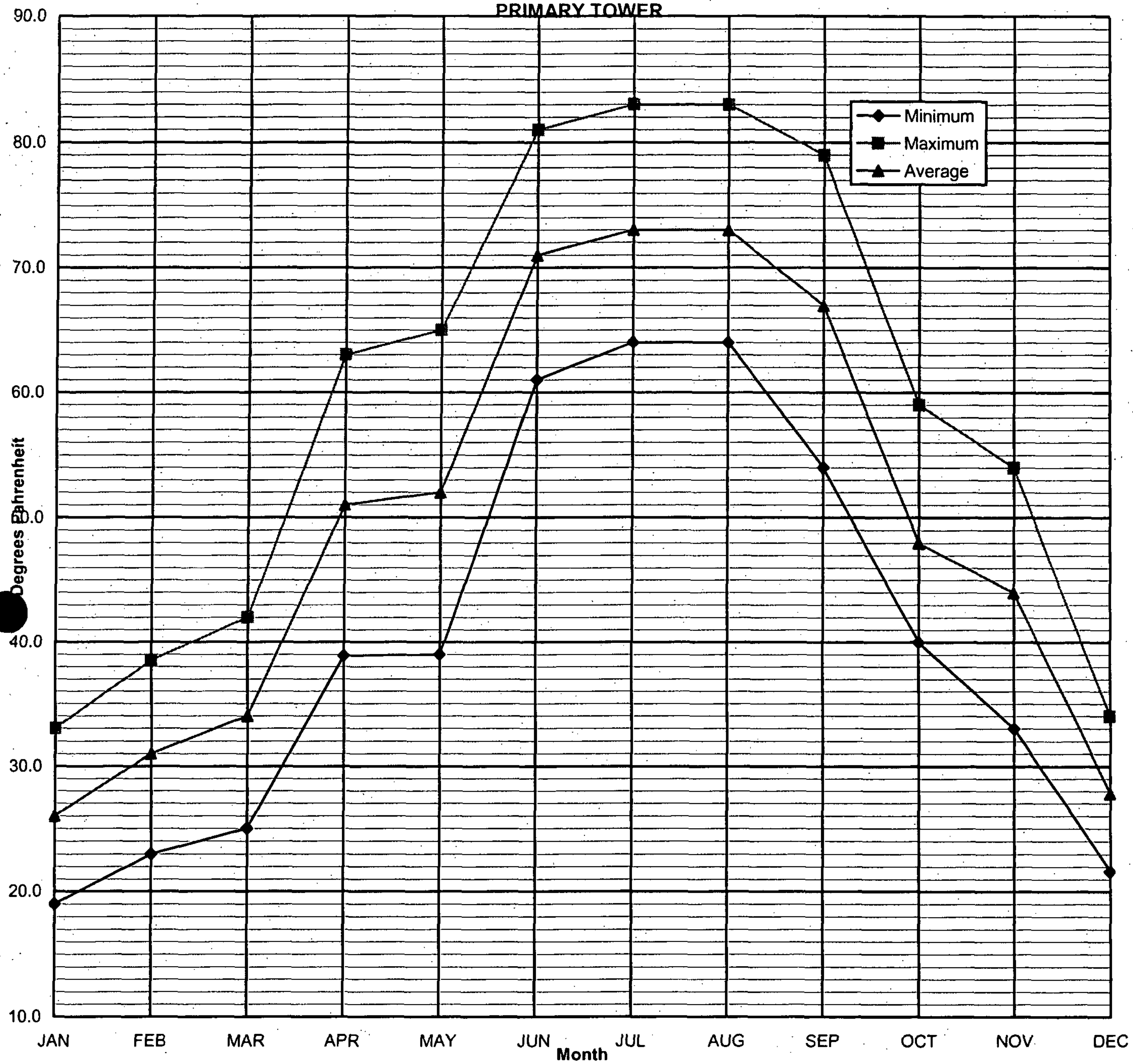


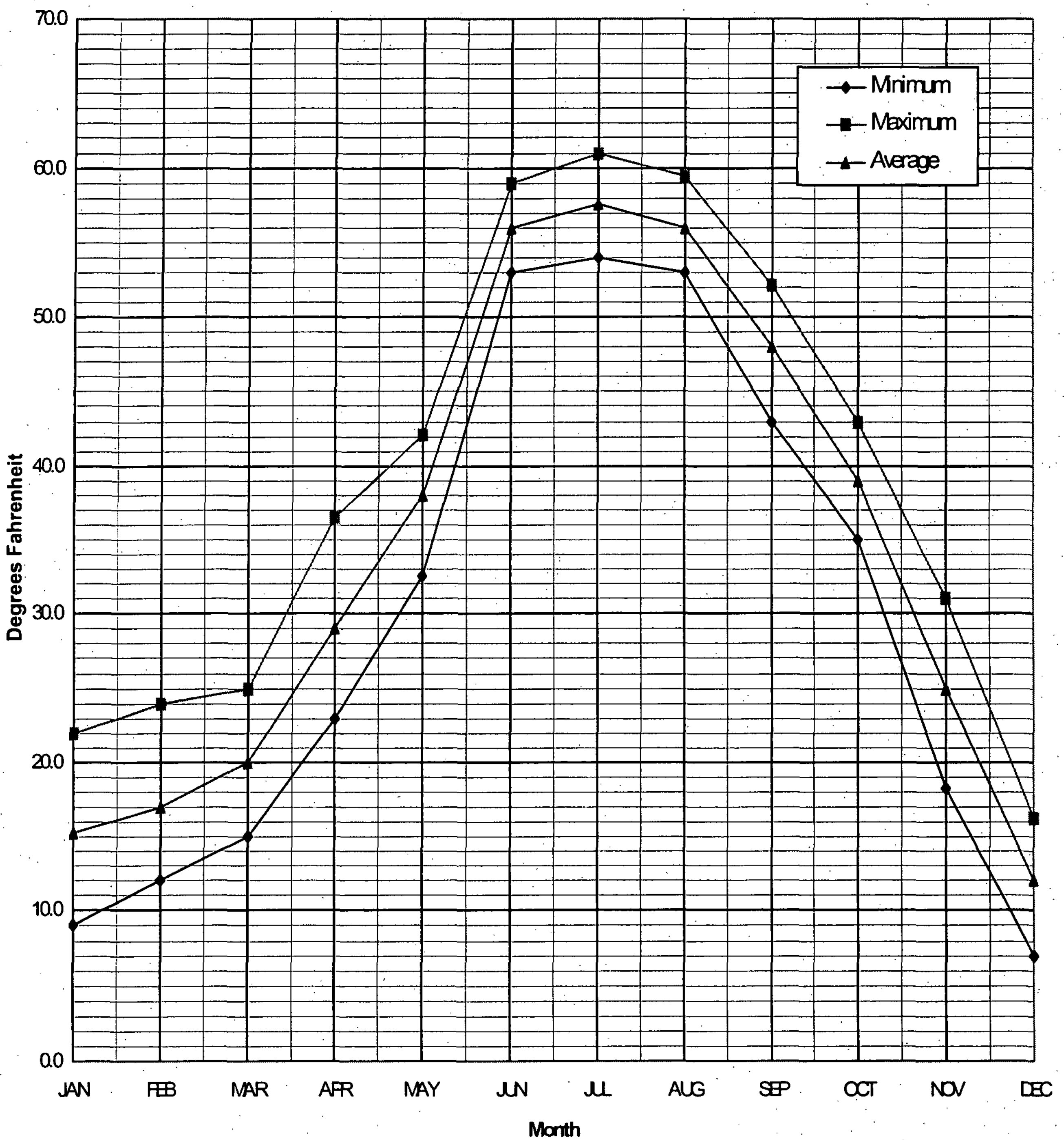
Figure 11b. 2005 Diurnal Variation of Average
Dew Point Temperature
Downriver Tower - 10 Meter Level

FIGURE 12. SSES 2005 MONTHLY AVERAGE OF THE DAILY MAXIMUM, MINIMUM AND AVERAGE OF 10M AMBIENT TEMPERATURE PRIMARY TOWER



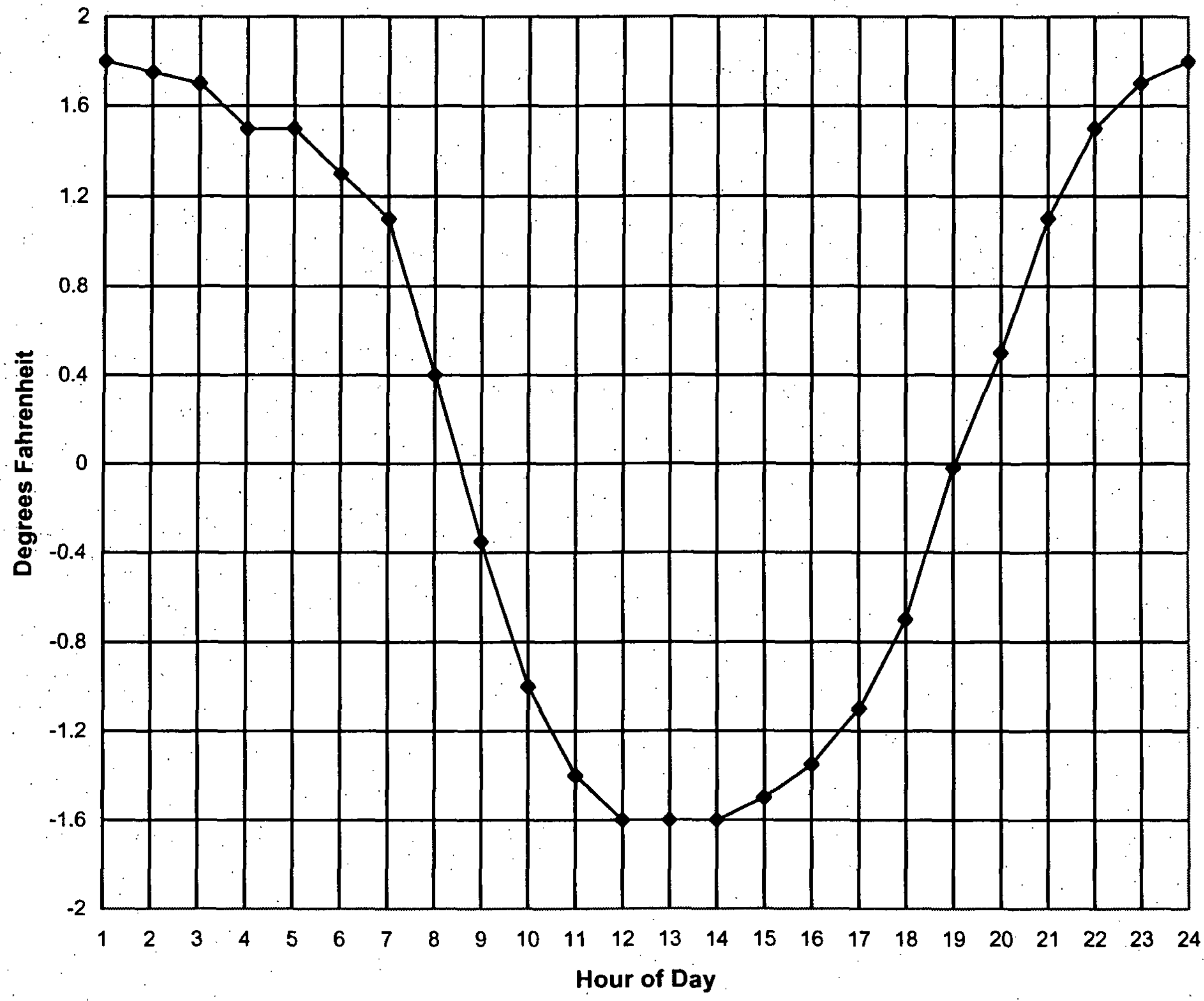
This plot shows the average of daily maximum and minimum ambient temperatures by month as well as the overall monthly average temperature.

FIGURE 13. SSES 2004 MONTHLY AVERAGE OF THE DAILY MAXIMUM, MINIMUM AND AVERAGE OF 10M DEW POINT
PRIMARY TOWER



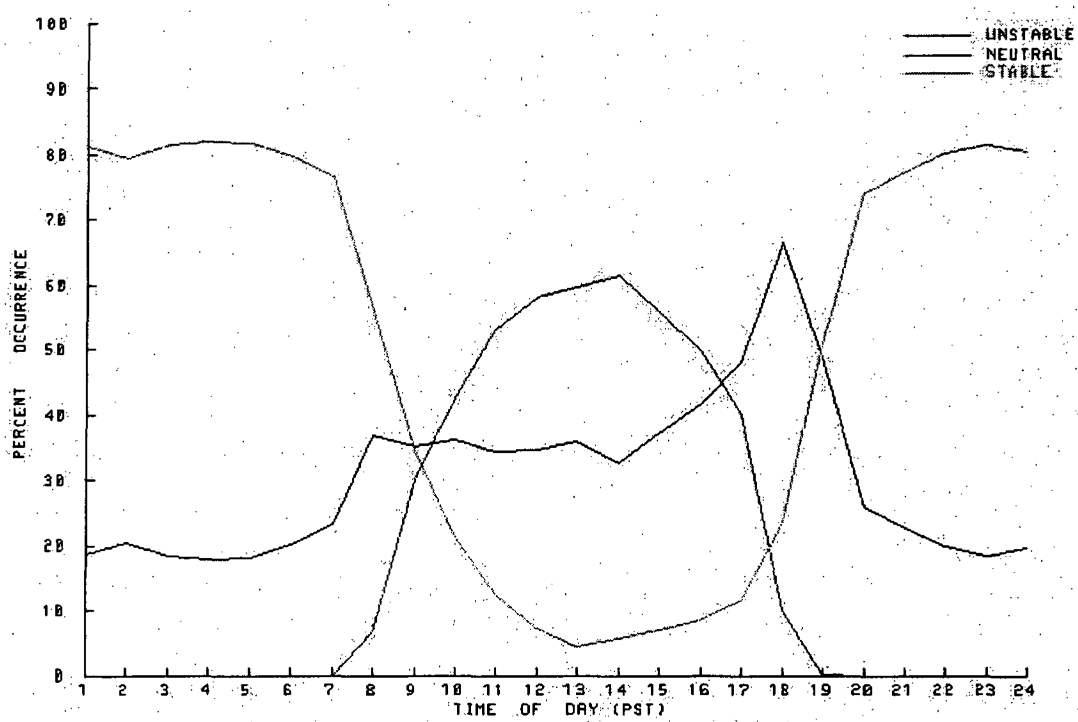
This plot shows the average of daily maximum and minimum dew point temperatures by month as well as the overall monthly average dew point

FIGURE 14. SSES 2005 DIURNAL VARIATION OF AVERAGE DELTA TEMPERATURE PRIMARY TOWER 60-10M LEVEL



This plot shows the effects of daytime radiational heating causing negative delta temperatures and nighttime radiational cooling, resulting in positive delta temperatures at night.

Figure 15. Percentage of Stability Category by Time-of-Day for 2005



Percent Occurrence of Unstable(A-C), Neutral(D) and Stable(E-G) Stability Classes vs. Time of Day for 2005

FIGURE 16. LOCATION OF METEOROLOGICAL TOWERS SUSQUEHANNA STEAM ELECTRIC STATION

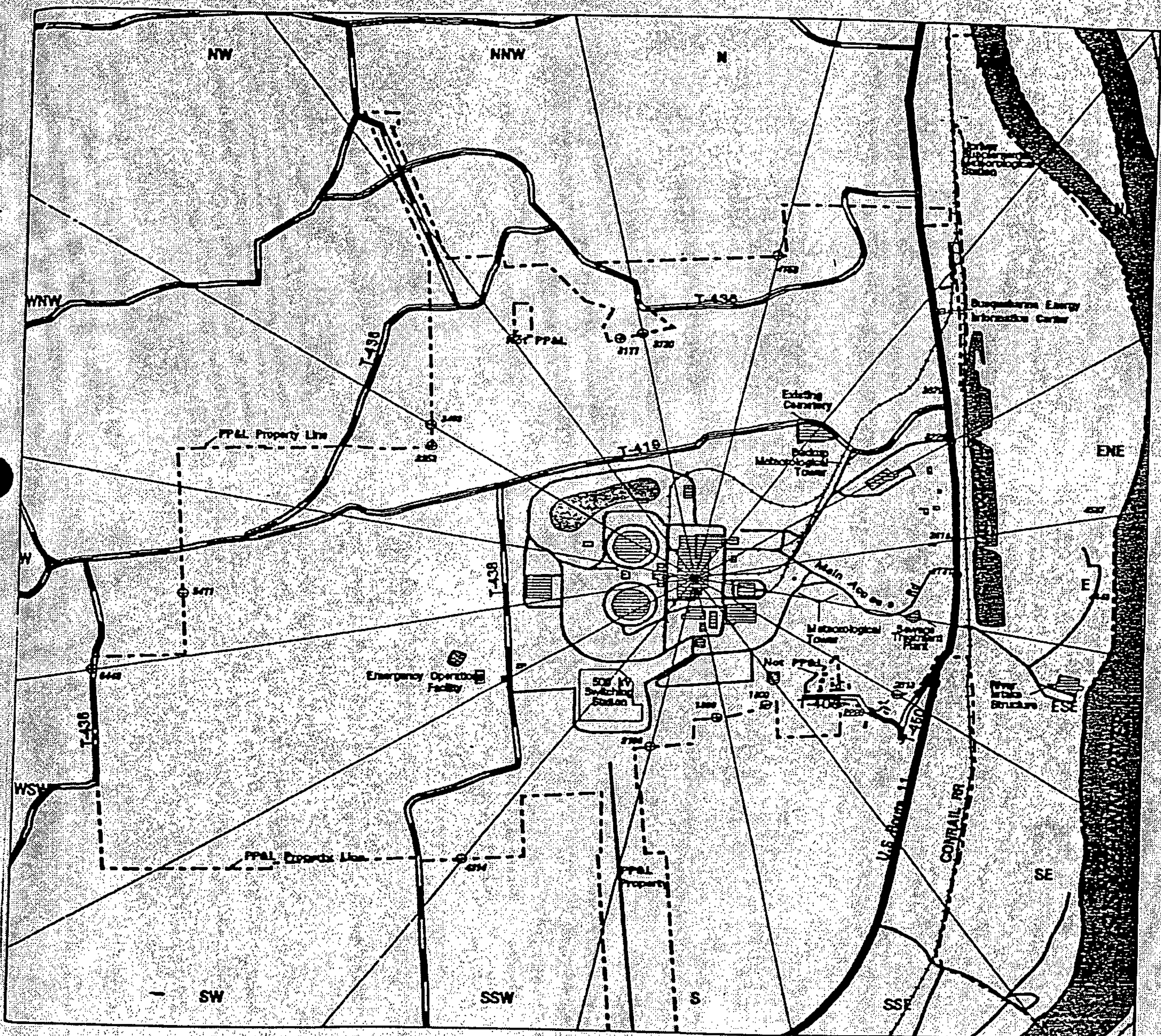


Figure 17. Interpolated Sector Average X/q Values (sec m3) at the EAB (2005)

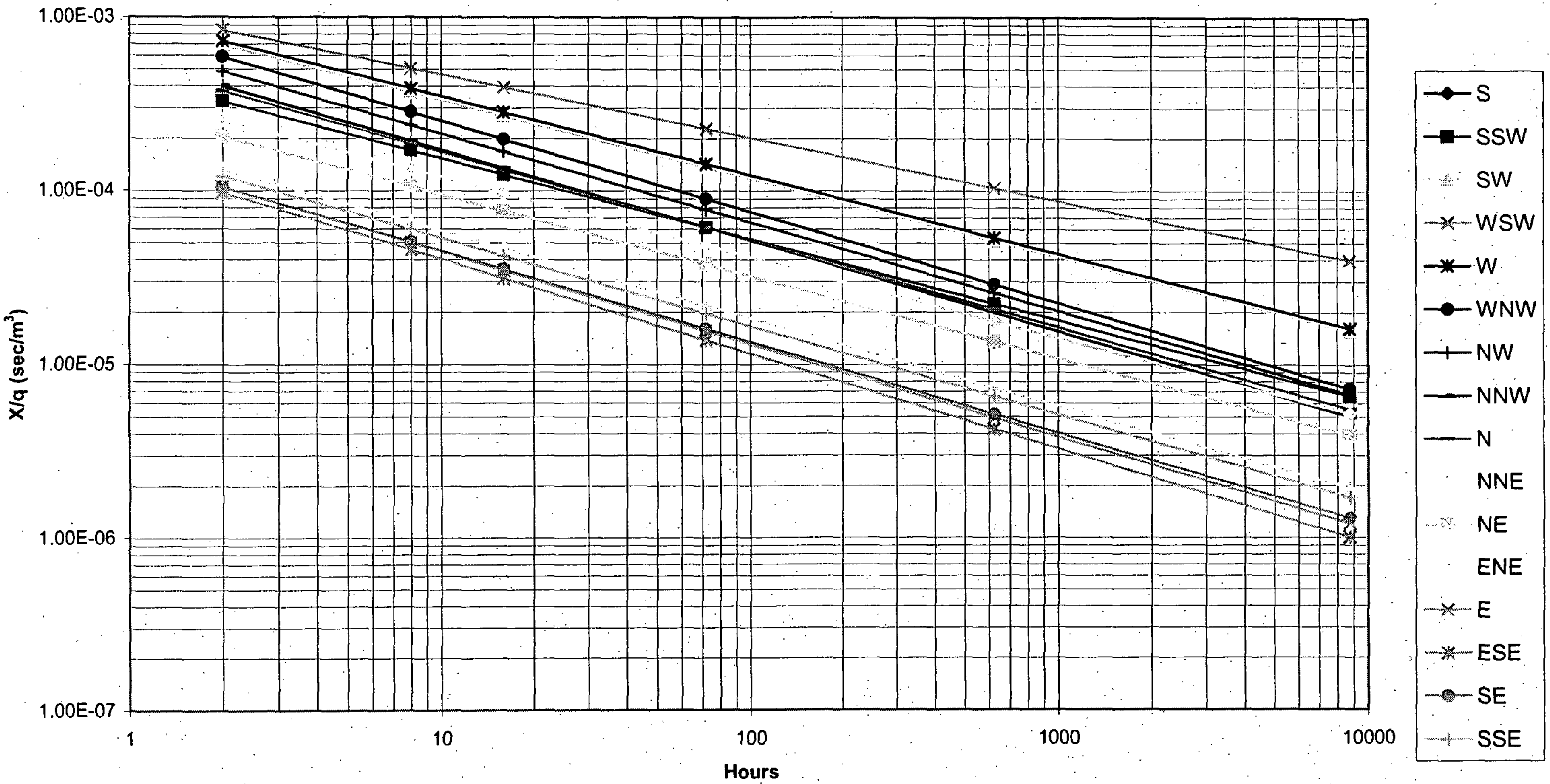


Figure 18. Interpolated Sector Average X/Q Values (sec/m3) at LPZ (2005)

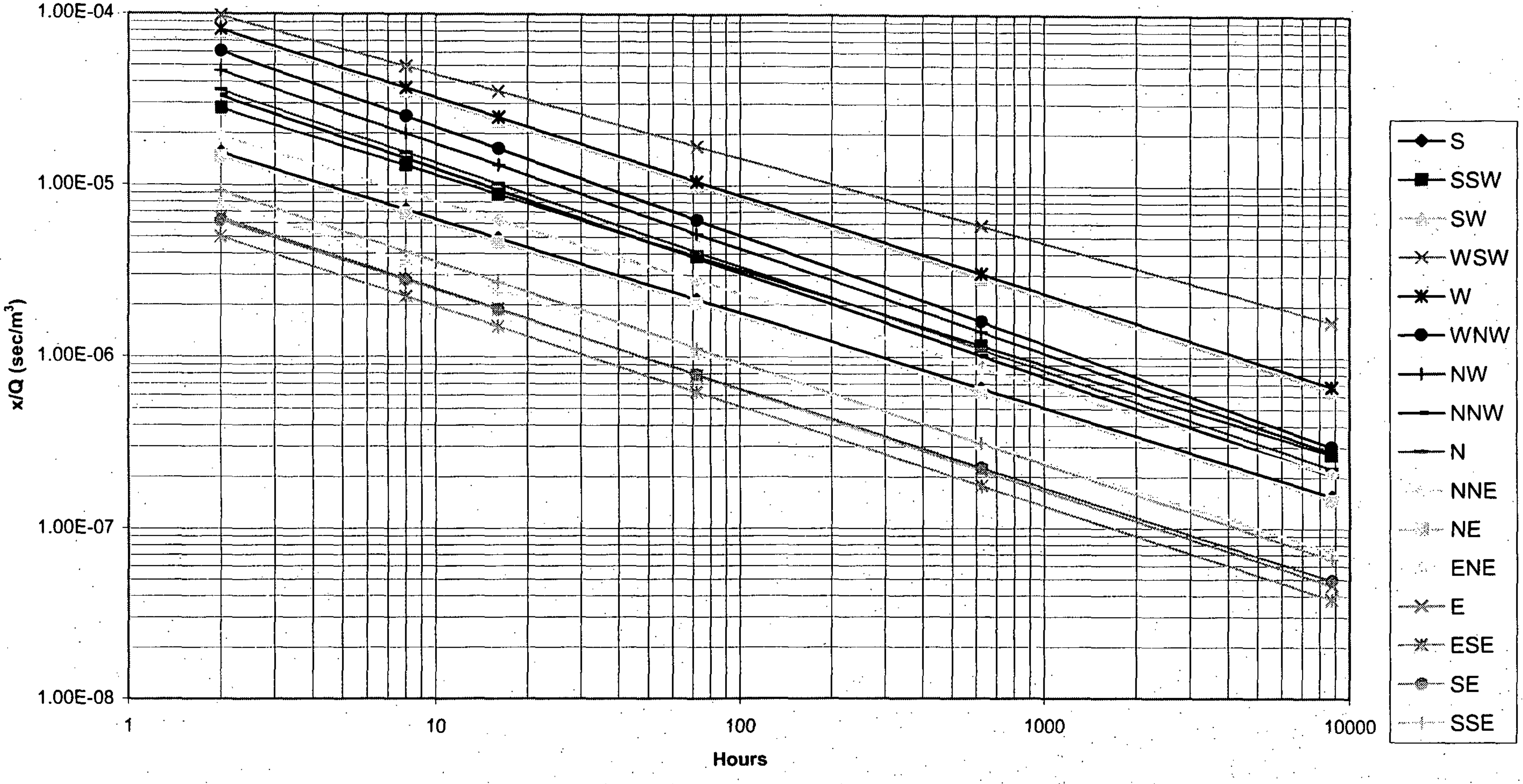


Figure 19. 5 Percent Overall Site X/Q Values for Exclusion Area Boundary, SSES 2005

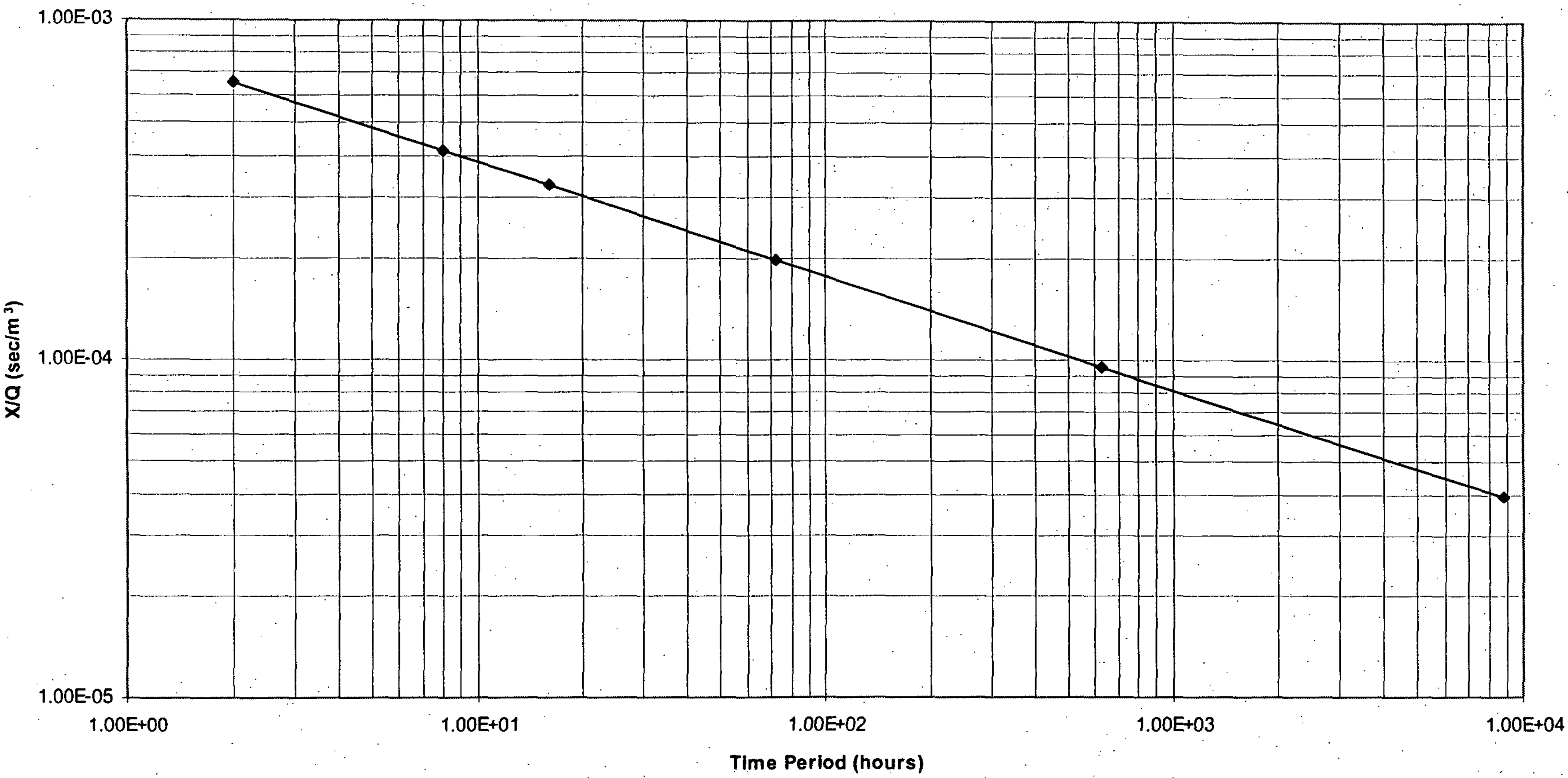
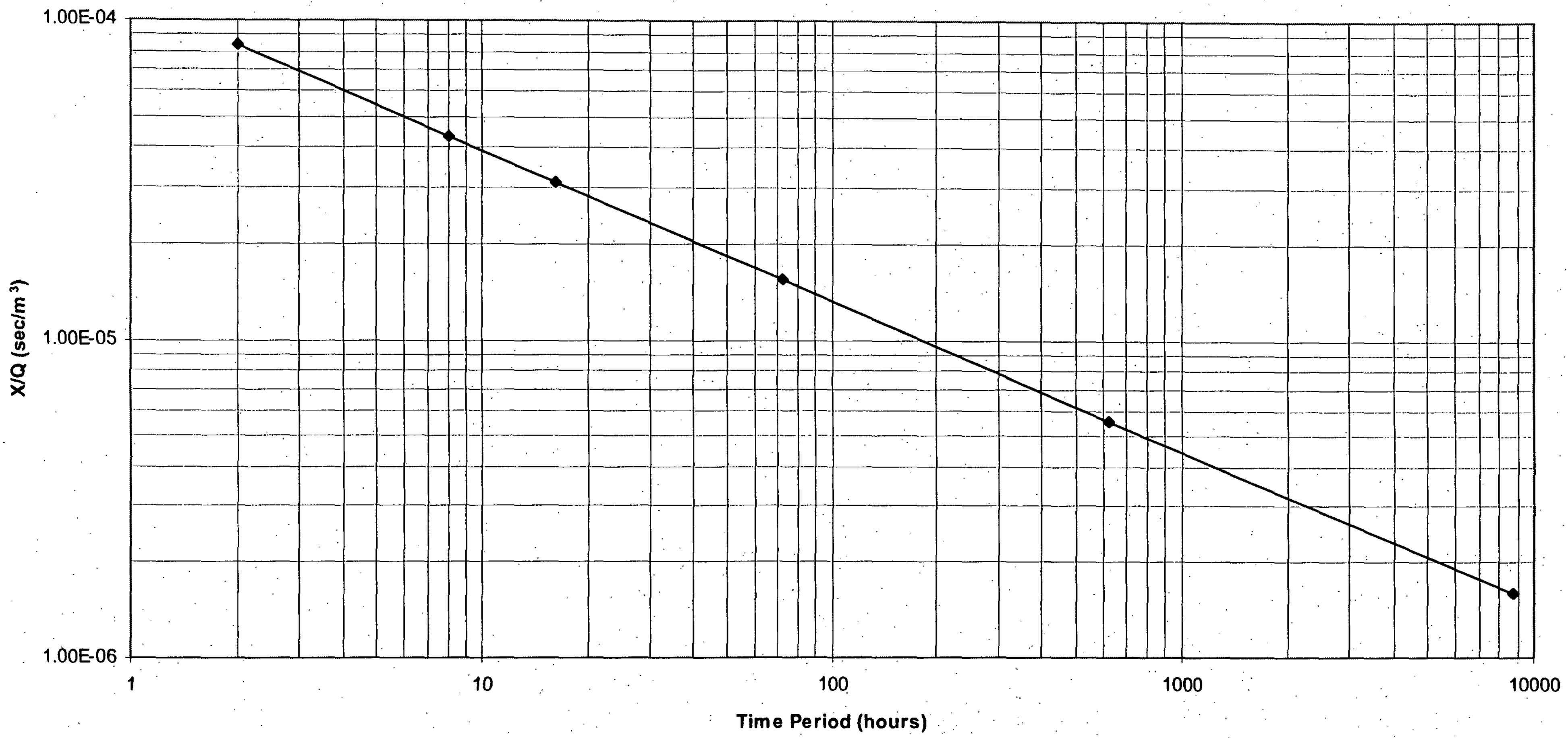


Figure 20. 5 Percent Overall Site X/Q Values for Low Population Zone, SSES 2005



APPENDIX A

SSES
METEOROLOGICAL INSTRUMENTATION
DESCRIPTION

APPENDIX A

SSES METEOROLOGICAL INTRUMENTATION DESCRIPTION

A. PRIMARY TOWER

- **Wind-Speed Sensor,** Climatronics Model 100075

Locations:	10m and 60m above surface
Threshold:	0.5 mph
Accuracy:	$\pm$ percent or $\pm$0.15 mph, whichever is greater
Sensing Technique:	Anemometer cup set attached to shaft and 30-hole photochopper assembly
Operating Range:	0 to 50 mph
Operating Temperature Range:	-40°F to +140°F
Distance Constant:	5 feet of air maximum

- **Wind-Direction Sensor,** Climatronics Model 100076

Locations:	10m and 60m above surface
Threshold:	0.5 mph
Accuracy:	$\pm$2°
Sensing Technique:	Vane attached to a shaft which is coupled to a precision low torque potentiometer
Damping Ratio:	0.4 at 10° initial angle of attack
Operating Range:	0 to 540°
Operating Temperature Range:	-40°F to +140°F
Distance Constant:	3.7 feet of air maximum

- **Standard Deviation Computer**, Climatronics Model 101035

Receives input from 10m and 60m wind direction. Sampling time is one second and computation time is 15 minutes.

Accuracy: ±2°

Operating Range: 0 to 100°

- **Motor Aspirated Temp/Dew-Point Shield,** Climatronics Model 100325

Locations: 60m above surface (two)
10m above surface (one)

Motor aspirated shield limits radiation errors to 0.2°F under maximum solar radiation

Aspiration Rate: 10 feet per second

Operating Temperature Range: -40°F to +130°F

- **Temperature Sensor,** Climatronics Model 100093

Locations: 10 m and 60 m above surface

Sensing element is a thermistor enclosed in a stainless steel sheath (use as a matched pair for 10-60m delta temperature)

Operating Range: -20°F to +100°F (-5°F to +5°F for delta temperature)

Accuracy: ±0.15°C (same for matched pairs)

Linearity: ±0.16°C (same for matched pairs)

Time Constant: 3.6 seconds in still air

- **Dew-Point Sensor,** Climatronics Model 101197

Location: 10m above surface

Sensor consists of bifilar gold electrodes wound on a lithium chloride impregnated wick.

Operating Range: -40°F to 100°F

Accuracy: ±0.5°C

- **Rain Gauge (Heated),** Climatronics Model 100097-1

A tipping bucket precipitation gauge (0.01 inches water/tip)

Location: near base of tower (approximately 650 feet MSL)

Accuracy: ±1.0 percent at 3 inches per hour

- **Analog Recording System**

Location: control room

Analog strip chart recorders for the various measured or computed parameters

- **Digital Data Acquisition System,** Campbell Scientific Model 21X

Location: base of tower

Digital recording system parallels the analog recorders

B. BACKUP TOWER

- **Wind-Speed Sensor,** Climatronics Model 100075

Location:	10m above surface
Specifications:	same as for primary tower

- **Wind-Direction Sensor,** Climatronics Model 100076

Location:	10m above surface
Specifications:	same as for primary tower

- **Standard Deviation Computer**, Climatronics Model 101035

Accuracy:	$\pm 2^{\circ}$
Range:	0 to 100°

C. SUPPLEMENTAL TOWERS

- **Wind-Speed Sensor**, Weathertronics Model 2030

Location:	10m above surface

Threshold: 0.5 mph

Accuracy:	±0.15 mph or 1%
Sensing Technique:	photon coupled chopper
Operating Range:	0 to 100 mph
Response:	distance constant equals 5 feet of flow

- **Wind-Direction Sensor,** Weathertronics Model 2020

Location:	10m above surface
Threshold:	0.5 mph
Resolution:	less that 1.0°
Potentiometer Linearity:	0.5%
Damping ratio:	0.4
Range:	0 to 540°

- **Sigma Computer,** Weathetronics Model 1620

Input from 10-M wind direction transmitter

Accuracy:	±0.1% full scale
Range:	0 to 100°
Samples/Period:	100

Temperature Probe, Weathertronics Model 4470

Location:	2m above surface
Sensing element:	platinum wire

Range: -50°C to +100°C

Time Constant: 15 seconds

Accuracy: ±0.3°C

- **Dew-Point Probe,** Weathertronics Model 5321

Location: 2m above surface

Probe consists of a bifilar, wound heating element over a cavity encasing a precision platinum temperature measuring sensor. The bifilar heater is wound over a fiberglass cloth which, is treated with lithium chloride salt solution.

Range: -50°C to 100°C

Accuracy: ±0.5°C over 0 to 50°C

ABS Consulting

SUSQUEHANNA

STEAM ELECTRIC STATION

2006 Meteorological Summary

Submitted to

PPL Susquehanna LLC

Prepared by

ABS Consulting Inc.

Report R-1710010-701
May 2007

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ABS Consulting

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Report Number:	R-1710010-701
Client:	PPL Susquehanna LLC
Project:	1710010

Revision Number	Approval Date	Prepared	Reviewed	Approved
0	25May-2006			

TABLE OF REVISIONS

Revision 0 Date: 25 May 2006

Original Issue

EXECUTIVE SUMMARY

This report summarizes the meteorological conditions at the PPL Susquehanna Steam Electric Station (SSES) for the year 2006. The station is located in the Susquehanna Valley near the town of Berwick, PA and the borough of Nescopeck, PA. The report will provide summaries for several meteorological parameters as measured at the primary meteorological tower located on the SSES site. Additionally, the report will provide atmospheric dispersion estimates of relative concentrations of radionuclides (X/Q) for several offsite areas. These dispersion estimates were derived using the XDCALC and WINDOW programs which follow the Nuclear Regulatory Commission (NRC) technical guidance.

Section 1 summarizes the meteorological data collection program currently in operation at SSES. Section 1.1 describes the onsite meteorological measurements program. Section 1.2 provides a brief climatological summary for the area surrounding SSES. Section 1.3 provides a summary of the following measured parameters: wind direction, wind speed, temperature, dew point temperature (a measure of atmospheric water vapor), atmospheric stability, and precipitation. In-depth tables and figures are presented to help the reader better understand the various meteorological conditions and the climatological environment at the station as well as Pennsylvania's northern Susquehanna Valley.

An established data review quality assurance program at ABS Consulting, Inc. (ABS) substantiates the quality of data obtained from the meteorological monitoring program at the SSES. This review includes daily interrogation, evaluation and validation of the data by meteorologists specializing in air quality. The meteorological data are then compiled on a monthly, quarterly and annual basis. Data from the primary meteorological tower are validated by crosschecks with data from an independent, backup meteorological tower located on the SSES site. Additional checks are made to a supplemental meteorological tower located offsite in the Susquehanna River plain. Meteorological data from the SSES meteorological monitoring program are also compared to offsite meteorological data at the regional National Weather Service observing sites in Williamsport, PA and Avoca, PA. With the exception of an underestimation of precipitation, the program data are representative of the meteorological conditions at the SSES site.

The NRC recommends an annual data recovery for wind direction, wind speed and atmospheric stability of at least 90 percent for a height level that represents the effluent release point. This recommended recovery of 90 percent was again exceeded during 2006 with the actual recovery percentages presented in Table 1.

Section 2 describes the long-term (routine) and short-term (accident) atmospheric dispersion estimates that were computed using onsite meteorological data for 2006. The 2006 dispersion estimates are compared to estimates from previous years that were reported in the SSES Final Safety Analysis Report (FSAR) and subsequent annual meteorological summaries. The dispersion estimates for 2006 are within the range of previous years. Evaluation of flooding estimates based on the years precipitation is also within the range quoted in the SSES FSAR.

Dispersion calculations only use the terrain/recirculation factors for the long-term calculation of X/Qs. This was to be consistent with the regulatory position on the calculation of short-term X/Qs where recirculation factors are not used. No changes to the site boundary distances occurred in 2006.

This report summarizes and documents the meteorological parameters at SSES. It also serves as input to an ongoing climatological database for the SSES site and surrounding areas.

1.1 INTRODUCTION

The purpose of this report is to provide a summary of the 2006 meteorological data at the Susquehanna Steam Electric Station (SSES). The report uses several calculation programs from the Meteorological Information and Dose Assessment Software (MIDAS) suite of programs to generate tables and figures included in the report. All of the calculations used hourly meteorological data from SSES meteorological towers (primary and backup). The hourly averaged data came from the onsite CR21X data loggers.

1.2 INPUT DATA

1.2.1 Meteorological Data

Meteorological data have been collected at the SSES site since the early 1970s. At the present time, the meteorological system is based on a 200 ft high tower located approximately 1000 ft to the southeast of the plant. Wind sensors are mounted at the 10m and 60m elevations on this tower. Vertical temperature differential is measured with redundant sensor pairs between the 10m and 60m levels. Sigma theta (the standard deviation of horizontal wind direction) is calculated from wind direction at both levels. Dew point and ambient temperature sensors are present at the 10m level. Precipitation is measured at ground level.

An onsite backup meteorological tower was erected in 1982. It is a 10m tower providing alternative measurements of wind speed, wind direction and sigma theta. A 10m supplemental downriver meteorological tower is also available. This tower measures wind speed, wind directions, sigma theta, temperature and dew point.

SSES meteorological data are transmitted to the plant Control Room, Technical Support Center, and Emergency Operations Facility for emergency response availability. The data are also transmitted via telephone data line directly to the ABS office in Rockville, Maryland.

The onsite CR21X data loggers at SSES generated the meteorological data used in all calculations. The data are hourly averages with the exception of the rainfall data that is the total rainfall for the hour. These data were transmitted to ABS Consulting on a daily basis using the Campbell Scientific LoggerNet program. Once the data was received, an ABS Meteorologist reviewed it. Data were compared between tower levels and between the primary, backup and downriver towers. When discrepancies were found bad data were edited out of the database. These periods of bad or missing data were left out of all calculations.

1.3. METHODOLOGY

1.3.1 MIDAS Software Calculations

The calculations performed for this report used MIDAS programs to generate tables and figures. All calculations used a final set of hourly meteorological data generated by ABS Consulting. The MIDAS programs used in the calculations have been previously validated in The Verification and Validation of MIDAS (Meteorological Information and Dose Assessment System), Volumes 1 and 2, December 1988 (Reference 9).

The following MIDAS programs were run to generate this report:

MIDMT – Meteorological Trend Plot
MIDEM – Edit Meteorological Data
MIDJF – Joint Frequency Distribution Table
MIDBD – Data Recovery Percentage Table
MIDRO – Wind Rose Plot
MIDMA – Meteorological Average Data Table
XDCALC – X/Q Calculations
XQINTR – X/Q Results at Specific Locations

Long-term dispersion modeling for effluents from normal operation of SSES is done using the MIDAS system XDCALC program, a straight-line Gaussian plume model designed to estimate average relative concentration. The model was developed in accordance with U.S. NRC Regulatory Guide 1.111 (Reference 3). For periods when the 10m wind speed is calm, the actual wind direction that occurred is used.

XDCALC and the XQINTR program that interpolates X/Q values to exact locations both use terrain correction factors to account for the temporal and spatial variations in the airflow in the region. A straight-line trajectory model assumes that a constant mean wind transports and diffuses effluents in the direction of airflow at the release point within the entire region of interest. The SSES terrain correction factors were taken from SSES FSAR Table 2.3-128 (Reference 5).

The WINDOW program was used for short-term diffusion estimates for 0-2 hour up to 30-day periods. The methodology used in WINDOW is described in NRC Regulatory Guide 1.145 (1982) (Reference 4). Allowances are made for plume meander during light winds and stable atmospheric conditions. The WINDOW methodology is distance and direction dependent.

2.0 METEOROLOGY

2.1 ONSITE METEOROLOGICAL MEASUREMENTS PROGRAM

The onsite meteorological program is designed to provide accurate and complete meteorological monitoring of the SSES site area. The program also produces accurate, summarized, hourly meteorological data for use as input in atmospheric dispersion estimate computer programs. Onsite meteorological data are processed and analyzed by air quality meteorologists using statistical computer programs. The output from these programs is then used as input data by atmospheric dispersion estimate computer programs. Atmospheric dispersion estimates provide valuable information to safety planners for both routine and accidental radioactive releases. This information is also used when estimating the possible consequences of hypothetical accident scenarios. Analysis of meteorological data provides an assessment of the diffusion patterns characteristic to the site.

2.1.1 Meteorological Towers

In November 1972, a 300 ft steel framed primary meteorological tower was erected at the SSES site approximately 1000 ft southeast of the Unit 1/Unit 2 Reactor Building. Recorded meteorological data from the tower's sensors are used to define the stability and movement of the layer of air into which the effluent from the facility would be released. In late June 1981, a major modification to the primary tower was performed by moving the wind and temperature sensors to 10 meters (33 ft) and 60 meters (197 ft). The rain gauge was left at the base of the tower. Also in 1981, a backup tower was erected to provide comparative meteorological data to the primary tower and to serve as a secondary data source in the event of sensor failure on the primary tower. This backup tower is used to measure wind speed and wind direction at the 10-meter level. The variability of wind direction (sigma theta) is also derived at this level and can be used to gauge atmospheric stability. The backup tower is located approximately 1600 ft north-northeast of the primary tower (see Figure 16). A 60-meter tower replaced the primary tower in November 2001, located about 25 ft southwest of the original tower. All of the instrumentation from the original 300 ft. tower was transferred to the new 60m tower at the same heights.

Two supplemental 10-meter towers were erected in 1985. In reference to their positions relative to the SSES site, these towers were named the "upriver" tower and the "downriver" tower. Figure 16 shows the location of the upriver tower that is used for the purpose of measuring the effects of the Susquehanna River Valley on atmospheric dispersion and transport of site airborne effluents. Wind speed and wind direction are measured at both towers with temperature and dew point temperature measured at the downriver tower. Variability of wind direction is derived at the 10-meter level at both tower locations. Meteorological data validation at the upriver tower was terminated on October 1, 1994. No data from the upriver tower is included in this report.

2.1.2 Instrumentation

New meteorological instrumentation was installed on the primary and backup towers in early October 1988. This instrumentation along with the downriver supplemental tower instrumentation is described in Appendix A. Model numbers, sensor heights and a brief description of instrument characteristics are provided.

Calibration and maintenance are conducted semi-annually on the primary, backup and downriver tower systems in accordance with the frequencies and procedures prescribed in the manufacturer's operating and maintenance manuals.

2.1.3 Data Reduction

Since April 1, 1992, the primary method of compiling the hourly meteorological data record was by transmission of the data via telephone line from the SSES meteorological shelters. These data now go directly to the ABS office in Rockville, Maryland. Prior to April 1992, data were received for review via electronic media from the PPL corporate computer in Allentown, Pennsylvania. This modification was made to eliminate duplication of the data (and the potential for error) by creating one validated meteorological database. The digital meteorological data are inspected daily by meteorologists to identify periods of questionable or missing data. Digital meteorological data that are questionable or missing are compared to data obtained via analog strip charts, maintained by the PPL staff at SSES. The analog strip chart data are used to replace questionable or missing digital data as necessary.

The meteorological parameters required by atmospheric diffusion estimate computer models are wind speed, wind direction and atmospheric stability. Atmospheric stability is determined by measuring the change in temperature with respect to height at the two levels of 10 and 60 meters. The summarized hourly data are used as input to two atmospheric dispersion estimate computer programs: the short-term (accident) atmospheric dispersion model (WINDOW) and the long-term (annual average) atmospheric dispersion model (XDCALC).

2.1.4 Data Recovery

Data recovery for all of the meteorological parameters measured at the primary, backup and downriver towers during 2006 is included in Table 1. The joint data recovery during 2006 for the meteorological parameters measured at the primary tower was very good with recoveries of 99% or greater for all parameters, with the exception of the 10m dew point temperature (98.6%). This is well above the 90 percent level recommended in NRC Regulatory Guide 1.23 (Reference 2).

2.2 <u>REGIONAL CLIMATOLOGY</u>

The regional climatology near the SSES site is profoundly influenced by the surrounding mountains and the Susquehanna River Valley, which is oriented from southwest to northeast. The topography influences the temperature, winds and precipitation amounts year round. The prevailing westerly winds that affect Pennsylvania carry most weather systems to the SSES vicinity from the west and southwest. Precipitation is fairly evenly distributed throughout the year; however, Atlantic coastal storms result in the heaviest rain and snowfalls during the fall, winter and spring months. Heavy rainfall occasionally affects central Pennsylvania from the outer fringes or remnants of Atlantic tropical storms during the summer and early fall months. The majority of summer precipitation occurs from showers and thunderstorms. Temperatures usually range between 0 and 100 degrees Fahrenheit over the course of a year.

2.3 LOCAL METEOROLOGY

2.3.1 Normal and Extreme Values of Meteorological Parameters

2.3.1.1 Wind Direction and Wind Speed

The wind direction classification system recommended by the NRC for annual meteorological summaries are the standard sixteen 22.5 degree wind direction sectors as depicted in Figure 1. **Wind directions always refer to the sector that the wind is coming from.** Specifically, a southwest wind is defined as a wind that originates from the southwest sector blowing toward the northeast sector.

During 2006, the 10-meter wind direction with the greatest frequency was from the east-northeast sector (14% of the time) with the average wind speed from this sector of 2.4 mph. This was the 22nd consecutive year that the east-northeast sector had the greatest frequency of wind. The most frequent 60-meter wind direction during 2006 was from the north-northeast sector (14.7% of the time) with the average wind speed originating from that sector of 6.0 mph. Table 2 summarizes the 2006 average wind speed and wind direction frequencies at the primary tower from both the 10 and 60m levels.

Table 3 lists annual hourly averages for wind directions and wind speeds at the 10 and 60-meter levels. This table clearly shows that wind speeds at night are less than daytime wind speeds. On average, the daytime winds flow "up the valley" and the lighter, overnight winds flow "down the valley." Extreme wind speeds at the SSES site usually occur with the passage of vigorous cold fronts and the subsequent onset of high pressure or during violent thunderstorms. The peak hourly average wind speed at the 10 and 60m levels during 2006 were 23.8 mph and 38.3 mph, respectively.

Tables 4 and 5 provide the 2006 wind direction persistence at the 10 and 60-meter levels. **Wind direction persistence is defined as the number of consecutive hours for which the wind direction originated from the same sector**. It is useful in determining predominance of wind direction at the SSES site and the probability of wind direction continuing from any given sector for consecutive hours. In 2006, the maximum 10-meter wind direction persistence was 16 hours from the southwest sector. The maximum 60-meter wind direction persistence was 29 hours, from the west-southwest sector. From an historical perspective, the greatest periods of wind persistence at SSES site are generally from the north-northeast, east-northeast, or southwest sectors. When winds are blowing from these sectors, there is a higher than normal probability that winds will continue from these sectors, especially in the nighttime hours. These tend to also be the predominant wind directions for east coast storms that can last for long periods of time. Figures 2 through 5 provide wind rose data at 10 and 60 meters on the primary tower, 10m on the backup tower and 10m on the downriver tower. **Wind roses display the frequency, in percent, of average wind direction and the wind speed groups from those directions**. The data is also presented in Table 2 for the primary tower 10 and 60m levels.

The diurnal variations of wind speed and direction at the 10 and 60-meter levels are presented in Table 3. Figures 6 through 9 provide the reader with a graphical presentation of these data.

Table 6 puts the primary tower 10-meter wind speed and direction data for 2006 into historical perspective. During 2006 the wind direction with the greatest frequency (as measured at the primary tower) was from the east-northeast sector. The second greatest wind direction frequency was from the southwest sector. At the primary tower, winds from the 10-meter level have predominated from the east-northeast sector for 24 of the past 28 years including the last 22 years in a row. At the 60m level the predominate direction in 2006 was from the north-northeast. During the last 21 years the predominate wind direction has either been from the north-northeast or southwest

2.3.1.2 Temperature and Atmospheric Water Vapor

Table 7 provides annual averages for each hour of the day for the ambient air temperature and the dew point temperature from the primary tower. Figures 10a, 10b, 11a and 11b graphically summarize the diurnal variation of the ambient and dew point temperatures from the primary and downriver towers. The dew point temperature on both the primary and downriver towers functioned normally during most of 2006. There were some time periods when they were reading too low, particularly during periods of rainfall and when the temperatures were below freezing. Particularly during the second half of 2006 dew point readings from the Downriver tower were 5-10 degrees below readings on the primary tower. The lower dew point readings from the downriver tower are evident in Figure 11b. Figures 12 and 13 show the average of the daily maximums, minimums and averages of temperature and dew point by month.

The temperatures during 2006 were above average. The winter temperatures were about four degrees warmer than normal, the spring and summer were about normal and fall was slightly cooler than normal. There were 8 days when temperatures reached above 90°F. This was about average for any given year. During 2006, the greatest average hourly temperature of 93.6°F occurred on August 1 and 2. The highest hourly average dew point temperature of 68.7°F occurred on August 1. The lowest hourly average temperature of 9.9°F occurred on the morning of February 19.

Table 8 presents a summary of mean annual values of temperature, wet bulb temperature, and relative humidity at SSES since 1973. The mean annual temperature at SSES during 2006 was 51.5°F. July 2006 was the warmest month of the year with an average temperature of 73.2°F. February was the coldest month of 2006 with an average temperature of 31.0°F. The weather pattern during 2006 was similar to recent years with warmer than normal winter conditions and then normal to warm summers. There were only 19 days when the temperature failed to get above 32°F, compared with the 27 days in a normal year. The minimum temperature for the year of 9.9 degrees is unusually warm. During a normal year it is expected that there will be 3 to 4 days with temperatures below zero. There were several prolonged warm periods during 2006. These were from May 29-31, June 17-19, July 16-21 and July 29-August 3 2006. Temperatures were particularly cold from January 15-17, February 18-20, February 26-28 and December 8-9 2006. The data used in this comparison were the 2006 SSES site data and 30-year average (1971-2000) NOAA data from Scranton-Wilkes-Barre (measured at the Avoca, PA airport).

2.3.1.3 Stability

The atmospheric stability at SSES is categorized using the Pasquill stability categories "A" through "G" (Reference 1). Atmospheric stability is measured by the vertical air temperature difference between the upper (60 meter level) and lower (10 meter level) temperature sensors at the primary tower.

Stability Classification	**Pasquill Category**	**Temperature Change with Height (°C/50m)**
Extremely unstable	A	$\Delta T/\Delta Z \leq -0.95$
Moderately unstable	B	$-0.95 < \Delta T/\Delta Z \leq -0.85$
Slightly unstable	C	$-0.84 < \Delta T/\Delta Z \leq -0.75$
Neutral	D	$-0.74 < \Delta T/\Delta Z \leq -0.25$
Slightly stable	E	$-0.24 < \Delta T/\Delta Z \leq 0.75$
Moderately stable	F	$0.76 < \Delta T/\Delta Z \leq 2.0$
Extremely stable	G	$2.0 < \Delta T/\Delta Z$

Table 9 presents the occurrence of Pasquill stability classes for each season of the year. During 2006, the greatest frequency of extremely unstable conditions (A) occurred in the summer. The greatest frequency of extremely stable conditions (G) occurred during the spring. This pattern was much closer to normal than what occurred during 2005. There was a much higher percentage of "D" stability (about 40%). This was probably caused by the high number of cloudy days with rain. Figure 14 shows a diurnal plot of delta temperature by the time-of-day. Figure 15 shows a plot of the percent of stability category by time-of-day.

As required by the NRC, annual Joint Frequency Distributions (JFD) were computed for wind speeds, wind directions, and stability categories. The annual JFD at 10 meters is presented in Table 10 while the annual JFD at 60 meters is presented in Table 11. At the 10-meter level, the greatest frequency of unstable conditions (stability Class A) occurred primarily with winds from the southwest sector. This would be a daytime phenomenon when southwest winds are prevalent. The greatest frequency of stable conditions (stability Class G) occurred with very light nighttime winds from the east-northeast sector. At the 60-meter level, the greatest frequency of unstable conditions (stability Class A) also occurred with southwest sector winds. The greatest frequency of stable conditions (stability Class G) occurred with winds from the north-northeast sector.

Pasquill stability class persistence is defined as the number of consecutive hours the stability class remains the same. The most consecutive occurrences of any Pasquill stability class were 48 hours of neutral stability (D). The most consecutive occurrences of extremely stable (G) conditions were 18 hours.

As with the wind and temperature data, the Pasquill stability class data for 2006 are put into historical context in Table 12 that lists the percent occurrence of Pasquill stability classes for each year since 1977. The 2006 Pasquill stability class distributions were more like recent years than last year. There was about 13% unstable hours in 2006 compared to an overall average of about 13%. Neutral hours occurred 41% of the time compared with a long-term average of 37%. Stable hours occurred about 46% of the time versus a long-term average of about 51% of the time. Overall these are insignificant differences when considering the affect on the dispersion estimates.

2.3.1.4 Precipitation

In central Pennsylvania, the 30-year average (1971-2000) annual precipitation values range from 41.59 inches in Williamsport, PA to 37.56 inches at Wilkes-Barre/Scranton Airport in Avoca, PA. The annual precipitation total during 2006 was 47.91 inches in Williamsport and 46.56 inches in Avoca. The annual precipitation total as measured at the SSES site was 42.46 inches. Precipitation data was supplemented with data from the NWS for the period of September 5 through October 31, 2006. The precipitation for the year started somewhat below average for the first five months of the year. However, the next five months were well above normal with June rainfall being over nine inches. The last two months of the year had about average rain and snowfall. Precipitation at SSES tends to be lower than the NWS sites particularly in the winter because the snow is difficult to collect and melt, and during summer thunderstorms windblown rain may not end up in the tipping bucket. The greatest one-day total at SSES was 3.43 inches on June 27, 2006. There were eight days with one inch or more of rain. Table 13 shows daily, monthly and annual precipitation at SSES. Table 14 shows the normal and 2006 monthly and annual precipitation totals at Williamsport and Avoca.

3.0 DIFFUSION ESTIMATES

The detailed methodology of diffusion estimates is described in three NRC publications: Regulatory Guide 1.3, Revision 2 (June 1974) (Reference 11), Regulatory Guide 1.111 (March 1976) (Reference 3) and Regulatory Guide 1.145, Revision 1 (November 1982) (Reference 4). The atmospheric dispersion programs (XDCALC and WINDOW) follow the criteria set forth by Regulatory Guides 1.111 and 1.145, respectively. Meteorological input data for 2006 SSES short-term and long-term diffusion estimates were provided in English units. The approach and calculation of diffusion estimates are presented below.

3.1 SHORT-TERM (ACCIDENT) DIFFUSION ESTIMATES

This section provides conservative estimates of atmospheric diffusion at both the Exclusion Area Boundary (EAB) and the Low Population Zone (LPZ) for appropriate time periods up to 30 days. The diffusion evaluations for short-term accidents were based on the assumption of a ground level release; that is, no credit was taken for reduction in ground level concentrations due to an elevated plume. The 2006 meteorological data from the primary tower at SSES were used in the diffusion calculations.

3.1.1 Diffusion Model for 0 to 2 Hours

The WINDOW computer code analytical procedure is used for evaluating the 0 to 2-hour accident period. Allowances are made for plume meander during light winds and stable atmospheric conditions. The methodology used in WINDOW is described in NRC Regulatory Guide 1.145 (1982).

The WINDOW methodology is distance and direction dependent. Variability of wind direction frequency was considered in determining the relative concentration (X/Q) values. The hourly X/Q values were determined as described below.

During neutral and stable conditions when the wind speed at the lower (10 meter) level is less than 6 m/sec, the relative concentration is computed as:

$$\frac{X}{Q} = \frac{1}{u\pi\Sigma_y\sigma_z} \qquad (1)$$

provided it is less than the greatest value calculated from either Equation 2 or 3

$$\frac{X}{Q} = \frac{1}{u(\sigma_y\sigma_z + cA)} \qquad (2)$$

or

$$\frac{X}{Q} = \frac{1}{u(3\pi\sigma_y\sigma_z)} \qquad (3)$$

where

X/Q	=	relative concentration at ground level (sec/m^3)
π	=	3.14159
$\bar{u}$	=	hourly average wind speed at the 10 meter (33 ft) level above plant grade (m/sec)
Σ_y	=	lateral plume spread with meander and building wake effects, in m, a function of atmospheric stability, wind speed, and downwind distance. For distances less than or equal to 800 meters, $\Sigma_y = M\sigma_y$, where M is a function of atmospheric stability and wind speed. For distances greater than 800 meters

$$\sum\nolimits_y = (M-1)\sigma_{y(800m)} + \sigma_y$$

A	=	smallest vertical plane, cross-sectional area of the building from which the effluent is released (2973 m^2)
c	=	building shape factor (0.5)
σ_y	=	lateral plume spread (m) at a given distance and stability
σ_z	=	vertical plume spread (m) at a given distance and stability

During all other atmospheric stability and/or wind speed conditions, X/Q is the greater value calculated from Equations 2 and 3.

Plume meander was accounted for by modifying the lateral diffusion coefficient, σ_y. The meander function (M) is evaluated as follows:

(1) For Pasquill stability classes A to C at all wind speeds or all stability classes when the wind speed is greater than 6 m/sec, M equals 1.

(2) For wind speeds less than or equal to 2 m/sec, M assumes the following values: 2 for D stability, 3 for E stability, 4 for F stability and 6 for G stability.

(3) For wind speeds between 2 m/sec and 6 m/sec, M is linearly interpolated between 1 and the stability dependent values given in (2).

An hourly observation is considered to be calm if the wind speed is less than the threshold of the wind instruments. For calm conditions a wind speed is assigned equal to the vane or anemometer starting speed, whichever is higher. During 2006, there was 1 hour of calm wind measured at the primary tower 10-meter level. Invalid data are not considered.

3.1.1.1 Exclusion Area Boundary and Low Population Zone

The X/Q values at the Exclusion Area Boundary (EAB) and Low Population Zone (LPZ) are determined for each sector. These are defined as the X/Q values that are exceeded 0.5 percent of the total time (NRC, 1982). To extract this value, the hourly X/Qs are sorted according to sector and magnitude. A cumulative probability distribution of X/Q values can easily be constructed as:

$$P(X/Q) = \frac{\text{rank of X/Q}}{\text{X/Q population size}} \qquad (4)$$

where P(X/Q) is the probability of being exceeded. For example, the tenth largest value of a population of 100 values has a probability of being exceeded of 10/100, or 10 percent. The greatest of the 16 sector X/Q values is defined as the maximum sector X/Q value.

For longer averaging times, these hourly X/Q values are used to represent the 2-hour X/Q value. Sector X/Q values are then determined for the EAB and LPZ for 8, 16, 72, and 624 hours by a logarithmic interpolation between the 2-hour X/Q value in each sector and the annual average X/Q (see Section 3.2) at the same point. The highest of the 16 sector X/Q values are then identified for each time period.

3.1.1.2 Five Percent Overall Site X/Q Values

The X/Q values which are exceeded no more than 5 percent of the total time at the EAB and the LPZ are determined in a manner similar to the sector X/Q values. All of the hourly X/Q values are sorted according to magnitude (independent of direction) and the 5 percent value chosen. The 5 percent overall site X/Q values are also determined for 8, 16, 72, and 624 hours by logarithmic interpolation between the maximum annual average X/Q value and the 2-hour 5 percent overall site X/Q value.

3.1.2 Results of Short-Term Diffusion Estimates

The 0.5% sector X/Q and maximum sector X/Q values for the EAB and LPZ are given in Tables 15 and 16, respectively. Figures 17 and 18 are plots at the EAB and LPZ of each of the 16 direction sectors for the five (2, 8, 16, 72 and 624 hour) time periods. Tables 17 and 18 present the 5 percent overall site X/Q values for the EAB and LPZ for the years 1978 through 2005. Figures 19 and 20 show the 2006 5% overall X/Q for each of the five time periods at the EAB and LPZ. The values for 8, 16, 72, and 624 hours reflect a logarithmic interpolation between the 2-hour sector X/Qs and the annual average X/Qs for the same sector.

3.2 LONG-TERM (ROUTINE) DIFFUSION ESTIMATES

The long-term diffusion characteristics for the SSES were estimated in accordance with the criteria set forth in NRC Regulatory Guide 1.111 (1977). The analysis was performed using the onsite meteorological data recorded at the primary tower for January through December 2006 (see Section 1.2) and the atmospheric diffusion computer model, XDCALC.

3.2.1 Atmospheric Diffusion Models

3.2.1.1 Straight-Line Airflow Model

A ground level release model based on meteorological data and plant parameters was used to calculate the annual average atmospheric relative concentration (X/Q) values. Depletion factors are computed directly from depletion curves from Regulatory Guide 1.111 as the relative deposition rates. For long-term, ground level relative concentrations, the plume is assumed to diffuse evenly over a 22.5-degree sector.

The hourly relative concentration values are calculated in the sector defined by the wind direction using the following equation:

$$X/Q = \frac{2.032}{\sigma_z \bar{u} x} \qquad (5)$$

where

X/Q = ground level relative concentration (sec/m^3)

σ_z = vertical standard deviation of the plume (m)

$\bar{u}$ = average wind speed (m/sec)

x = distance from the source (m)

However, with consideration of the turbulent wake effect, Equation 5 is revised as follows:

$$X/Q = \frac{2.032}{\sqrt{\sigma_z^2 + cV^2/\pi}\,\bar{u} x} \qquad (6)$$

Where

c = building shape factor

V = vertical height of the highest adjacent building

The wake factor (cV^2/π) is limited, close to the source, to a factor of $2\sigma_z^2$.

If $\sqrt{3} < \sigma_z < \sqrt{\sigma_z^2 + c\frac{V^2}{\pi}}$, the equation is

$$X/Q = \frac{2.032}{\sqrt{3}\sigma_z \bar{u} x} \quad (7)$$

(i.e., X/Q is calculated to be the larger of Equations 6 and 7). The total relative concentration at each sector and distance is then divided by the total number of hours in the database.

3.2.1.2 Methods of Depletion and Deposition Calculation

Depleted X/Q values are computed by applying the depletion factors provided in Figure 2 of Regulatory Guide 1.111 to the calculated X/Q values. Relative deposition rates were calculated using the following equation:

$$D/Q = \frac{DEP_j}{x * 0.3927} * T_f \quad (8)$$

where

D/Q = deposition rate at ground level (m^{-2})

DEP_j = relative deposition rate at ground level (m^{-1}) for the distance j interpolated from Table 2.2.5.5.1-3 of the MIDAS documentation (derived from Regulatory Guide 1.111 curves for program XDCALC.

0.3927 = radians per 22.5 degree direction sector

x = distance from the source (m)

T_f = terrain/recirculation correction factor (TCF)

3.2.1.3 Terrain/Recirculation Correction Factors

The straight-line trajectory, Gaussian diffusion model assumes that a constant mean wind transports and diffuses plume effluents in the direction of airflow at the release point within the entire region of interest. In other words, the wind speed and atmospheric stability at the release point are assumed to determine the atmospheric dispersion characteristics in the direction of the mean wind at all distances.

The PUFF model described in the SSES FSAR approximates a continuous release by dividing the plume into a sufficient number of plume elements to represent a continuous plume. Each plume element can be modified or advected independently according to the meteorological conditions (wind direction, wind speed, and atmospheric stability) of its immediate location. The X/Q values calculated by the PUFF model would, therefore, account for the temporal and spatial variations in the airflow in the site region.

The terrain/recirculation correction factors (T_f) are determined as the ratio between the puff advection X/Q estimates and the straight-line X/Q estimates in the form:

$$Tf(x,y) = \frac{\frac{X}{Q}(x,y)_p}{\frac{X}{Q}(x,y)_s} \qquad (9)$$

Where

$T_f(x,y)$ = terrain/recirculation correction factor at the point (x,y)

$X/Q(x,y)_p$ = the annual average relative concentration at point (x,y) using a puff advection modeling scheme

$X/Q(x,y)_s$ = the annual average relative concentration at point (x,y) using a straight-line modeling scheme

As noted in the SSES FSAR, 1973-1976 data were used to compute the TCFs. The TCFs for the SB are listed in Table 19. The TCFs for standard distances are available in the SSES FSAR (1978). Terrain/recirculation correction factors and distances to the nearest residence, garden, dairy animal, and production animal in each sector are presented in Table 20.

3.2.2 Results of Long-Term Diffusion Estimates

The terrain/recirculation corrected annual average undecayed and undepleted relative concentration (X/Q) values calculated for the EAB and SB using the 2006 SSES meteorological data are presented in Tables 21 and 22. These two tables also present the annual average 2.26-day decayed and undepleted and 8-day decayed and depleted X/Qs as well as deposition rates (D/Q). Similar calculations were also made for the nearest residences, gardens, dairy animals, production animals, and two special locations within 1 mile of the SSES site. These calculations can be found in Tables 23 and 24. Annual average X/Qs for standard distances in each sector are presented in Tables 25 through 28.

4.0 REFERENCES

1. ANSI/ANS-3.11 Standard for Determining Meteorological Information at Nuclear Facilities, December 22, 2005.

2. Nuclear Regulatory Commission, Regulatory Guide 1.23, Meteorological Monitoring Programs For Nuclear Power Plants (March 2007, Revision 1).

3. Nuclear Regulatory Commission, Regulatory Guide 1.111, Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors, 1977.

4. Nuclear Regulatory Commission Regulatory Guide 1.145, Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants, 1982.

5. Susquehanna Steam Electric Station FSAR, Section 2.

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9. MIDAS Programs, Verification and Validation of MIDAS Software Volumes 1 and 2, December 1988.

10. Certification of Computer Program, WINDOW, Version 5.4.1, June 07, 2001.

11. Nuclear Regulatory Commission Regulatory Guide 1.3, Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Boiling Water Reactors, Revision 2, June 1974.

12. Report R-1288497-0701 Program output from Window, XDCALC and Wetnes.

TABLE 1. SSES METEOROLOGICAL DATA RECOVERY FOR 2006	
PARAMETER	**PERCENT VALID DATA RECOVERY**
Wind Speed 10m - Primary (1) Wind Speed 60m – Primary Wind Speed 10m – Backup (2) Wind Speed 10m – Downriver (3)	99.6 99.5 99.9 99.8
Wind Direction 10m - Primary Wind Direction 60m – Primary Wind Direction 10m – Backup Wind Direction 10m – Downriver	99.6 99.6 99.9 99.5
Temperature 10m – Primary Dew Point 10m – Primary	99.5 98.6
Delta Temperature 60m – Primary	99.3
Sigma Theta 10m – Primary Sigma Theta 60m – Primary Sigma Theta 10m – Backup Sigma Theta 10m – Downriver	99.6 99.6 99.9 99.5
Precipitation – Primary	100.0(4)
Composite Parameters	
Wind Speed and Direction 10m, Delta Temperature 60-10m	99.3
Wind Speed and Direction 60m, Delta Temperature 60-10m	99.3

(1) SSES "Primary" meteorological tower
(2) SSES "Backup" meteorological tower
(3) SSES "Downriver" meteorological tower
(4) Data supplemented with data from the NWS for the period of September 5 through October 31, 2006.

TABLE 2. 2006 AVERAGE WIND SPEED AND DIRECTION FREQUENCIES BY SECTOR PRIMARY TOWER: 10 AND 60 METER LEVELS				
Direction From	10 Meter		60 Meter	
	Frequency (%)	Speed (mph)	Frequency (%)	Speed (mph)
N	5.5	6.0	7.7	6.9
NNE	7.9	4.7	14.7	6.0
NE	9.7	3.1	9.5	5.0
ENE	14.0	2.4	3.8	4.5
E	6.1	2.4	3.2	4.4
ESE	4.6	3.2	3.0	6.5
SE	4.5	3.6	3.3	6.2
SSE	4.1	3.4	3.2	5.8
S	6.0	4.2	4.1	6.4
SSW	7.3	4.6	7.3	7.8
SW	10.6	7.3	12.2	8.2
WSW	4.8	8.8	11.3	11.8
W	3.0	8.2	4.3	11.4
WNW	3.4	8.6	3.8	11.0
NW	4.3	8.6	4.4	10.7
NNW	4.3	8.4	4.1	10.4
Calm	0.01		0.01	

This table presents the frequency in percent that the winds originated from a given sector. The average wind speed from that sector is also reported. During 2006, winds at the 10-meter level originating from the East-Northeast sector were the most predominant, originating from this sector 14.0 % of the time. The average wind speed recorded from this sector during 2006 was 2.4 miles per hour.

TABLE 3. 2006 HOURLY MEANS, EXTREMES, AND DIURNAL VARIATIONS WIND SPEED AND DIRECTION PRIMARY TOWER: 10 AND 60 METER LEVELS				
	10 Meter		60 Meter	
Hours	**Wind Speed (mph)**	**Direction (sector)**	**Wind Speed (mph)**	**Direction (sector)**
1:00 am	3.78	ENE	6.56	NNE
2:00 am	3.74	ENE	6.48	NNE
3:00 am	3.69	ENE	6.24	NNE
4:00 am	3.56	ENE	6.14	NNE
5:00 am	3.50	ENE	6.05	NNE
6:00 am	3.53	ENE	6.06	NNE
7:00 am	3.61	ENE	6.06	NNE
8:00 am	3.84	ENE	6.03	NNE
9:00 am	4.42	SW	6.55	SE
10:00 am	5.30	SW	7.48	SW
11:00 am	6.15	SW	8.55	SW
Noon	6.92	SW	9.57	SW
1:00 pm	7.41	SW	10.20	SW
2:00 pm	7.48	SW	10.41	SW
3:00 pm	7.53	SW	10.60	WSW
4:00 pm	7.31	SW	10.45	WSW
5:00 pm	6.76	SW	10.10	WSW
6:00 pm	5.89	SSW	9.33	SW
7:00 pm	5.05	SSW	8.48	SW
8:00 pm	4.45	NE	7.70	NE
9:00 pm	4.15	NE	7.19	NNE
10:00 pm	4.11	ENE	6.96	NNE
11:00 pm	3.93	ENE	6.78	NNE
Midnight	3.81	ENE	6.65	NNE
24 Hour Average	5.0	*	7.8	*
Absolute Max	23.8	*	38.3	*
Absolute Min	0.3	*	0.3	*
Total Observation	8724	8728	8718	8723

This table presents the mean values for wind speed and direction for each hour of the day. For example, the shaded value of 3.69 in Row 3 means that during 2006, the average wind speed at 3:00 a.m. was 3.69 mph. Maximum values, minimum values, and the 24-hour mean (denoted by asterisks) are not computed for wind direction. The wind direction sector shown for each hour reflects the primary sector for the hour over the year.

TABLE 4. 2006 WIND DIRECTION PERSISTENCE
PRIMARY TOWER: 10 METER LEVEL

Number of Consecutive Hours

Sector	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
N	204	60	20	9	4	2	0	2	0	1	0	0	0	0	0	0
NNE	322	81	24	10	6	3	1	3	0	1	0	0	0	0	0	0
NE	467	92	29	10	3	2	1	1	1	0	0	0	0	1	0	0
ENE	467	132	43	29	14	7	5	4	3	1	2	0	0	0	0	0
E	413	40	9	2	0	0	0	0	0	0	0	0	0	0	0	0
ESE	264	37	10	5	0	0	0	0	0	0	0	1	0	0	0	0
SE	254	24	14	4	4	1	1	0	0	0	0	0	0	0	0	0
SSE	244	33	11	1	0	0	1	0	0	0	0	0	0	0	0	0
S	306	67	17	6	1	0	0	0	0	0	0	0	0	0	0	0
SSW	366	71	24	5	2	4	0	0	0	0	0	0	0	0	0	0
SW	381	94	39	20	15	4	3	1	0	0	0	0	1	0	0	1
WSW	210	39	20	7	3	1	0	1	0	0	0	1	1	0	0	0
W	142	26	7	5	2	0	1	0	1	0	0	0	0	0	0	0
WNW	109	26	10	6	5	2	1	2	1	0	1	0	0	0	0	0
NW	137	32	12	8	1	4	2	3	0	0	0	1	0	0	2	0
NNW	133	34	18	9	5	0	4	0	1	0	1	0	0	1	0	0
Total	**4419**	**888**	**307**	**136**	**65**	**30**	**20**	**17**	**7**	**2**	**3**	**3**	**2**	**2**	**2**	**1**

This table presents the number of occurrences that the wind direction persisted from a given sector. For example, the shaded value (20) in the north sector means that 20 times during 2006 the winds persisted from the north for three consecutive hours.

TABLE 5. 2006 WIND DIRECTION PERSISTENCE
PRIMARY TOWER: 60 METER LEVEL

Number of Consecutive Hours

Sector	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
N	278	83	23	17	5	6	0	2	1	0	0	0	0	0	0
NNE	493	125	79	23	18	7	4	2	0	1	1	0	0	1	0
NE	400	106	30	14	5	2	3	0	0	0	1	0	0	0	0
ENE	227	31	8	2	1	0	1	0	0	0	0	0	0	0	0
E	183	23	8	3	2	0	0	0	0	0	0	0	0	0	0
ESE	162	23	5	2	1	0	0	1	1	0	0	1	0	0	0
SE	180	29	6	4	1	1	1	0	0	0	0	0	0	0	0
SSE	181	35	4	3	0	1	0	0	0	0	0	0	0	0	0
S	233	46	7	2	0	0	0	0	0	0	0	0	0	0	0
SSW	344	81	13	8	4	2	1	1	0	1	0	0	0	0	0
SW	475	123	60	16	8	6	1	0	0	0	1	0	0	0	0
WSW	423	84	38	16	11	7	3	3	1	0	0	1	0	0	0
W	159	38	15	7	4	3	2	1	0	1	0	0	0	0	0
WNW	121	31	14	9	4	1	2	1	0	0	0	0	0	0	0
NW	119	34	20	11	1	5	1	2	1	0	0	1	0	0	1
NNW	132	44	12	6	4	1	1	0	0	3	0	0	0	1	0
Total	**4110**	**936**	**342**	**143**	**69**	**42**	**20**	**13**	**4**	**3**	**3**	**3**	**0**	**2**	**1**

This table presents the number of occurrences that the wind direction persisted from a given sector.

TABLE 5. (Continued) 2006 WIND DIRECTION PERSISTENCE PRIMARY TOWER: 60 METER LEVEL

Number of Consecutive Hours

Sector	16	17	18	19	20	21	22	23	24	25	26	27	28	29
N	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0	1	0	0	0	0	0	1
W	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	1	0	0	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**

This table presents the number of occurrences that the wind direction persisted from a given sector

TABLE 6. 2006 PREDOMINANT WIND DIRECTIONS, 1973-2006 PRIMARY TOWER: 10 METER LEVEL				
Year	**Highest Frequency**		**Second Highest Frequency**	
	Direction From	**Percent Occurrence**	**Direction From**	**Percent Occurrence**
1973-1976	WSW	10.77	W	10.68
1977	W	13.98	WSW	13.00
1978	W	13.42	ENE	13.32
1979	ENE	11.64	E	10.59
1980	W	10.49	ENE	9.92
1981	W	11.58	E	9.54
1982	ENE	12.17	WSW	10.15
1983	NE	12.88	SW	10.83
1984	SW	13.17	SW	11.82
1985	ENE	13.14	ENE	11.72
1986	ENE	11.01	SW	10.71
1987	ENE	14.72	NE	10.69
1988	ENE	13.79	SW	9.80
1989	ENE	15.29	SW	9.91
1990	ENE	15.30	SW	10.90
1991	ENE	16.12	SW	10.36
1992	ENE	15.02	NE	9.55
1993	ENE	15.33	NE	9.92
1994	ENE	16.73	SW	10.90
1995	ENE	14.37	SW	11.01
1996	ENE	14.83	SW	10.59
1997	ENE	15.37	SW	11.58
1998	ENE	17.09	NE	10.01
1999	ENE	16.16	SW	10.23
2000	ENE	16.13	SW	9.86
2001	ENE	16.98	SW	10.49
2002	ENE	14.46	SW	11.47
2003	ENE	14.14	NE	10.96
2004	ENE	13.60	NE	11.39
2005	ENE	15.26	SW	9.63
2006	ENE	13.95	SW	10.61

This table presents the first and second most predominant wind directions at the SSES site. In 2006 winds were most frequent from the East-northeast, originating from that sector 13.95% of the time.

TABLE 7. 2006 HOURLY MEANS AND EXTREMES OF AMBIENT TEMPERATURE AND DEW POINT TEMPERATURE PRIMARY TOWER: 10 METER LEVEL

Hours	Ambient Temperature Primary (Degrees F)	Dew Point Temperature Primary (Degrees F)
1:00 AM	48.10	33.33
2:00 AM	47.42	33.12
3:00 AM	46.81	32.89
4:00 AM	46.25	32.60
5:00 AM	45.72	32.39
6:00 AM	45.46	32.32
7:00 AM	45.85	32.49
8:00 AM	47.22	33.08
9:00 AM	49.37	33.76
10:00 AM	51.79	34.23
11:00 AM	54.12	34.41
NOON	56.07	34.39
1:00 PM	57.62	34.54
2:00 PM	58.67	34.60
3:00 PM	59.32	34.61
4:00 PM	59.56	34.47
5:00 PM	59.03	34.21
6:00 PM	57.77	34.03
7:00 PM	55.98	33.94
8:00 PM	54.05	33.98
9:00 PM	52.26	34.04
10:00 PM	50.87	33.95
11:00 PM	49.78	33.75
MIDNIGHT	48.87	33.56
HOURLY MEAN	51.5	33.3
AVG DAILY MAX	60.5	38.1
AVG DAILY MIN	42.9	28.5
ABSOLUTE MAX	93.6	68.7
ABSOLUTE MIN	9.9	-14.1
TOTAL OBSERVATIONS	8713	8632

TABLE 8. ANNUAL MEAN VALUES OF AMBIENT TEMPERATURE, WET BULB TEMPERATURE, AND RELATIVE HUMIDITY, 1973-2006			
Year	**Ambient Temperature (degrees F)**	**Wet Bulb Temperature (degrees F)**	**Relative Humidity (percent)**
1973-1976	48.7	44.4	70.0
1977	48.6	42.4	55.4
1978	46.6	41.0	61.7
1979	49.1	44.1	64.6
1980	48.2	42.1	58.8
1981	47.3	40.6	55.1
1982	49.1	41.0	60.5
1983	49.3	43.7	63.8
1984	48.4	45.1	68.3
1985	49.5	43.3	61.0
1986	49.6	39.2	60.3
1987	48.9	42.4	57.9
1988	49.1	42.4	56.8
1989	48.0	43.3	67.6
1990	51.3	45.1	63.3
1991	51.3	45.1	63.2
1992	48.8	43.0	63.3
1993	49.6	42.1	60.3
1994	49.2	41.8	53.2
1995	50.0	44.4	66.3
1996	48.8	44.0	69.0
1997	49.3	35.3	61.1
1998	52.6	46.6	64.7
1999	50.9	46.2	74.2
2000	48.8	39.5	53.7
2001	50.6	43.7	61.3
2002	51.2	43.4	57.1
2003	48.6	42.4	61.9
2004	49.6	43.5	62.9
2005	49.7	42.5	55.6
2006	51.5	43.1	50.2

The 51.5°F temperature represents the average temperature for 2006. It was the second highest average over the 34 years of data collection.

TABLE 9. 2006 PASQUILL STABILITY CLASS OCCURRENCE BY SEASON (PERCENT) USING DELTA TEMPERATURE 60-10							
	Pasquill Stability Classes (Percent of Occurrence)						
Season	**A**	**B**	**C**	**D**	**E**	**F**	**G**
Winter	0.46	0.83	1.62	54.49	24.54	10.14	7.92
Spring	2.00	2.48	5.24	53.57	18.56	9.60	8.55
Summer	19.34	4.48	4.57	19.85	33.11	13.67	4.98
Fall	5.05	2.36	2.73	36.01	33.46	13.35	7.04
This table provides a summary (in percent) of the hourly Pasquill stability class occurrences by season. For example, stability class "A" occurred 2.00% of the time during spring 2006.							

TABLE 10. SSES JOINT FRQUENCY DISTRIBUTION OF WIND SPEED AND WIND DIRECTION 10m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF JANUARY 1, 2006 THROUGH DECEMBER 31, 2006

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/06 0:00 - 12/31/06 23:00 Total Period

Elevation: **Speed:** 10M SPD **Direction:** 10M WD **Lapse:** DT60-10

Stability Class A Delta Temperature Extremely Unstable

	Wind Speed (mph)						
Wind Direction	**1 - 4**	**4 - 8**	**8 - 13**	**13 - 19**	**19 - 25**	**≥ 25**	**Total**
N	1	17	11	0	0	0	29
NNE	4	31	7	0	0	0	42
NE	11	17	0	0	0	0	28
ENE	15	3	0	0	0	0	18
E	11	8	0	0	0	0	19
ESE	12	3	1	0	0	0	16
SE	10	13	1	0	0	0	24
SSE	13	3	1	0	0	0	17
S	16	11	4	0	0	0	31
SSW	11	51	6	0	0	0	68
SW	10	106	85	2	0	0	203
WSW	4	22	33	0	0	0	59
W	1	4	5	0	0	0	10
WNW	0	2	1	0	0	0	3
NW	1	1	5	0	0	0	7
NNW	1	9	5	0	0	0	15
Total	121	301	165	2	0	0	589

Number of Calm Hours for this Table	1
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	58
Number of Valid Hours for this Table	589
Total Hours for the Period	8760

TABLE 10 (continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/06 0:00 12/31/06 23:00 Total Period

-

Elevation: **Speed:** 10M SPD **Direction:** 10M WD **Lapse:** DT60-10

Stability Class B Delta Temperature Moderately Unstable

Wind Direction	Wind Speed (mph) 1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
N	5	5	9	0	0	0	19
NNE	0	15	6	0	0	0	21
NE	1	6	2	0	0	0	9
ENE	6	4	1	0	0	0	11
E	5	1	3	0	0	0	9
ESE	2	0	1	0	0	0	3
SE	2	3	2	0	0	0	7
SSE	5	2	0	0	0	0	7
S	1	4	3	0	0	0	8
SSW	5	7	4	0	0	0	16
SW	4	29	31	3	0	0	67
WSW	0	4	8	1	0	0	13
W	0	3	5	0	0	0	8
WNW	1	2	8	0	0	0	11
NW	0	2	1	0	0	0	3
NNW	0	2	8	0	0	0	10
Total	37	89	92	4	0	0	222

Number of Calm Hours for this Table	1
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	58
Number of Valid Hours for this Table	222
Total Hours for the Period	8760

TABLE 10 (continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/06 0:00 - 12/31/06 23:00 Total Period

Elevation: **Speed:** 10M SPD **Direction:** 10M WD **Lapse:** DT60-10

Stability Class C Delta Temperature Slightly Unstable

	Wind Speed (mph)						
Wind Direction	**1 - 4**	**4 - 8**	**8 - 13**	**13 - 19**	**19 - 25**	**≥ 25**	**Total**
N	2	20	20	2	0	0	44
NNE	3	20	6	0	0	0	29
NE	2	13	0	0	0	0	15
ENE	0	4	1	0	0	0	5
E	5	2	0	0	0	0	7
ESE	8	1	2	0	0	0	11
SE	4	4	2	0	0	0	10
SSE	2	5	0	0	0	0	7
S	4	7	7	0	0	0	18
SSW	5	10	7	0	0	0	22
SW	0	24	33	5	0	0	62
WSW	0	15	19	2	0	0	36
W	0	7	4	1	0	0	12
WNW	1	1	2	0	0	0	4
NW	0	1	9	0	0	0	10
NNW	0	2	12	3	0	0	17
Total	36	136	124	13	0	0	309

Number of Calm Hours for this Table	1
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	58
Number of Valid Hours for this Table	309
Total Hours for the Period	8760

TABLE 10 (continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/06 0:00 - 12/31/06 23:00 Total Period

Elevation: **Speed:** 10M SPD **Direction:** 10M WD **Lapse:** DT60-10

Stability Class D Delta Temperature Neutral

	Wind Speed (mph)						
Wind Direction	**1 - 4**	**4 - 8**	**8 - 13**	**13 - 19**	**19 - 25**	**≥ 25**	**Total**
N	20	158	79	2	0	0	259
NNE	47	192	46	0	0	0	285
NE	71	116	2	0	0	0	189
ENE	59	33	8	0	0	0	100
E	56	34	10	2	0	0	102
ESE	68	59	21	4	0	0	152
SE	70	63	19	5	1	0	158
SSE	55	46	10	1	0	0	112
S	60	74	29	2	2	0	167
SSW	71	160	18	2	0	0	251
SW	35	188	157	50	1	0	431
WSW	14	70	112	50	13	0	259
W	8	74	88	30	1	0	201
WNW	8	86	135	34	0	0	263
NW	8	99	180	43	0	0	330
NNW	3	111	145	40	0	0	299
Total	653	1563	1059	265	18	0	3558

Number of Calm Hours for this Table	1
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	58
Number of Valid Hours for this Table	3558
Total Hours for the Period	8760

TABLE 10 (continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/06 0:00 12/31/06 23:00 Total Period

Elevation: **Speed:** 10M SPD **Direction:** 10M WD **Lapse:** DT60-10

Stability Class E Delta Temperature Slightly Stable

	Wind Speed (mph)						
Wind Direction	**1 - 4**	**4 - 8**	**8 - 13**	**13 - 19**	**19 - 25**	**≥ 25**	**Total**
N	53	60	2	0	0	0	115
NNE	136	96	10	0	0	0	242
NE	214	54	7	0	0	0	275
ENE	296	14	6	0	0	0	316
E	170	7	4	0	0	0	181
ESE	130	11	4	0	0	0	145
SE	119	17	3	2	0	0	141
SSE	132	21	7	1	0	0	161
S	164	68	17	2	0	0	251
SSW	105	139	10	1	0	0	255
SW	50	84	20	1	0	0	155
WSW	12	30	5	1	0	0	48
W	11	16	3	0	0	0	30
WNW	3	8	1	0	0	0	12
NW	9	12	4	0	0	0	25
NNW	8	20	7	0	0	0	35
Total	1612	657	110	8	0	0	2387

Number of Calm Hours for this Table	1
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	58
Number of Valid Hours for this Table	2387
Total Hours for the Period	8760

TABLE 10 (continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/06 0:00 - 12/31/06 23:00 Total Period

Elevation: **Speed:** 10M SPD **Direction:** 10M WD **Lapse:** DT60-10

Stability Class F Delta Temperature Moderately Stable

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
			Wind Speed (mph)				
N	8	1	0	0	0	0	9
NNE	46	8	0	0	0	0	55
NE	174	9	0	0	0	0	183
ENE	407	6	0	0	0	0	413
E	148	1	0	0	0	0	149
ESE	48	0	0	0	0	0	48
SE	42	0	0	0	0	0	42
SSE	44	0	0	0	0	0	44
S	37	3	0	0	0	0	40
SSW	17	5	0	0	0	0	22
SW	3	1	0	0	0	0	4
WSW	2	1	0	0	0	0	3
W	0	0	0	0	0	0	0
WNW	2	0	0	0	0	0	2
NW	3	0	0	0	0	0	3
NNW	1	0	0	0	0	0	1
Total	982	35	0	0	0	0	1018

Number of Calm Hours for this Table	1
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	58
Number of Valid Hours for this Table	1017
Total Hours for the Period	8760

TABLE 10 (continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/06 0:00 12/31/06 23:00 Total Period

Elevation: Speed: 10M SPD **Direction:** 10M WD **Lapse:** DT60-10

Stability Class G Delta Temperature Extremely Stable

Wind Direction	Wind Speed (mph) 1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
N	2	1	0	0	0	0	3
NNE	11	0	0	0	0	0	11
NE	137	7	0	0	0	0	144
ENE	345	6	0	0	0	0	351
E	61	0	0	0	0	0	61
ESE	25	0	0	0	0	0	25
SE	10	1	0	0	0	0	11
SSE	6	0	0	0	0	0	6
S	5	0	0	0	0	0	5
SSW	0	0	0	0	0	0	0
SW	1	0	0	0	0	0	1
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	1	0	0	0	0	0	1
Total	604	15	0	0	0	0	619

Number of Calm Hours for this Table	1
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	58
Number of Valid Hours for this Table	619
Total Hours for the Period	8760

TABLE 10 (continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/06 0:00 - 12/31/06 23:00 Total Period

Elevation: **Speed:** 10M SPD **Direction:** 10M WD **Lapse:** DT60-10
Summary of All Stability Classes Delta Temperature

Wind Direction	Wind Speed (mph) 1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
N	91	262	121	4	0	0	478
NNE	247	362	75	0	0	0	685
NE	610	222	11	0	0	0	843
ENE	1128	70	16	0	0	0	1214
E	456	53	17	2	0	0	528
ESE	293	74	29	4	0	0	400
SE	257	101	27	7	1	0	393
SSE	257	77	18	2	0	0	354
S	287	167	60	4	2	0	520
SSW	214	372	45	3	0	0	634
SW	103	432	326	61	1	0	923
WSW	32	142	177	54	13	0	418
W	20	104	105	31	1	0	261
WNW	15	99	147	34	0	0	295
NW	21	115	199	43	0	0	378
NNW	14	144	177	43	0	0	378
Total	4045	2796	1550	292	18	0	8702

Number of Calm Hours for this Table	1
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	58
Number of Valid Hours for this Table	8701
Total Hours for the Period	8760

TABLE 11. SSES JOINT FRQUENCY DISTRIBUTION OF WIND SPEED AND WIND DIRECTION 60m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF JANUARY 1, 2006 THROUGH DECEMBER 31, 2006

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/06 0:00 - 12/31/06 23:00 Total Period

Elevation: **Speed:** 60M SPD **Direction:** 60M WD **Lapse:** DT60-10

Stability Class A Delta Temperature Extremely Unstable

	Wind Speed (mph)						
Wind Direction	**1 - 4**	**4 - 8**	**8 - 13**	**13 - 19**	**19 - 25**	**≥ 25**	**Total**
N	0	14	24	0	0	0	38
NNE	3	16	15	5	0	0	39
NE	9	21	5	0	0	0	35
ENE	10	10	0	0	0	0	20
E	12	7	0	0	0	0	19
ESE	3	7	0	1	0	0	11
SE	3	5	0	1	0	0	9
SSE	1	10	2	1	0	0	14
S	11	9	4	3	0	0	27
SSW	16	21	14	3	0	0	54
SW	5	58	93	33	0	0	189
WSW	0	15	53	32	1	0	101
W	0	1	10	1	0	0	12
WNW	0	0	6	0	0	0	6
NW	1	2	3	1	0	0	7
NNW	0	1	6	1	0	0	8
Total	74	197	235	82	1	0	589

Number of Calm Hours for this Table	1
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	59
Number of Valid Hours for this Table	589
Total Hours for the Period	8760

TABLE 11 (continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/06 0:00 - 12/31/06 23:00 Total Period

Elevation: **Speed:** 60M SPD **Direction:** 60M WD **Lapse:** DT60-10

Stability Class B Delta Temperature Moderately Unstable

Wind Direction	Wind Speed (mph) 1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
N	2	4	9	1	0	0	16
NNE	1	10	13	1	0	0	25
NE	1	4	7	0	0	0	12
ENE	2	3	1	0	0	0	6
E	2	1	1	2	0	0	6
ESE	3	1	0	1	0	0	5
SE	0	1	1	2	0	0	4
SSE	2	2	1	0	0	0	5
S	3	1	3	0	0	0	7
SSW	2	3	4	4	0	0	13
SW	2	9	22	13	0	0	46
WSW	2	3	15	22	2	0	44
W	0	1	9	0	0	0	10
WNW	0	1	9	0	0	0	10
NW	0	0	1	0	0	0	1
NNW	0	2	9	1	0	0	12
Total	22	46	105	47	2	0	222

Number of Calm Hours for this Table	1
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	59
Number of Valid Hours for this Table	222
Total Hours for the Period	8760

TABLE 11 (continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/06 0:00 - 12/31/06 23:00 Total Period

Elevation: **Speed:** 60M SPD **Direction:** 60M WD **Lapse:** DT60-10

Stability Class C Delta Temperature Slightly Unstable

	Wind Speed (mph)						
Wind Direction	**1 - 4**	**4 - 8**	**8 - 13**	**13 - 19**	**19 - 25**	**≥ 25**	**Total**
N	3	6	19	8	0	0	36
NNE	0	13	22	2	0	0	37
NE	1	8	6	0	0	0	15
ENE	3	3	0	1	0	0	7
E	5	1	1	0	0	0	7
ESE	4	0	2	1	0	0	7
SE	1	0	2	1	0	0	4
SSE	0	2	3	0	0	0	5
S	5	3	1	3	0	0	12
SSW	2	4	6	6	1	0	19
SW	2	8	26	13	0	0	49
WSW	0	9	27	21	3	2	62
W	0	1	12	2	0	0	15
WNW	0	2	3	1	0	0	6
NW	0	1	2	4	0	0	7
NNW	1	1	15	4	0	0	21
Total	27	62	147	67	4	2	309

Number of Calm Hours for this Table	1
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	59
Number of Valid Hours for this Table	309
Total Hours for the Period	8760

TABLE 11 (continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/06 0:00 - 12/31/06 23:00 Total Period

Elevation: **Speed:** 60M SPD **Direction:** 60M WD **Lapse:** DT60-10

Stability Class D Delta Temperature Neutral

Wind Direction	Wind Speed (mph) 1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
N	11	67	147	22	1	0	248
NNE	33	93	155	37	1	0	319
NE	41	63	69	9	0	0	182
ENE	32	31	21	4	1	0	89
E	16	21	26	5	1	0	69
ESE	17	26	41	25	5	2	116
SE	21	40	30	16	5	1	113
SSE	32	21	33	10	1	0	97
S	25	36	25	16	0	2	104
SSW	30	62	48	29	10	2	181
SW	33	162	138	65	4	2	404
WSW	10	79	138	170	75	19	491
W	2	39	123	87	25	9	285
WNW	1	39	125	100	11	0	276
NW	0	44	175	92	8	0	319
NNW	2	24	160	67	12	0	265
Total	306	847	1454	754	160	37	3558

Number of Calm Hours for this Table	1
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	59
Number of Valid Hours for this Table	3558
Total Hours for the Period	8760

TABLE 11 (continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/06 0:00 12/31/06 23:00 Total Period

-

Elevation: **Speed:** 60M SPD **Direction:** 60M WD **Lapse:** DT60-10

Stability Class E Delta Temperature Slightly Stable

	Wind Speed (mph)						
Wind Direction	**1 - 4**	**4 - 8**	**8 - 13**	**13 - 19**	**19 - 25**	**≥ 25**	**Total**
N	37	86	21	0	0	0	144
NNE	104	212	68	3	0	0	387
NE	123	108	33	10	9	0	283
ENE	55	41	14	4	2	0	116
E	54	26	5	2	0	0	87
ESE	38	20	7	5	0	0	70
SE	47	27	22	2	1	1	100
SSE	62	33	14	7	2	1	119
S	50	46	33	11	3	0	143
SSW	49	90	100	28	7	2	276
SW	38	132	100	12	1	0	283
WSW	17	53	114	38	2	0	224
W	6	30	10	3	0	0	49
WNW	4	15	6	1	0	0	26
NW	2	11	19	5	0	0	37
NNW	15	14	11	3	0	0	43
Total	701	944	577	134	27	4	2387

Number of Calm Hours for this Table	1
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	59
Number of Valid Hours for this Table	2387
Total Hours for the Period	8760

TABLE 11 (continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/06 0:00 - 12/31/06 23:00 Total Period

Elevation: **Speed:** 60M SPD **Direction:** 60M WD **Lapse:** DT60-10

Stability Class F Delta Temperature Moderately Stable

	Wind Speed (mph)						
Wind Direction	**1 - 4**	**4 - 8**	**8 - 13**	**13 - 19**	**19 - 25**	**≥ 25**	**Total**
N	26	78	6	0	0	0	110
NNE	77	199	13	0	0	0	289
NE	119	57	4	0	0	0	181
ENE	44	5	0	0	0	0	49
E	46	7	0	0	0	0	53
ESE	36	2	1	0	0	0	39
SE	34	7	1	0	0	0	42
SSE	19	3	0	0	0	0	22
S	17	17	4	0	0	0	38
SSW	11	38	9	0	0	0	58
SW	5	31	25	1	0	0	62
WSW	2	12	35	1	0	0	50
W	3	2	0	0	0	0	5
WNW	0	2	0	0	0	0	2
NW	2	7	1	0	0	0	10
NNW	4	2	1	0	0	0	7
Total	445	469	100	2	0	0	1017

Number of Calm Hours for this Table	1
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	59
Number of Valid Hours for this Table	1016
Total Hours for the Period	8760

TABLE 11 (continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 01/01/06 0:00 - 12/31/06 23:00 Total Period

Elevation: **Speed:** 60M SPD **Direction:** 60M WD **Lapse:** DT60-10
Stability Class G Delta Temperature Extremely Stable

Wind Direction	Wind Speed (mph) 1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
N	12	60	3	0	0	0	75
NNE	53	134	0	0	0	0	187
NE	65	54	0	0	0	0	119
ENE	39	7	0	0	0	0	46
E	29	5	0	0	0	0	34
ESE	13	4	0	0	0	0	17
SE	13	5	0	0	0	0	18
SSE	12	4	2	0	0	0	18
S	9	14	1	0	0	0	24
SSW	5	21	7	0	0	0	33
SW	1	21	4	0	0	0	26
WSW	1	6	5	0	0	0	12
W	0	2	0	0	0	0	2
WNW	2	1	0	0	0	0	3
NW	2	2	0	0	0	0	4
NNW	0	1	0	0	0	0	1
Total	256	341	22	0	0	0	619

Number of Calm Hours for this Table	1
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	59
Number of Valid Hours for this Table	619
Total Hours for the Period	8760

TABLE 11 (continued)

Hours at Each Wind Speed and Direction

Period of Record = 01/01/06 0:00 - 12/31/06 23:00 Total Period

Elevation: **Speed:** 60M SPD **Direction:** 60M WD **Lapse:** DT60-10
Summary of All Stability Classes Delta Temperature

	Wind Speed (mph)						
Wind Direction	**1 - 4**	**4 - 8**	**8 - 13**	**13 - 19**	**19 - 25**	**≥ 25**	**Total**
N	91	315	229	31	1	0	667
NNE	271	677	286	48	1	0	1283
NE	359	315	124	19	9	0	827
ENE	185	100	36	9	3	0	333
E	164	68	33	9	1	0	275
ESE	114	60	51	33	5	2	265
SE	119	85	56	22	6	2	290
SSE	128	75	55	18	3	1	280
S	120	126	71	33	3	2	355
SSW	115	239	188	70	18	4	634
SW	86	421	408	137	5	2	1059
WSW	32	177	387	284	83	21	984
W	11	76	164	93	25	9	378
WNW	7	60	149	102	11	0	329
NW	7	67	201	102	8	0	385
NNW	22	45	202	76	12	0	357
Total	1831	2906	2640	1086	194	43	8701

Number of Calm Hours for this Table	1
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	59
Number of Valid Hours for this Table	8700
Total Hours for the Period	8760

TABLE 12. ANNUAL PASQUILL STABILITY CLASS OCCURRENCES PRIMARY TOWER 1973-2006 (in percent)

YEAR	A	B	C	D	E	F	G
1973-1976	16.23	7.64	4.24	30.72	26.17	10.51	4.49
1977	6.62	3.29	1.45	34.03	38.52	11.49	4.59
1978	1.38	1.82	0.79	34.72	44.72	12.33	4.23
1979	1.36	1.72	1.44	38.18	41.27	11.46	4.56
1980	5.68	4.02	2.41	41.84	27.37	12.34	6.34
1981	11.29	3.45	2.82	32.80	29.29	11.38	8.97
1982	15.68	3.48	2.83	23.41	29.99	14.00	11.59
1983	4.35	3.30	5.02	39.32	28.69	12.02	7.30
1984	3.57	2.72	4.23	34.36	33.51	13.50	8.10
1985	5.36	3.50	3.98	35.44	33.36	12.05	6.30
1986	5.62	3.13	3.67	32.92	35.78	11.26	7.62
1987	9.33	2.53	3.61	34.09	28.72	13.43	8.29
1988	13.83	3.60	4.19	31.10	27.26	12.74	7.28
1989	4.57	3.00	4.51	40.90	30.01	10.72	6.28
1990	3.37	2.53	3.59	39.34	29.79	13.93	7.44
1991	5.25	3.75	4.55	39.38	25.28	14.24	7.55
1992	3.06	2.91	4.80	47.76	26.26	11.09	4.11
1993	3.78	3.56	4.11	39.33	26.68	12.19	7.34
1994	6.24	3.18	4.43	34.25	29.55	13.26	9.08
1995	5.34	3.48	4.62	41.06	27.08	11.29	7.14
1996	2.17	2.22	3.94	44.42	30.79	11.13	5.33
1997	4.98	3.66	5.49	38.80	28.05	12.87	6.16
1998	2.88	2.94	4.08	35.15	30.97	15.58	8.39
1999	5.63	3.35	4.05	38.27	27.24	11.94	9.52
2000	2.65	3.08	4.63	44.92	25.47	11.86	7.39
2001	4.55	3.82	5.22	37.39	27.47	13.49	8.06
2002	3.21	3.71	4.93	40.47	26.43	13.28	7.97
2003	4.10	1.70	2.89	43.99	30.15	11.08	6.09
2004	3.51	3.30	5.24	39.42	32.38	11.56	4.89
2005	12.48	3.32	3.68	30.47	28.85	12.87	8.33
2006	6.77	2.55	3.55	40.89	27.43	11.70	7.11

Pasquill stability class assignments were based on the temperature difference between the 90-meter and 10-meter levels from 1973 through July 1981. From July 1981 to present, the stability class assignment is based on the temperature difference between the 60-meter and 10-meter levels.

TABLE 13. SSES DAILY, MONTHLY AND ANNUAL PRECIPITATION TOTALS FOR 2006

Date	Amount (inches)	Date	Amount (inches)	Date	Amount (inches)	Date	Amount (inches)	Date	Amount (inches)	Date	Amount (inches)
Jan		Feb		Mar		Apr		May		June	
2	0.56	3	0.58	9	0.01	3	0.19	12	0.29	3	0.15
3	0.53	4	0.37	12	0.22	5	0.17	13	0.03	4	0.32
5	0.02	5	0.02	13	0.16	7	0.89	14	0.02	7	0.09
11	0.69	17	0.09	14	0.01	13	0.87	15	0.02	8	0.11
14	0.41	23	0.04	24	0.04	14	0.13	16	0.01	14	0.59
18	1.04			25	0.51	21	0.03	18	0.01	19	0.01
23	0.54	**Total**	**1.96**			22	0.88	19	0.07	22	0.3
24	0.12			**Total**	**1.19**	23	0.33	20	0.01	23	0.02
25	0.01					24	0.09	23	0.1	24	0.91
29	0.23					25	0.03	26	0.05	25	0.82
31	0.13							30	0.09	26	1.27
						Total	**3.68**	31	0.06	27	3.43
Total	**4.28**									28	0.94
								Total	**1.01**	30	0.25
										Total	**9.28**

Date	Amount (inches)	Date	Amount (inches)	Date	Amount (inches)	Date	Amount (inches)	Date	Amount (inches)	Date	Amount (inches)
July		Aug		Sep		Oct		Nov		Dec	
2	0.23	3	0.23	1	0.01	1	0.03	1	0.16	1	0.25
3	0.95	7	0.02	2	0.19	4	0.42	2	0.45	13	0.18
4	0.03	15	0.87	3	0.01	6	0.07	8	0.58	18	0.04
5	0.34	19	0.15	5	0.01	7	1.01	12	0.3	22	0.4
12	0.25	24	0.05	13	0.05	11	0.09	13	0.01	23	0.13
13	0.7	25	0.1	14	1.16	12	0.07	14	0.16	25	0.22
15	0.11	26	0.36	15	0.68	17	0.22	16	1.32	26	0.11
21	0.2	27	0.48	16	0.02	19	0.1	23	0.58		
22	0.74	28	0.05	18	0.09	20	0.97			**Total**	**1.33**
27	0.03	29	0.04	28	1.69	25	0.02	**Total**	**3.56**		
28	0.26	30	0.02	29	0.11	26	0.01				
		31	0.02	30	0.02	27	0.18				
Total	**3.84**					28	1.72				
		Total	**2.39**	**Total**	**4.04**	31	0.99				
						Total	**5.9**				

Annual Total = 42.46

TABLE 14. NORMAL AND ACTUAL (2006) PRECIPITATION DATA FOR WILLIAMSPORT AND AVOCA, PA (inches)				
	WILLIAMSPORT		AVOCA	
MONTH	NORMAL*	2006	NORMAL*	2006
JAN	2.85	5.59	2.46	4.26
FEB	2.61	1.55	2.08	1.22
MAR	3.21	1.15	2.69	1.31
APR	3.49	2.40	3.28	3.15
MAY	3.79	3.43	3.69	2.16
JUN	4.45	6.42	3.97	9.00
JUL	4.08	3.83	3.74	3.02
AUG	3.38	6.33	3.10	4.40
SEP	3.98	5.49	3.86	5.76
OCT	3.19	5.40	3.02	3.83
NOV	3.62	3.84	3.12	6.06
DEC	2.94	2.48	2.55	1.39
Total inches	41.59	47.91	37.56	45.56

* Normal values are for the 30 year period from 1971 – 2000

TABLE 15. 2006 EXCLUSION AREA BOUNDARY SHORT-TERM (ACCIDENT) DISPERSION ESTIMATES X/Q VALUES (sec/meter3)

Affected Sector	Distance (Miles)	Time Period				
		0-2 hours	0-8 hours	8-24 hours	1-4 days	4-30 days
N	0.34	2.82E-04	1.62E-04	7.11E-05	3.50E-05	1.50E-05
NNE	0.34	2.19E-04	1.36E-04	5.19E-05	2.54E-05	1.00E-05
NE	0.34	1.68E-04	1.10E-04	3.81E-05	2.00E-05	8.50E-06
ENE	0.34	1.02E-04	7.61E-05	2.39E-05	1.24E-05	7.00E-06
E	0.34	9.95E-05	7.44E-05	2.85E-05	1.26E-05	4.00E-06
ESE	0.34	9.80E-05	7.64E-05	2.61E-05	1.50E-05	7.00E-06
SE	0.34	1.06E-04	7.83E-05	2.71E-05	2.00E-05	8.50E-06
SSE	0.34	9.90E-05	6.88E-05	2.49E-05	1.11E-05	7.00E-06
S	0.34	1.97E-04	1.17E-04	4.34E-05	3.00E-05	8.50E-06
SSW	0.34	2.48E-04	1.67E-04	6.44E-05	3.35E-05	1.22E-05
SW	0.34	3.62E-04	2.51E-04	1.00E-04	5.48E-05	3.00E-05
WSW	0.34	5.17E-04	4.06E-04	1.52E-04	8.83E-05	5.00E-05
W	0.34	4.38E-04	2.91E-04	1.25E-04	6.07E-05	3.50E-05
WNW	0.34	3.39E-04	2.05E-04	7.85E-05	4.60E-05	2.00E-05
NW	0.34	3.28E-04	1.91E-04	6.84E-05	3.64E-05	1.50E-05
NNW	0.34	2.84E-04	1.60E-04	6.12E-05	3.50E-05	1.50E-05

The shaded values denote the maximum relative short-term concentration values (X/Q) for each time period as generated by the dispersion estimate modeling program, WINDOW, with no terrain/recirculation factors included.

TABLE 16. 2006 LOW POPULATION ZONE SHORT-TERM (ACCIDENT) DISPERSION ESTIMATES X/Q VALUES (sec/meter^3)						
Affected Sector	**Distance (Miles)**	**Time Period**				
		0-2 hours	**0-8 hours**	**8-24 hours**	**1-4 days**	**4-30 days**
N	3.0	3.38E-05	1.74E-05	3.11E-06	1.29E-06	7.00E-07
NNE	3.0	2.64E-05	1.28E-05	2.31E-06	1.50E-06	4.80E-07
NE	3.0	1.95E-05	1.06E-05	1.76E-06	1.00E-06	3.20E-07
ENE	3.0	8.48E-06	7.12E-06	1.16E-06	5.04E-07	2.12E-07
E	3.0	8.65E-06	6.86E-06	1.20E-06	7.00E-07	2.20E-07
ESE	3.0	7.71E-06	6.78E-06	1.05E-06	7.00E-07	2.20E-07
SE	3.0	8.45E-06	7.17E-06	1.21E-06	5.86E-07	3.20E-07
SSE	3.0	7.89E-06	5.95E-06	1.50E-06	7.00E-07	3.20E-07
S	3.0	2.39E-05	1.12E-05	1.97E-06	9.37E-07	4.80E-07
SSW	3.0	3.02E-05	1.63E-05	2.68E-06	1.48E-06	7.00E-07
SW	3.0	3.65E-05	2.54E-05	7.00E-06	3.00E-06	1.50E-06
WSW	3.0	6.07E-05	4.12E-05	8.50E-06	5.00E-06	3.00E-06
W	3.0	5.27E-05	2.98E-05	3.70E-06	2.55E-06	1.50E-06
WNW	3.0	3.95E-05	2.08E-05	3.35E-06	3.00E-06	1.00E-06
NW	3.0	3.90E-05	1.96E-05	2.90E-06	2.00E-06	7.00E-07
NNW	3.0	3.46E-05	1.60E-05	2.84E-06	1.50E-06	7.00E-07

The shaded values denote the maximum relative short-term concentration values (X/Q) for each time period as generated by the dispersion estimate modeling program, WINDOW, with no terrain/recirculation factors included.

TABLE 17. COMPARISON OF FIVE PERCENT OVERALL X/Q VALUES FOR THE EXCLUSION AREA BOUNDARY, 1978-2006 (sec/meter3)

EXCLUSION AREA BOUNDARY					
Year	5% OVERALL RELATIVE CONCENTRATIONS X/Q (sec/meter^3)				
	0-2 hours	0-8 hours	8-24 hours	1-4 days	4-30 days
1978	5.0 E-04	2.7 E-04	2.2 E-04	1.4 E-04	7.7 E-05
1979	3.9 E-04	2.1 E-04	1.7 E-04	1.1 E-04	5.6 E-05
1980	3.5 E-04	2.3 E-04	1.8 E-04	1.2 E-04	6.0 E-05
1981	4.4 E-04	2.9 E-04	2.4 E-04	1.5 E-04	7.9 E-05
1982	4.8 E-04	3.2 E-04	2.6 E-04	1.7 E-04	8.8 E-05
1983	3.5 E-04	2.5 E-04	2.1 E-04	1.5 E-04	8.9 E-05
1984	3.5 E-04	2.5 E-04	2.1 E-04	1.4 E-04	8.2 E-05
1985	2.7 E-04	1.7 E-04	1.3 E-04	8.1 E-04	3.9 E-05
1986	3.5 E-04	2.2 E-04	1.7 E-04	1.0 E-04	4.8 E-05
1987	3.4 E-04	2.3 E-04	1.9 E-04	1.2 E-04	6.4 E-05
1988	3.1 E-04	2.0 E-04	1.6 E-04	1.0 E-04	5.2 E-05
1989	2.8 E-04	1.9 E-04	1.5 E-04	9.6 E-05	5.0 E-05
1990	2.8 E-04	1.7 E-04	1.4 E-04	8.1 E-05	3.8 E-05
1991	3.3 E-04	2.0 E-04	1.5 E-04	8.8 E-05	4.0 E-05
1992	1.3 E-04	8.7 E-05	7.2 E-05	4.8 E-05	2.7 E-05
1993	1.4 E-04	9.5 E-05	7.9 E-05	5.2 E-05	2.9 E-05
1994	1.3 E-04	8.8 E-05	7.2 E-05	4.8 E-05	2.6 E-05
1995	1.3 E-04	1.0 E-04	9.3 E-05	7.4 E-05	5.3 E-05
1996	1.3 E-04	1.0 E-04	9.2 E-05	7.2 E-05	5.1 E-05
1997	1.4 E-04	9.1 E-05	7.4 E-05	4.8 E-05	2.5 E-05
1998	4.9 E-04	3.6 E-04	3.1 E-04	2.2 E-04	1.4 E-04
1999	6.5 E-04	4.2 E-04	3.4 E-04	2.0 E-04	9.4 E-05
2000	4.8 E-04	3.2 E-04	2.7 E-04	1.7 E-04	8.6 E-05
2001	6.6 E-04	4.2 E-04	3.3 E-04	2.0 E-04	1.0 E-04
2002	6.6 E-04	4.1 E-04	3.3 E-04	2.0 E-04	9.4 E-05
2003	6.0E-04	3.7E-04	2.9E-04	1.7E-04	8.2E-05
2004	6.0E-04	3.7E-04	2.9E-04	1.7E-04	8.1E-05
2005	6.5E-04	4.1E-04	3.3E-04	2.0E-04	9.6E-05
2006	6.9E-04	4.1E-04	3.2E-04	1.8E-04	8.1E-05

The above values were calculated using the WINDOW atmospheric dispersion model, with no terrain/recirculation factors included. Used the peak annual average from all directions.

TABLE 18. COMPARISON OF FIVE PERCENT OVERALL X/Q VALUES FOR THE LOW POPULATION ZONE, 1978-2006 (sec/meter3)					
LOW POPULATION ZONE					
Year	5% OVERALL RELATIVE CONCENTRATIONS X/Q (sec/meter^3)				
	0-2 hours	**0-8 hours**	**8-24 hours**	**1-4 days**	**4-30 days**
1978	7.2 E-05	2.9 E-05	2.1 E-05	1.1 E-05	4.1 E-06
1979	6.6 E-05	2.6 E-05	1.9 E-05	9.6 E-06	3.6 E-06
1980	7.3 E-05	4.1 E-05	3.1 E-05	1.7 E-05	6.9 E-06
1981	9.7 E-05	5.4 E-05	4.1 E-05	2.2 E-05	8.6 E-06
1982	1.1 E-04	6.6 E-05	5.0 E-05	2.9 E-05	1.3 E-05
1983	8.4 E-05	4.8 E-05	3.6 E-05	1.9 E-05	8.0 E-06
1984	7.6 E-05	4.4 E-05	3.3 E-05	1.8 E-05	7.4 E-06
1985	5.8 E-05	3.4 E-05	2.6 E-05	1.4 E-05	5.8 E-06
1986	7.0 E-05	4.0 E-05	3.0 E-05	1.6 E-05	6.8 E-06
1987	7.9 E-05	4.7 E-05	3.7 E-05	2.1 E-05	9.5 E-06
1988	7.3 E-05	4.3 E-05	3.3 E-05	1.8 E-05	7.9 E-06
1989	6.7 E-05	4.0 E-05	3.1 E-05	1.7 E-05	7.7 E-06
1990	6.7 E-05	4.0 E-05	3.1 E-05	1.8 E-05	8.0 E-06
1991	6.2 E-05	3.8 E-05	3.0 E-05	1.7 E-05	7.8 E-06
1992	4.2 E-05	2.7 E-05	2.2 E-05	1.4 E-05	6.9 E-06
1993	5.4 E-05	3.4 E-05	2.7 E-05	1.6 E-05	7.9 E-06
1994	6.1 E-05	3.8 E-05	3.0 E-05	1.8 E-05	8.9 E-06
1995	5.1 E-05	3.2 E-05	2.6 E-05	1.6 E-05	7.7 E-06
1996	4.7 E-05	3.0 E-05	2.4 E-05	1.5 E-05	7.5 E-06
1997	4.8 E-05	3.1 E-05	2.5 E-05	1.5 E-05	7.7 E-06
1998	5.8 E-05	3.7 E-05	3.0 E-05	1.8 E-05	9.1 E-06
1999	7.4 E-05	3.9 E-05	2.8 E-05	1.3 E-05	5.0 E-06
2000	5.2 E-05	2.9 E-05	2.3 E-05	1.2 E-05	4.6 E-06
2001	7.4 E-05	3.9 E-05	2.9 E-05	1.5 E-05	5.5 E-06
2002	7.4 E-05	3.9 E-05	2.8 E-05	1.4 E-05	5.2 E-06
2003	7.4 E-05	3.6 E-05	2.6 E-05	1.3 E-05	4.2 E-06
2004	6.0E-05	3.2E-05	2.3E-05	1.2E-05	4.4E-06
2005	8.3E-05	4.3E-05	3.1E-05	1.5E-05	5.6E-06
2006	6.9E-05	3.6E-05	2.6E-05	1.3E-05	4.6E-06

The above values were calculated using the WINDOW atmospheric dispersion model, with no terrain/recirculation factors included. Used the peak annual average from all directions.

TABLE 19. TERRAIN AND RECIRCULATION CORRECTION FACTORS USED IN DISPERSION MODELS AT THE SITE BOUNDARY

	Site Boundary		Exclusion Area Boundary	
Affected Sector	**Distance (miles)**	**Recirculation Factor**	**Distance (miles)**	**Recirculation Factor**
N	0.59	2.20	0.34	2.18
NNE	0.78	2.37	0.34	2.00
NE	0.7	2.31	0.34	2.15
ENE	0.86	2.52	0.34	2.36
E	0.8	2.33	0.34	2.30
ESE	0.5	2.58	0.34	2.79
SE	0.43	2.44	0.34	2.46
SSW	0.41	2.57	0.34	2.49
S	0.38	2.35	0.34	2.30
SSW	0.39	2.30	0.34	2.32
SW	0.61	2.05	0.34	1.89
WSW	1.22	2.31	0.34	1.68
W	1.03	2.22	0.34	2.27
WNE	0.61	2.66	0.34	2.54
NW	0.66	3.02	0.34	3.00
NNW	0.59	2.53	0.34	2.26

The SSES Final Safety Analysis Report has terrain/recirculation correction factors assigned for standard distances. During 1997, real estate purchases in and around the SSES area caused site boundary distances to change. As a result, the terrain/recirculation values listed in this table were re-calculated using the SSES 1997 Site Boundary Distances and the original terrain/recirculation factors quoted in the SSES-FSAR. No changes to the Site Boundary distances occurred during 2006.

TABLE 20. DISTANCES AND TERRAIN/RECIRCULATION CORRECTION FACTORS FOR SSES 2006 LAND USE CENSUS LOCATIONS

RESIDENCE			GARDEN		
AFFECTED SECTOR	MILES	Terrain Correction Factor	AFFECTED SECTOR	MILES	Terrain Correction Factor
N	1.3	2.15	N	3.2	2.19
NNE	1	2.50	NNE	2.3	2.55
NE	0.9	2.33	NE	2.6	2.48
ENE	2.1	2.42	ENE	2.4	2.48
E	1.4	2.09	E	1.8	2.07
ESE	0.5	2.58	ESE	2.5	2.00
SE	0.5	2.43	SE	0.6	2.44
SSE	0.6	2.71	SSE	2.9	2.30
S	1	2.46	S	2.5	2.20
SSW	0.9	2.39	SSW	1.2	2.35
SW	1.5	2.14	SW	1.9	2.11
WSW	1.3	2.32	WSW	1.3	2.32
W	1.2	2.18	W	1.2	2.18
WNW	0.8	2.74	WNW	1.3	2.59
NW	0.8	3.30	NW	4.5	2.56
NNW	0.6	2.53	NNW	4	2.40

PRODUCTION ANIMAL			DAIRY ANIMAL		
AFFECTED SECTOR	MILES	Terrain Correction Factor	AFFECTED SECTOR	MILES	Terrain Correction Factor
NNE	2.3	2.55	E	4.5	1.80
E	1.8	2.07	ESE	4.2	1.58
SSW	3	2.35	SSW	3	2.11
WSW	1.7	2.36	SSW	3.1	2.06
			SSW	3.5	1.88
			SSW	14.01	1.03
			WSW	1.7	2.34
			W	5	1.46
			NNW	4.2	2.4

Distances to the nearest garden, residence, dairy animal and production animal in each of the affected sectors was provided by the 2006 SSES Land Use Census(Reference 7). The terrain/recirculation correction factors listed for the distances in the above tables were mathematically interpolated from the terrain/recirculation factors quoted for standard distances in the SSES Final Safety Analysis Report.

TABLE 21. 2006 ANNUAL AVERAGE RELATIVE CONCENTRATION (sec/meter^3) AND DEPOSITION (meter^{-2}) ESTIMATES AT THE EXCLUSION AREA BOUNDARY					
Affected Sector		Relative Concentration (sec/meter^3)			Deposition
	Distance (miles	No Decay Undepleted	2.26 Days of Decay Undepleted	8.0 Days of Decay Depleted	D/Q (meter^{-2})
N	0.34	1.33E-05	1.33E-05	1.25E-05	5.08E-08
NNE	0.34	1.07E-05	1.07E-05	1.01E-05	5.68E-08
NE	0.34	8.88E-06	8.88E-06	8.33E-06	8.87E-08
ENE	0.34	4.04E-06	4.04E-06	3.79E-06	4.42E-08
E	0.34	2.85E-06	2.85E-06	2.67E-06	2.69E-08
ESE	0.34	3.59E-06	3.59E-06	3.37E-06	3.68E-08
SE	0.34	4.21E-06	4.21E-06	3.95E-06	4.18E-08
SSE	0.34	4.19E-06	4.19E-06	3.93E-06	4.22E-08
S	0.34	7.70E-06	7.69E-06	7.22E-06	4.94E-08
SSW	0.34	1.56E-05	1.56E-05	1.47E-05	7.12E-08
SW	0.34	3.38E-05	3.38E-05	3.17E-05	7.14E-08
WSW	0.34	6.07E-05	6.07E-05	5.69E-05	9.12E-08
W	0.34	3.23E-05	3.23E-05	3.03E-05	5.37E-08
WNW	0.34	1.97E-05	1.97E-05	1.85E-05	4.56E-08
NW	0.34	1.86E-05	1.86E-05	1.74E-05	5.28E-08
NNW	0.34	1.21E-05	1.21E-05	1.13E-05	3.59E-08

The above values were calculated using the XDCALC atmospheric dispersion model with terrain/recirculation factors included.

TABLE 22. 2006 ANNUAL AVERAGE RELATIVE CONCENTRATION (sec/meter^3) AND DEPOSITION (meter^{-2}) ESTIMATES AT THE SITE BOUNDARY					
Affected Sector		**Relative Concentration (sec/meter^3)**			**Deposition**
	Distance (miles	**No Decay Undepleted**	**2.26 Days of Decay Undepleted**	**8.0 Days of Decay Depleted**	**D/Q (meter^{-2})**
N	0.59	6.11E-06	6.09E-06	5.51E-06	2.01E-08
NNE	0.78	3.85E-06	3.83E-06	3.41E-06	1.64E-08
NE	0.58	4.22E-06	4.22E-06	3.82E-06	3.78E-08
ENE	0.49	2.37E-06	2.36E-06	2.16E-06	2.40E-08
E	0.48	1.72E-06	1.72E-06	1.58E-06	1.51E-08
ESE	0.5	1.87E-06	1.87E-06	1.71E-06	1.78E-08
SE	0.43	2.95E-06	2.95E-06	2.73E-06	2.79E-08
SSE	0.41	3.28E-06	3.28E-06	3.04E-06	3.19E-08
S	0.38	6.67E-06	6.66E-06	6.21E-06	4.18E-08
SSW	0.39	1.28E-05	1.27E-05	1.19E-05	5.62E-08
SW	0.61	1.52E-05	1.51E-05	1.37E-05	2.88E-08
WSW	1.22	1.18E-05	1.17E-05	1.01E-05	1.43E-08
W	1.03	6.05E-06	5.99E-06	5.25E-06	7.98E-09
WNW	0.61	8.73E-06	8.68E-06	7.86E-06	1.77E-08
NW	0.66	7.15E-06	7.12E-06	6.41E-06	1.73E-08
NNW	0.59	6.10E-06	6.08E-06	5.51E-06	1.57E-08
The above values were calculated using the XDCALC atmospheric dispersion model with terrain/recirculation factors included.					

TABLE 23. 2006 ANNUAL ATMOSPHERIC DISPERSION ESTIMATES FOR NEAREST RESIDENCE AND GARDEN*

NEAREST RESIDENCE WITHIN A 5-MILE RADIUS OF SSES BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	*NAME*	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
1	N	H.Burd	1.3	1.91E-06	1.90E-06	1.64E-06	5.09E-09
2	NNE	E.Ashbridge III	1	2.83E-06	2.82E-06	2.47E-06	1.13E-08
3	NE	W.Tuggle	0.9	2.26E-06	2.25E-06	1.98E-06	1.84E-08
4	ENE	D.Barberi	2.1	2.89E-07	2.87E-07	2.38E-07	2.33E-09
5	E	L.Kozlowski/ W. Witts	1.4	3.15E-07	3.14E-07	2.68E-07	2.20E-09
6	ESE	R.Panetta	0.5	1.86E-06	1.86E-06	1.70E-06	1.77E-08
7	SE	J.Futoma	0.5	2.34E-06	2.34E-06	2.14E-06	2.15E-08
8	SSE	J.Naunczek	0.6	1.95E-06	1.95E-06	1.76E-06	1.75E-08
9	S	S.Slusser	1	1.69E-06	1.68E-06	1.47E-06	8.43E-09
10	SSW	S.Molnar	0.9	3.89E-06	3.88E-06	3.42E-06	1.40E-08
11	SW	F.Michael	1.5	4.02E-06	3.99E-06	3.40E-06	6.46E-09
12	WSW	F.Michael	1.3	1.07E-05	1.06E-05	9.12E-06	1.28E-08
13	W	F. Hummel	1.2	4.71E-06	4.66E-06	4.04E-06	6.02E-09
14	WNW	R.Orlando	0.8	6.01E-06	5.97E-06	5.31E-06	1.15E-08
15	NW	B. Kramer	0.8	5.89E-06	5.85E-06	5.21E-06	1.36E-08
16	NNW	G. John	0.6	5.96E-06	5.93E-06	5.37E-06	1.53E-08

NEAREST GARDEN WITHIN A 5-MILE RADIUS OF SSES BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	*NAME*	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
1	N	J.Wojcik	3.2	5.08E-07	4.99E-07	3.98E-07	1.15E-09
2	NNE	R.Chapin	2.3	8.41E-07	8.33E-07	6.85E-07	2.97E-09
3	NE	F. Kremski	2.6	4.79E-07	4.74E-07	3.85E-07	3.44E-09
4	ENE	G.Dennis	2.4	2.41E-07	2.39E-07	1.96E-07	1.95E-09
5	E	W.Daily	1.8	2.11E-07	2.10E-07	1.76E-07	1.46E-09
6	ESE	L.Travelpiece	2.5	1.23E-07	1.22E-07	9.93E-08	9.53E-10
7	SE	F.Scholl	0.6	1.79E-06	1.79E-06	1.61E-06	1.58E-08
8	SSE	H.Roinick	2.9	1.47E-07	1.46E-07	1.17E-07	1.06E-09
9	S	T. Stemrich	2.5	3.80E-07	3.76E-07	3.07E-07	1.71E-09
10	SSW	S.Bodnar	1.2	2.51E-06	2.50E-06	2.16E-06	8.43E-09
11	SW	R. Broody	1.9	2.85E-06	2.81E-06	2.36E-06	4.41E-09
12	WSW	F.Michael	1.3	1.07E-05	1.06E-05	9.12E-06	1.28E-08
13	W	F.Hummel	1.2	4.71E-06	4.66E-06	4.04E-06	6.02E-09
14	WNW	P.Moskaluk	1.3	2.77E-06	2.74E-06	2.37E-06	4.72E-09
15	NW	R.Reider	4.5	3.66E-07	3.55E-07	2.73E-07	5.45E-10
16	NNW	P.Culver	4	3.53E-07	3.44E-07	2.68E-07	5.67E-10

1	X/Q	RELATIVE CONCENTRATION (SEC/M^3)
2	X/Q DEC	DECAYED AND UNDEPLETED, HALF-LIFE 2.26 DAYS (SEC/M^3)
3	X/Q DEC+DEP	DECAYED AND DEPLETED, HALF-LIFE 8 DAYS (SEC/M^3)
4	DEPOSITION	RELATIVE DEPOSITION RATE (1/M^2)

*2006 Land Use Census Locations

TABLE 24. 2006 ANNUAL ATMOSPHERIC DISPERSION ESTIMATES FOR NEAREST MEAT ANIMAL, DAIRY LOCATIIONS AND SPECIAL RECEPTORS*

NEAREST ANIMAL RAISED FOR MEAT CONSUMPTION WITHIN A 5-MILE RADIUS OF SSES BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	*NAME*	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
2	NNE	R.Chapin	2.3	8.41E-07	8.33E-07	6.85E-07	2.97E-09
4	ENE	G.Dennis	2.4	2.41E-07	2.39E-07	1.96E-07	1.95E-09
5	E	W.Daily	1.8	2.11E-07	2.10E-07	1.76E-07	1.46E-09
10	SSW	R. & C. Ryman	3	5.77E-07	5.69E-07	4.56E-07	1.65E-09
12	WSW	T. & M Berger	1.7	7.30E-06	7.22E-06	6.11E-06	8.38E-09

ALL DAIRY LOCATIONS NEAR SSES

SECTOR NUMBER	AFFECTED SECTOR	*NAME*	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
5	E	W.Bloss	4.5	4.29E-08	4.24E-08	3.22E-08	2.54E-10
6	ESE	F.Rinehimer	4.2	4.22E-08	4.18E-08	3.19E-08	2.86E-10
10	SSW	R. & C. Ryman	3	5.77E-07	5.69E-07	4.56E-07	1.65E-09
10	SSW	R.Ryman	3.1	5.37E-07	5.29E-07	4.22E-07	1.51E-09
10	SSW	C. K. Drasher	3.5	4.07E-07	4.00E-07	3.15E-07	1.09E-09
10	SSW	K.Davis	14.01	3.36E-08	3.14E-08	2.09E-08	5.84E-11
12	WSW	T. & M. Berger	1.7	7.30E-06	7.22E-06	6.11E-06	8.38E-09
13	W	J. Dent	5	4.29E-07	4.12E-07	3.15E-07	3.47E-10
16	NNW	H.Shoemaker	4.2	3.31E-07	3.22E-07	2.49E-07	5.21E-10

SPECIAL RECEPTOR LOCATIONS

AFFECTED SECTOR	LOCATION	MILES	X/Q(1)	X/Q DEC(2)	X/Q DEC+DEP(3)	DEPOSITION(4)
3 / NE	Riverlands / EIC	0.7	3.26E-06	3.25E-06	2.91E-06	2.80E-08
12 / WSW	Tower's Club	0.5	3.66E-05	3.64E-05	3.34E-05	5.15E-08
5 / E	East Gate	0.5	1.62E-06	1.62E-06	1.48E-06	1.41E-08

1	X/Q	RELATIVE CONCENTRATION (SEC/M^3)
2	X/Q DEC	DECAYED AND UNDEPLETED, HALF-LIFE 2.26 DAYS (SEC/M^3)
3	X/Q DEC+DEP	DECAYED AND DEPLETED, HALF-LIFE 8 DAYS (SEC/M^3)
4	DEPOSITION	RELATIVE DEPOSITION RATE (1/M^2)

*2006 Land Use Census Locations

TABLE 25. 2006 SSES ANNUAL RELATIVE CONCENTRATIONS NO DECAY, UNDEPLETED X/Q (sec/m^3)

	MILES									
DIRECTION FROM	.0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10 - 20	20 - 30	30 - 40	40 - 50
N	1.91E-06	3.76E-07	1.73E-07	1.01E-07	7.01E-08	3.45E-08	1.29E-08	6.30E-09	3.98E-09	2.83E-09
NNE	3.86E-06	7.71E-07	3.64E-07	2.16E-07	1.52E-07	7.63E-08	2.96E-08	1.47E-08	9.36E-09	6.72E-09
NE	1.00E-05	1.88E-06	9.20E-07	5.75E-07	4.13E-07	2.14E-07	8.76E-08	4.44E-08	2.87E-08	2.10E-08
ENE	2.01E-05	3.69E-06	1.84E-06	1.17E-06	8.42E-07	4.41E-07	1.83E-07	9.36E-08	6.07E-08	4.46E-08
E	8.03E-06	1.55E-06	7.62E-07	4.73E-07	3.39E-07	1.75E-07	7.11E-08	3.61E-08	2.33E-08	1.70E-08
ESE	4.40E-06	8.65E-07	4.14E-07	2.50E-07	1.78E-07	9.02E-08	3.58E-08	1.79E-08	1.15E-08	8.30E-09
SE	3.55E-06	7.13E-07	3.39E-07	2.03E-07	1.43E-07	7.21E-08	2.82E-08	1.41E-08	8.99E-09	6.48E-09
SSE	3.07E-06	6.23E-07	2.97E-07	1.78E-07	1.25E-07	6.32E-08	2.48E-08	1.23E-08	7.91E-09	5.69E-09
S	3.53E-06	7.25E-07	3.41E-07	2.02E-07	1.42E-07	7.15E-08	2.77E-08	1.37E-08	8.78E-09	6.31E-09
SSW	3.09E-06	6.30E-07	2.91E-07	1.70E-07	1.18E-07	5.87E-08	2.23E-08	1.09E-08	6.91E-09	4.92E-09
SW	2.34E-06	4.51E-07	2.05E-07	1.19E-07	8.24E-08	4.02E-08	1.49E-08	7.27E-09	4.59E-09	3.25E-09
WSW	9.65E-07	1.85E-07	8.38E-08	4.83E-08	3.32E-08	1.59E-08	5.79E-09	2.78E-09	1.74E-09	1.22E-09
W	7.00E-07	1.36E-07	6.09E-08	3.48E-08	2.39E-08	1.13E-08	4.05E-09	1.91E-09	1.18E-09	8.21E-10
WNW	7.24E-07	1.37E-07	6.14E-08	3.52E-08	2.40E-08	1.12E-08	3.94E-09	1.84E-09	1.12E-09	7.71E-10
NW	9.65E-07	1.86E-07	8.37E-08	4.82E-08	3.29E-08	1.55E-08	5.50E-09	2.58E-09	1.59E-09	1.10E-09
NNW	9.48E-07	1.81E-07	8.17E-08	4.71E-08	3.23E-08	1.53E-08	5.51E-09	2.61E-09	1.61E-09	1.12E-09

TABLE 26. 2006 SSES ANNUAL RELATIVE CONCENTRATIONS
2.26-DAY DECAY, UNDEPLETED X/Q (sec/m^3)

	MILES									
DIRECTION FROM	.0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10 - 20	20 - 30	30 - 40	40 - 50
N	1.90E-06	3.74E-07	1.71E-07	9.93E-08	6.88E-08	3.34E-08	1.21E-08	5.66E-09	3.42E-09	2.33E-09
NNE	3.85E-06	7.66E-07	3.59E-07	2.13E-07	1.49E-07	7.36E-08	2.76E-08	1.30E-08	7.92E-09	5.43E-09
NE	1.00E-05	1.86E-06	9.06E-07	5.63E-07	4.01E-07	2.04E-07	8.00E-08	3.81E-08	2.32E-08	1.59E-08
ENE	2.00E-05	3.65E-06	1.81E-06	1.14E-06	8.17E-07	4.19E-07	1.66E-07	7.94E-08	4.82E-08	3.32E-08
E	8.00E-06	1.53E-06	7.47E-07	4.60E-07	3.27E-07	1.64E-07	6.31E-08	2.96E-08	1.77E-08	1.19E-08
ESE	4.38E-06	8.56E-07	4.06E-07	2.44E-07	1.72E-07	8.52E-08	3.19E-08	1.48E-08	8.80E-09	5.90E-09
SE	3.54E-06	7.05E-07	3.33E-07	1.98E-07	1.39E-07	6.84E-08	2.54E-08	1.18E-08	7.01E-09	4.70E-09
SSE	3.06E-06	6.17E-07	2.92E-07	1.74E-07	1.22E-07	6.02E-08	2.25E-08	1.05E-08	6.32E-09	4.28E-09
S	3.52E-06	7.19E-07	3.37E-07	1.98E-07	1.39E-07	6.86E-08	2.55E-08	1.20E-08	7.24E-09	4.92E-09
SSW	3.08E-06	6.26E-07	2.88E-07	1.67E-07	1.16E-07	5.69E-08	2.09E-08	9.79E-09	5.94E-09	4.06E-09
SW	2.33E-06	4.49E-07	2.04E-07	1.18E-07	8.12E-08	3.92E-08	1.42E-08	6.68E-09	4.08E-09	2.80E-09
WSW	9.63E-07	1.85E-07	8.32E-08	4.78E-08	3.28E-08	1.56E-08	5.55E-09	2.59E-09	1.57E-09	1.07E-09
W	6.99E-07	1.35E-07	6.04E-08	3.45E-08	2.36E-08	1.11E-08	3.88E-09	1.78E-09	1.07E-09	7.17E-10
WNW	7.23E-07	1.37E-07	6.11E-08	3.49E-08	2.37E-08	1.10E-08	3.80E-09	1.73E-09	1.03E-09	6.90E-10
NW	9.64E-07	1.85E-07	8.32E-08	4.77E-08	3.25E-08	1.52E-08	5.28E-09	2.41E-09	1.44E-09	9.65E-10
NNW	9.46E-07	1.80E-07	8.11E-08	4.67E-08	3.19E-08	1.50E-08	5.27E-09	2.42E-09	1.45E-09	9.79E-10

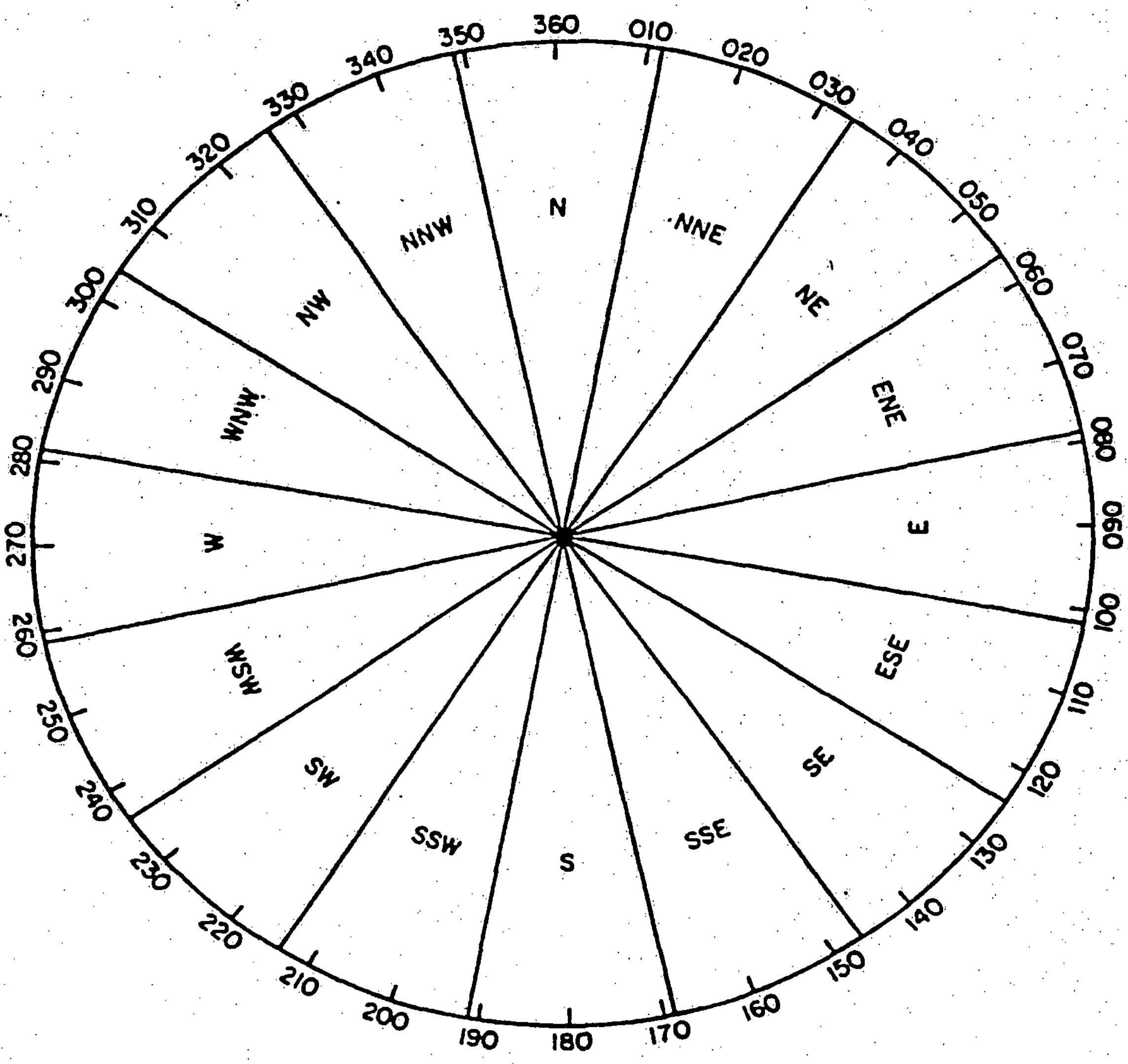
TABLE 27. 2006 SSES ANNUAL RELATIVE CONCENTRATIONS
8-DAY DECAY, DEPLETED X/Q (sec/m^3)

	MILES									
DIRECTION FROM	.0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10 - 20	20 - 30	30 - 40	40 - 50
N	1.74E-06	3.19E-07	1.40E-07	7.80E-08	5.25E-08	2.39E-08	7.96E-09	3.38E-09	1.91E-09	1.23E-09
NNE	3.52E-06	6.53E-07	2.94E-07	1.67E-07	1.14E-07	5.30E-08	1.82E-08	7.84E-09	4.47E-09	2.91E-09
NE	9.16E-06	1.59E-06	7.43E-07	4.44E-07	3.08E-07	1.48E-07	5.35E-08	2.35E-08	1.35E-08	8.92E-09
ENE	1.84E-05	3.12E-06	1.48E-06	9.01E-07	6.29E-07	3.05E-07	1.12E-07	4.94E-08	2.85E-08	1.88E-08
E	7.33E-06	1.31E-06	6.14E-07	3.65E-07	2.52E-07	1.20E-07	4.31E-08	1.88E-08	1.08E-08	7.07E-09
ESE	4.02E-06	7.32E-07	3.34E-07	1.93E-07	1.32E-07	6.22E-08	2.17E-08	9.37E-09	5.33E-09	3.46E-09
SE	3.24E-06	6.03E-07	2.73E-07	1.57E-07	1.07E-07	4.98E-08	1.72E-08	7.38E-09	4.19E-09	2.72E-09
SSE	2.80E-06	5.27E-07	2.40E-07	1.37E-07	9.35E-08	4.37E-08	1.51E-08	6.52E-09	3.72E-09	2.41E-09
S	3.23E-06	6.13E-07	2.76E-07	1.56E-07	1.06E-07	4.95E-08	1.70E-08	7.30E-09	4.16E-09	2.70E-09
SSW	2.82E-06	5.34E-07	2.35E-07	1.31E-07	8.87E-08	4.08E-08	1.37E-08	5.84E-09	3.31E-09	2.14E-09
SW	2.14E-06	3.82E-07	1.66E-07	9.21E-08	6.17E-08	2.80E-08	9.23E-09	3.92E-09	2.22E-09	1.43E-09
WSW	8.82E-07	1.57E-07	6.78E-08	3.74E-08	2.49E-08	1.11E-08	3.58E-09	1.50E-09	8.46E-10	5.41E-10
W	6.39E-07	1.15E-07	4.93E-08	2.70E-08	1.79E-08	7.91E-09	2.51E-09	1.04E-09	5.75E-10	3.63E-10
WNW	6.61E-07	1.16E-07	4.97E-08	2.73E-08	1.80E-08	7.83E-09	2.44E-09	9.98E-10	5.49E-10	3.43E-10
NW	8.82E-07	1.57E-07	6.78E-08	3.74E-08	2.47E-08	1.08E-08	3.40E-09	1.40E-09	7.74E-10	4.86E-10
NNW	8.66E-07	1.53E-07	6.61E-08	3.65E-08	2.42E-08	1.07E-08	3.41E-09	1.41E-09	7.83E-10	4.95E-10

TABLE 28. 2006 SSES ANNUAL RELATIVE DEPOSITION – D/Q (meters-2)

	MILES									
DIRECTION FROM	.0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10 - 20	20 - 30	30 - 40	40 - 50
N	1.12E-08	1.71E-09	7.77E-10	4.07E-10	2.60E-10	1.09E-10	3.54E-11	1.30E-11	6.95E-12	4.37E-12
NNE	1.60E-08	2.45E-09	1.11E-09	5.82E-10	3.72E-10	1.55E-10	5.06E-11	1.86E-11	9.94E-12	6.24E-12
NE	1.97E-08	3.01E-09	1.37E-09	7.16E-10	4.57E-10	1.91E-10	6.22E-11	2.29E-11	1.22E-11	7.68E-12
ENE	2.83E-08	4.34E-09	1.96E-09	1.03E-09	6.58E-10	2.75E-10	8.95E-11	3.29E-11	1.76E-11	1.10E-11
E	1.23E-08	1.89E-09	8.54E-10	4.48E-10	2.86E-10	1.20E-10	3.89E-11	1.43E-11	7.65E-12	4.80E-12
ESE	9.34E-09	1.43E-09	6.47E-10	3.40E-10	2.17E-10	9.06E-11	2.95E-11	1.09E-11	5.79E-12	3.64E-12
SE	9.18E-09	1.40E-09	6.36E-10	3.34E-10	2.13E-10	8.90E-11	2.90E-11	1.07E-11	5.69E-12	3.58E-12
SSE	8.27E-09	1.26E-09	5.73E-10	3.01E-10	1.92E-10	8.01E-11	2.61E-11	9.61E-12	5.13E-12	3.22E-12
S	1.21E-08	1.86E-09	8.41E-10	4.41E-10	2.82E-10	1.18E-10	3.83E-11	1.41E-11	7.53E-12	4.73E-12
SSW	1.48E-08	2.26E-09	1.03E-09	5.38E-10	3.44E-10	1.44E-10	4.67E-11	1.72E-11	9.18E-12	5.77E-12
SW	2.16E-08	3.30E-09	1.49E-09	7.84E-10	5.00E-10	2.09E-10	6.80E-11	2.50E-11	1.34E-11	8.40E-12
WSW	9.76E-09	1.49E-09	6.76E-10	3.55E-10	2.27E-10	9.46E-11	3.08E-11	1.13E-11	6.05E-12	3.80E-12
W	6.09E-09	9.32E-10	4.22E-10	2.22E-10	1.41E-10	5.91E-11	1.92E-11	7.08E-12	3.78E-12	2.38E-12
WNW	6.89E-09	1.05E-09	4.77E-10	2.50E-10	1.60E-10	6.68E-11	2.17E-11	8.01E-12	4.27E-12	2.68E-12
NW	8.85E-09	1.35E-09	6.13E-10	3.22E-10	2.05E-10	8.58E-11	2.79E-11	1.03E-11	5.49E-12	3.45E-12
NNW	8.85E-09	1.35E-09	6.13E-10	3.22E-10	2.05E-10	8.58E-11	2.79E-11	1.03E-11	5.49E-12	3.45E-12

FIGURE 1. THE SIXTEEN STANDARD
22.5 DEGREE WIND DIRECTION SECTORS



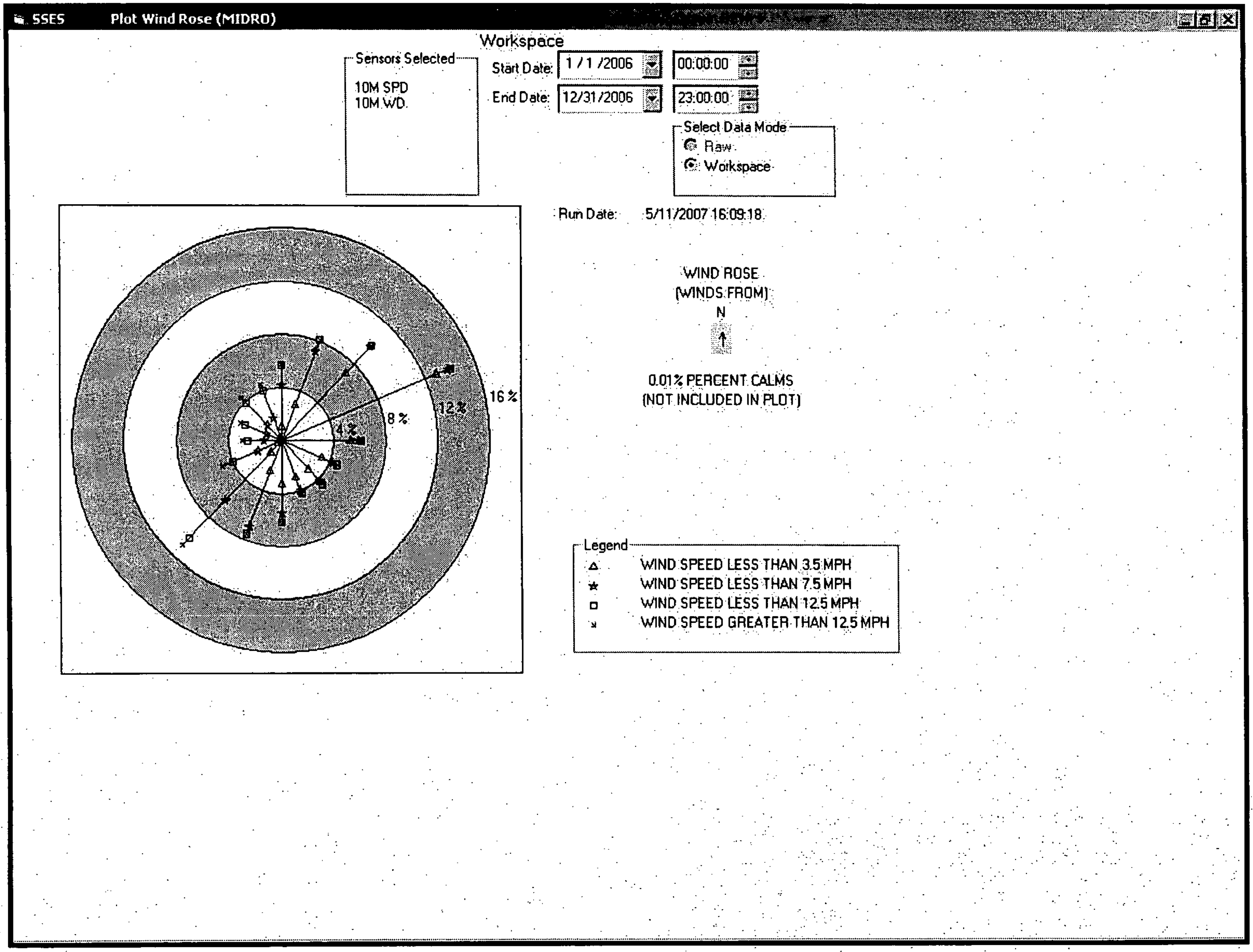


Figure 2. SSES 2006 ANNUAL WIND ROSE
10M LEVEL – PRIMARY TOWER

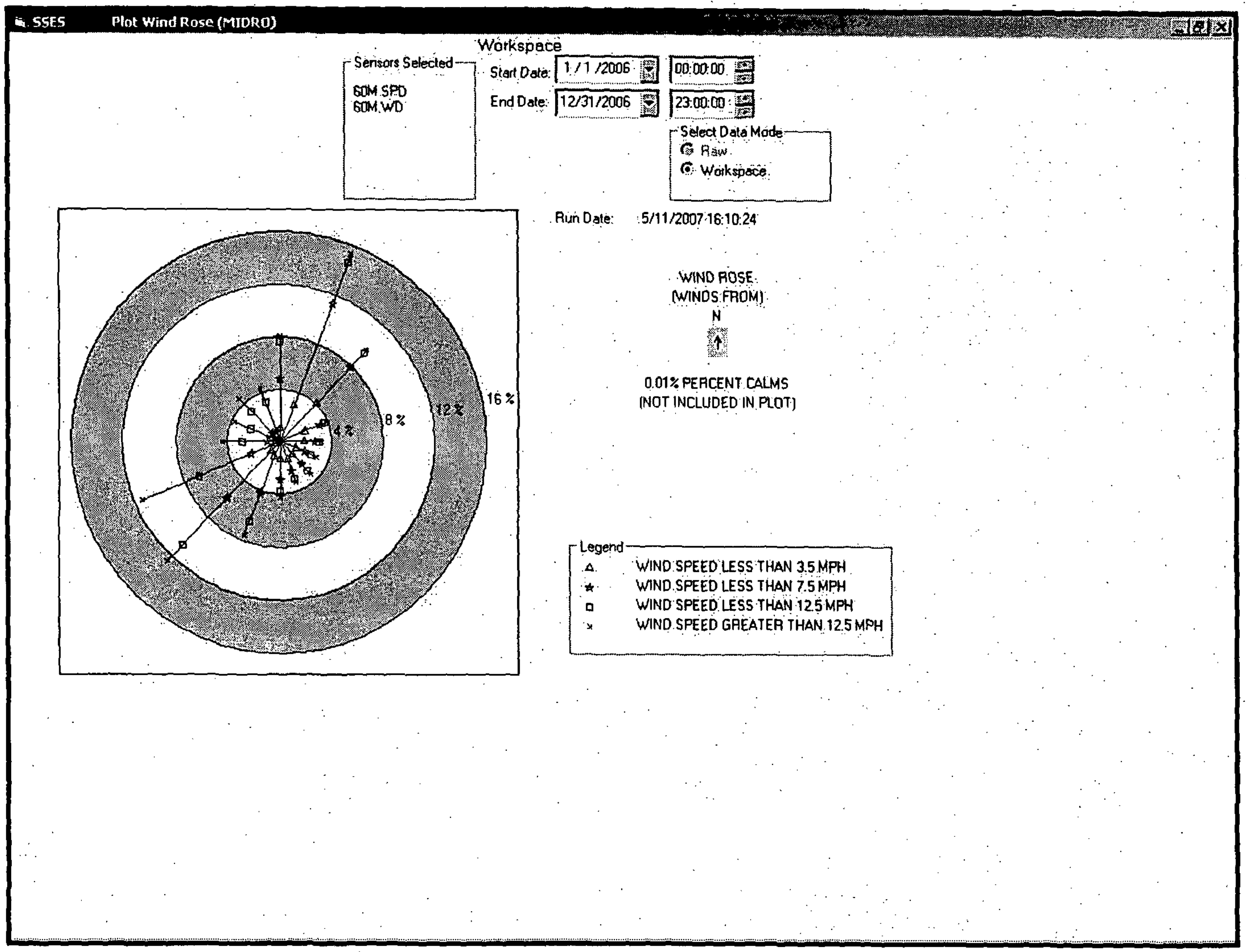


Figure 3. SSES 2006 ANNUAL WIND ROSE
60M LEVEL – PRIMARY TOWER

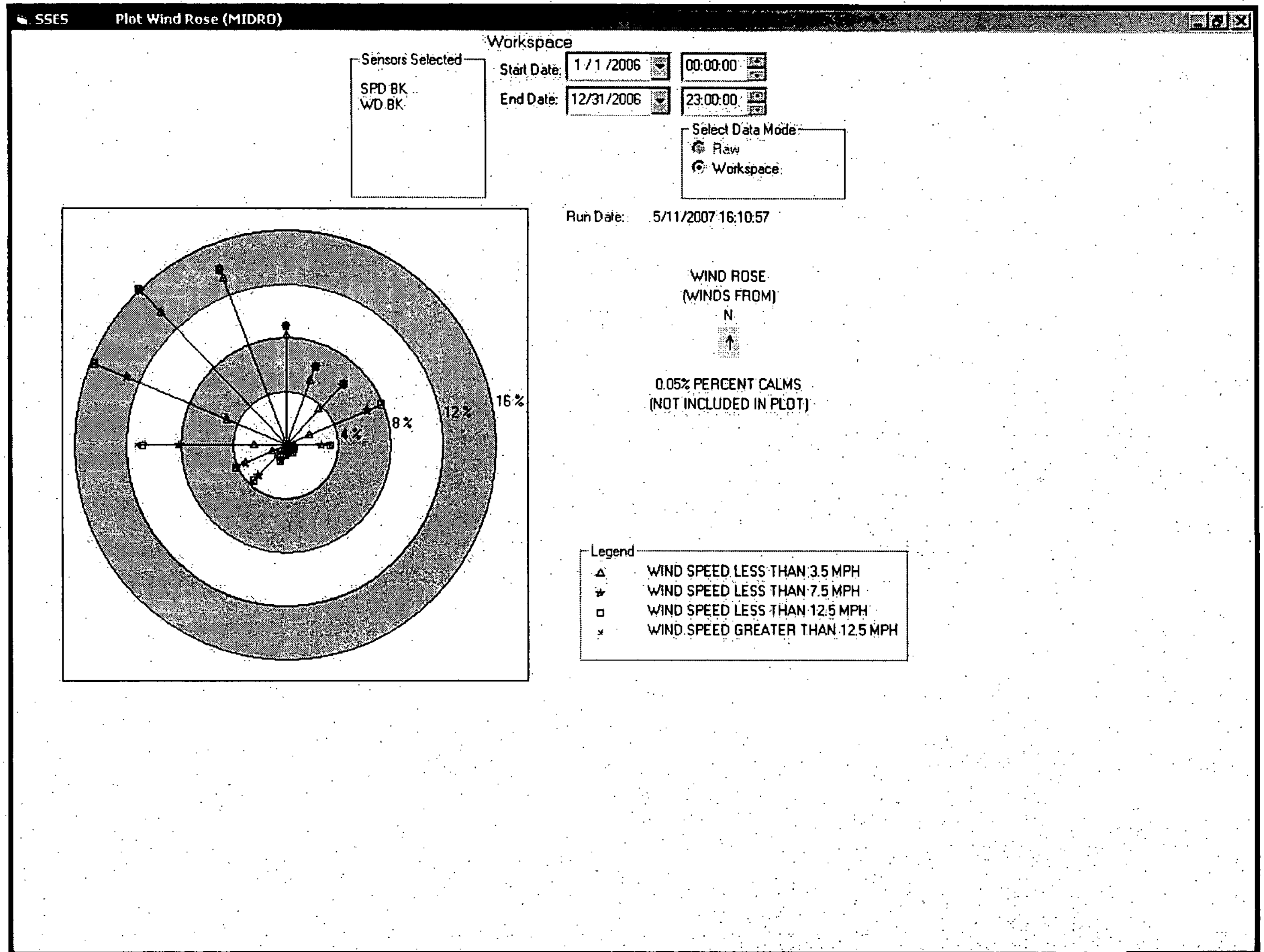


Figure 4. SSES 2005 ANNUAL WIND ROSE
10M LEVEL – BACKUP TOWER

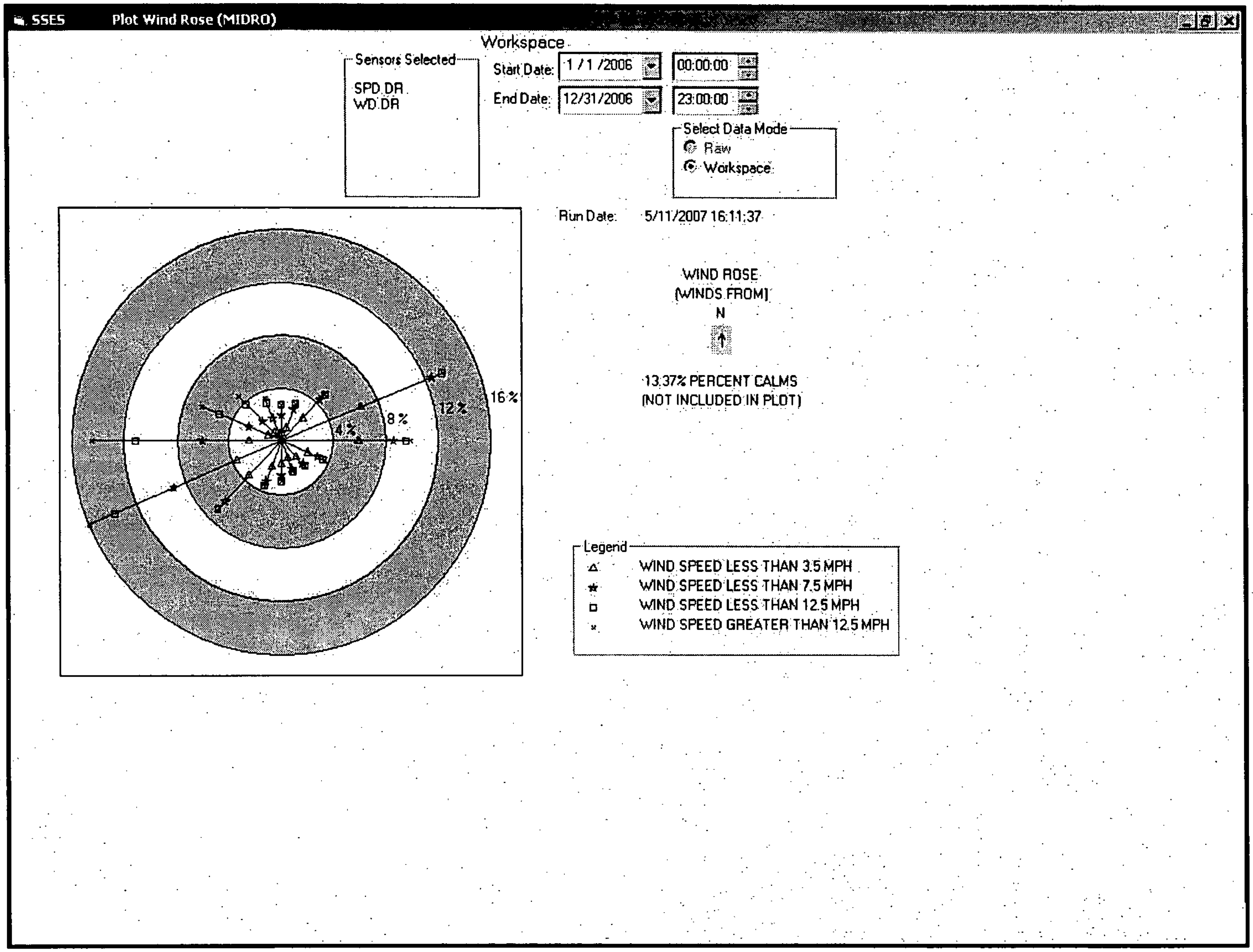
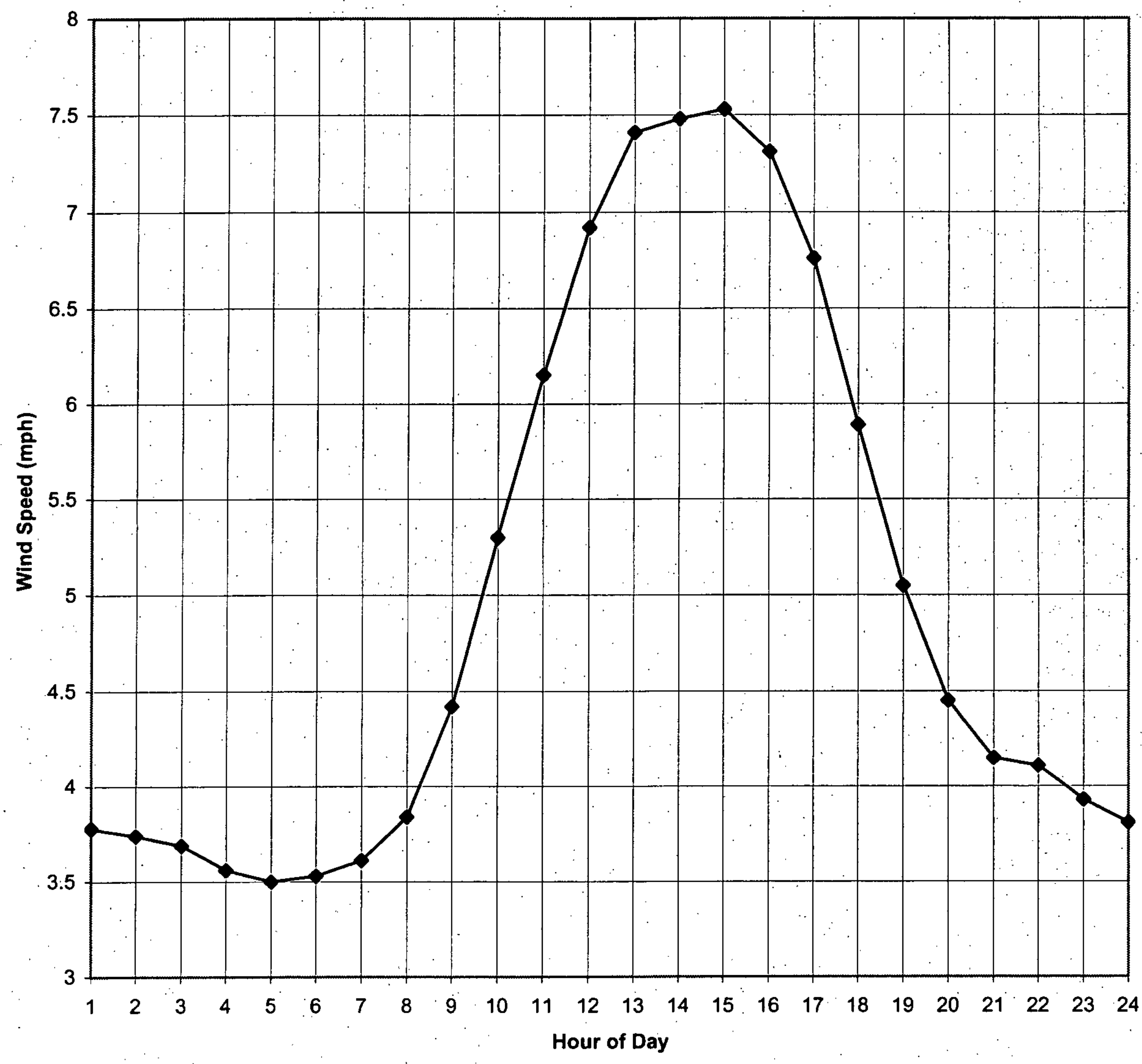


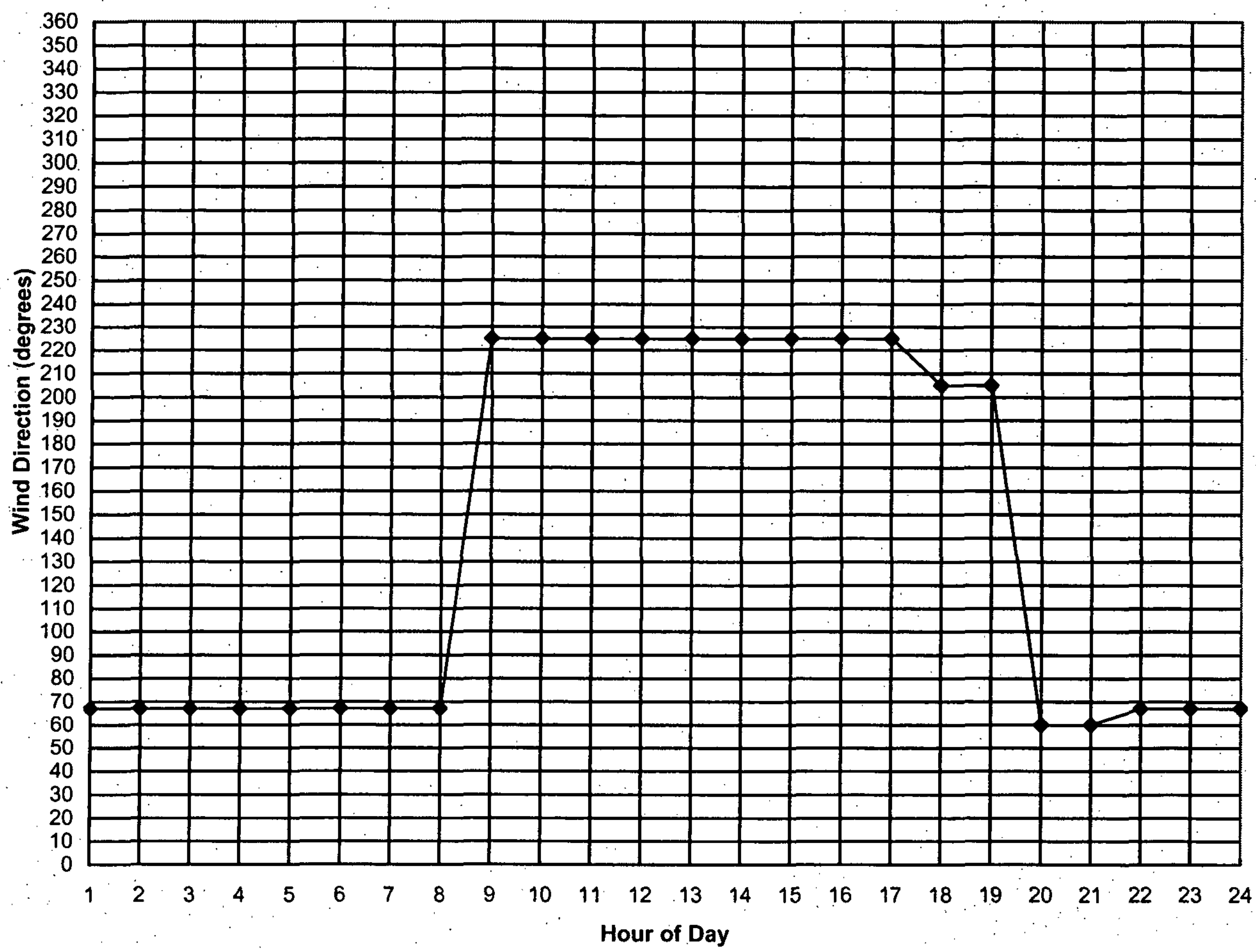
Figure 5. SSES 2005 ANNUAL WIND ROSE
10M LEVEL – DOWNRIVER TOWER

Figure 6. 2006 Diurnal Variation of Average Wind Speed
Primary Tower – 10 Meter Level



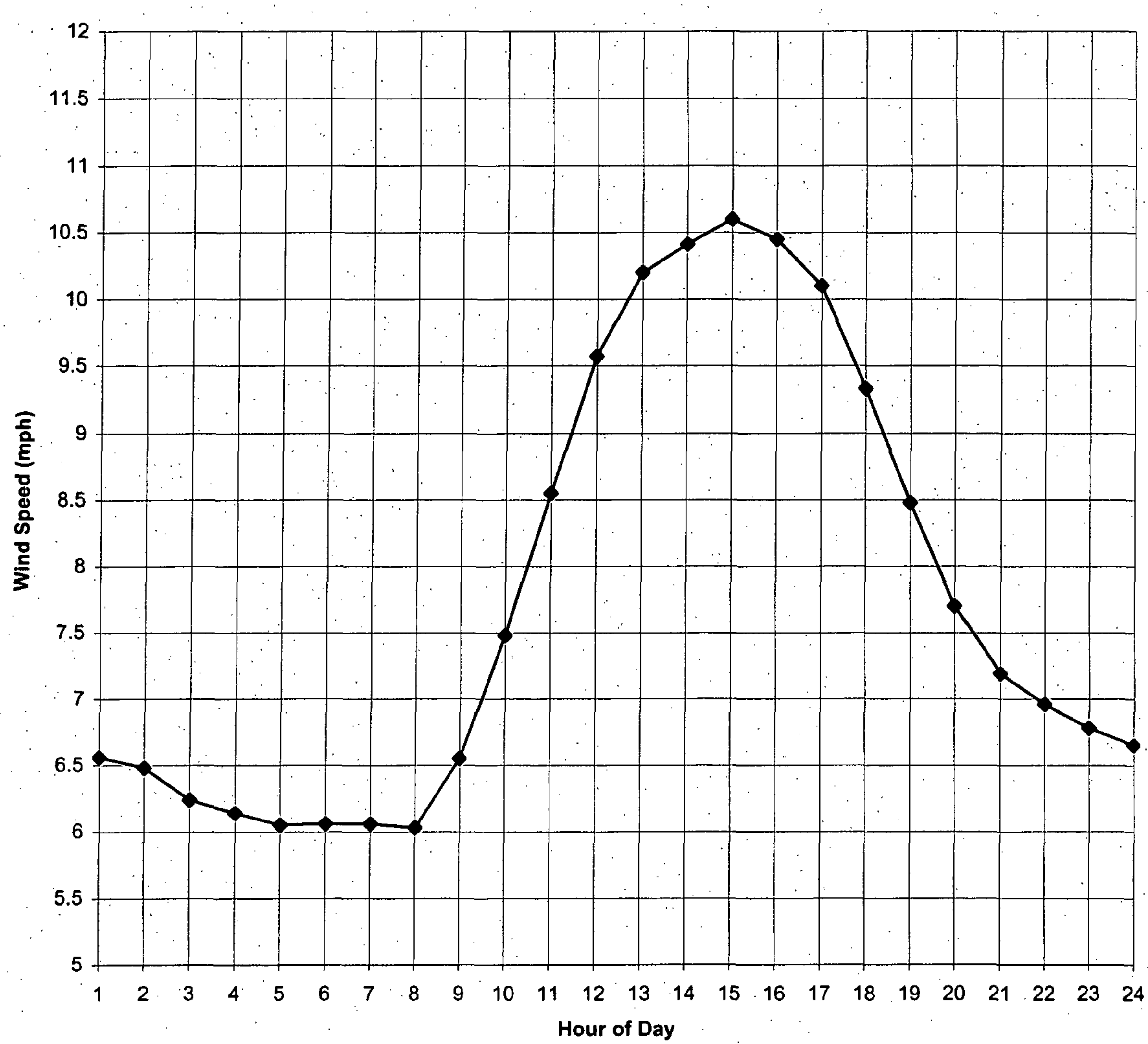
This plot shows how the wind speed varies with the time-of-day. Radiational heating during the day causes more mixing which makes for higher overall daytime wind speeds.

Figure 7. 2006 Diurnal Variation of Average Wind Direction
Primary Tower - 10 Meter Level



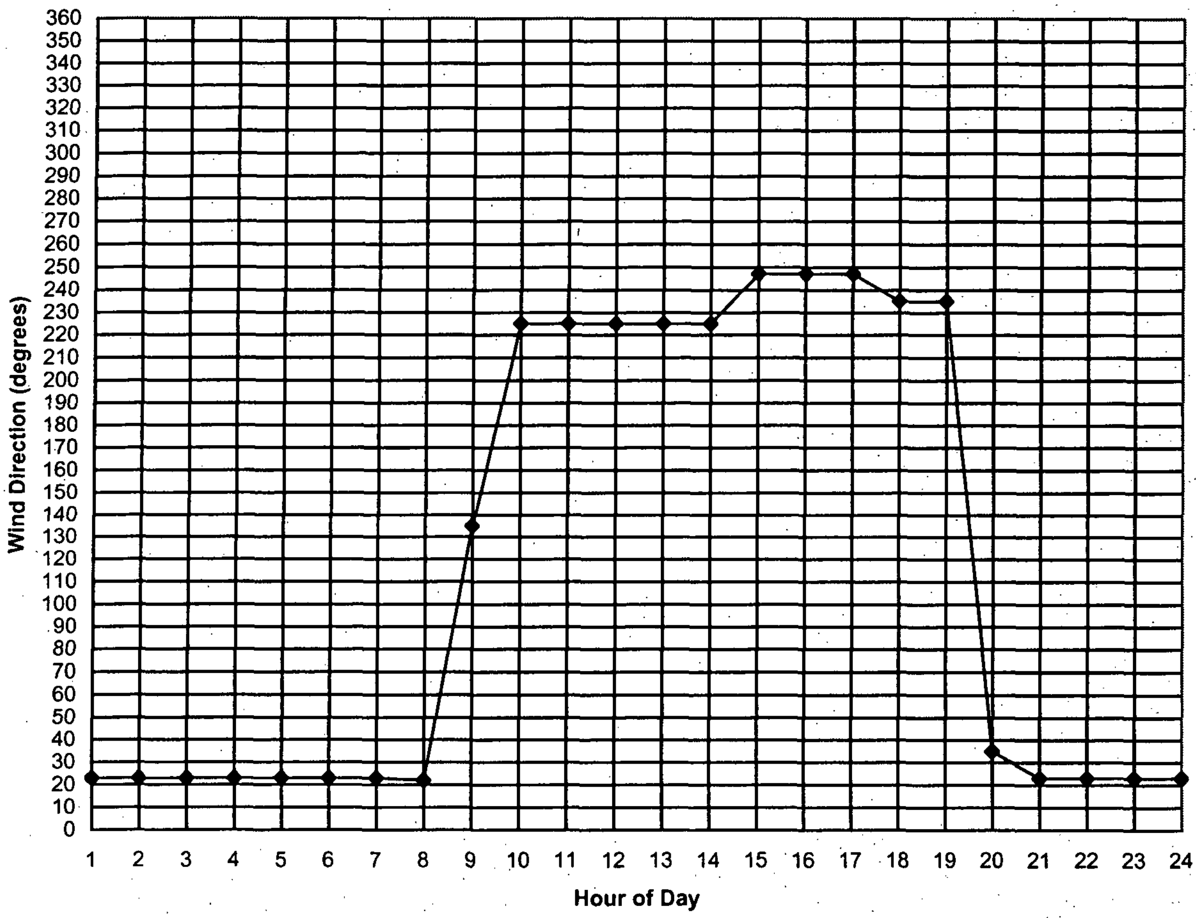
This plot shows the variation of wind direction with the time-of-day. This is primarily caused by the heating and subsequent cooling of the ground which promotes wind flow up and down the Susquehanna River valley.

Figure 8. 2006 Diurnal Variation of Average Wind Speed
Primary Tower- 60 Meter Level



This plot shows how the wind speed varies with the time-of-day. Radiational heating during the day causes more mixing which makes for higher overall daytime wind speeds.

Figure 9. 2006 Diurnal Variation of Average Wind Direction
Primary Tower - 60 Meter Level



This plot shows the variation of wind direction with the time-of-day. This is primarily caused by the heating and subsequent cooling of the ground that promotes wind flow up and down the Susquehanna River valley.

Figure 10a. 2006 Diurnal Variation of Average Ambient Temperature Primary Tower – 10 Meter Level

Figure 10b. 2006 Variation of Average Dew Point Temperature Primary Tower - 10 Meter level

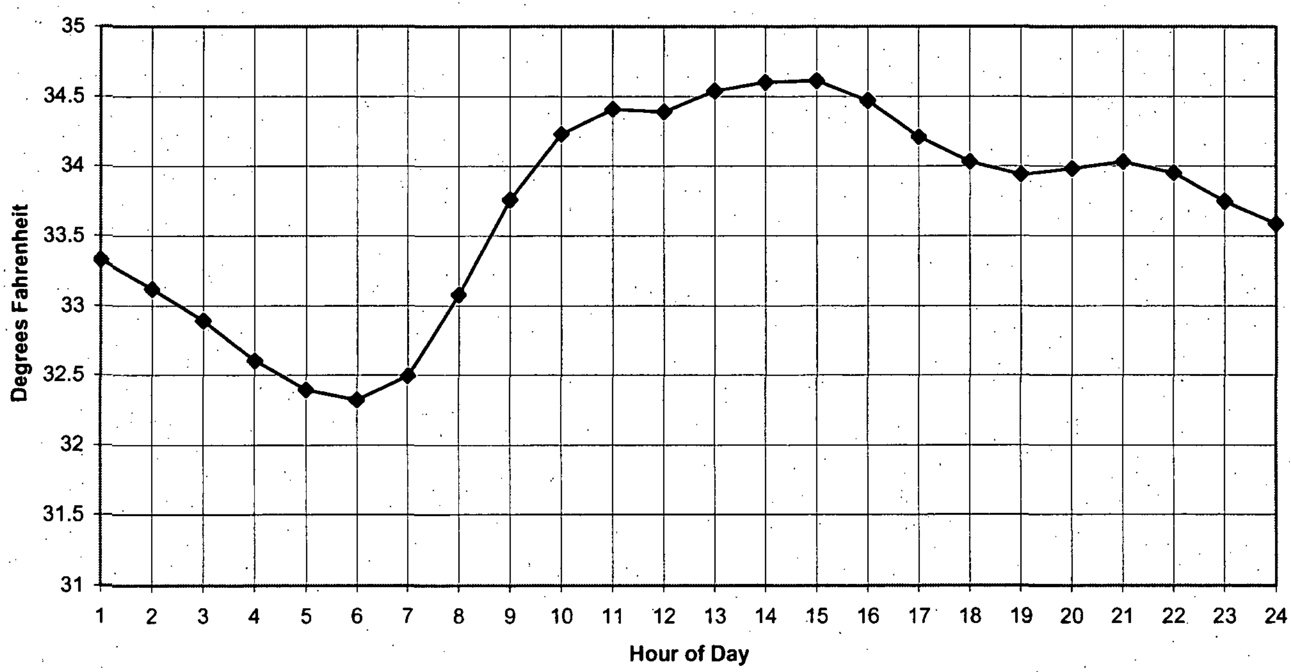


Figure 11a. 2006 Diurnal Varation of Average Temperature Downriver Tower - 10 Meter Level

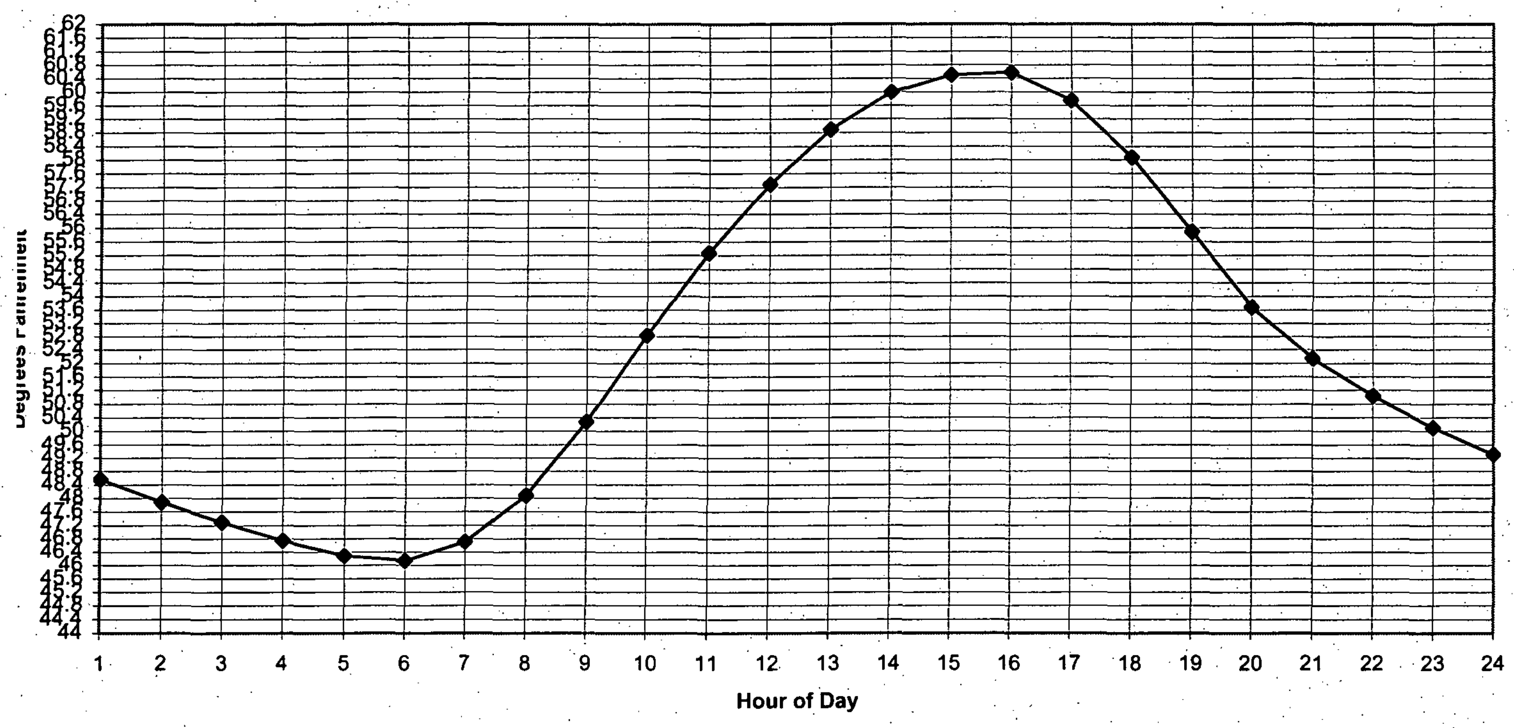


Figure 11b. 2006 Diurnal Variation of Average
Dew Point Temperature
Downriver Tower - 10 Meter Level

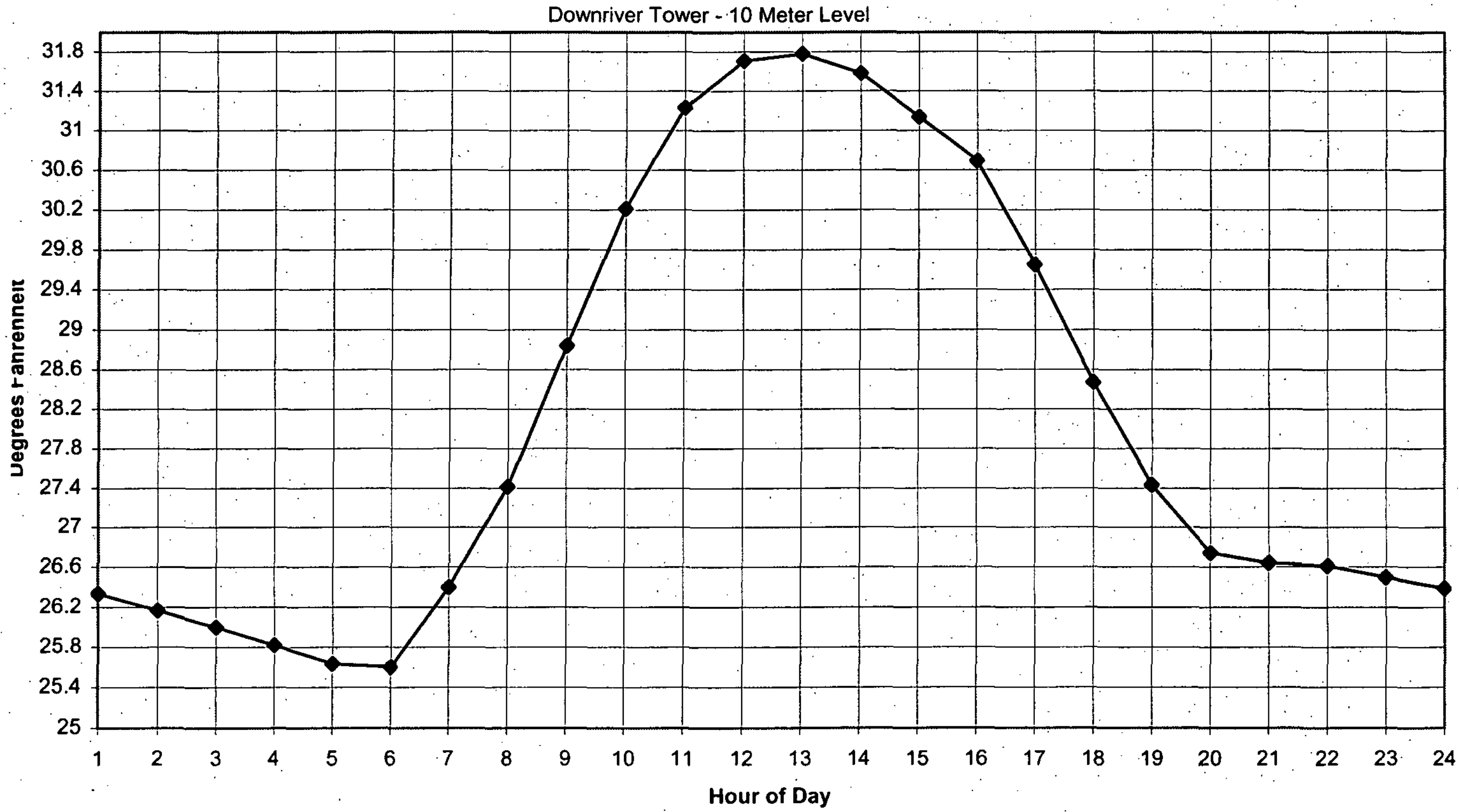
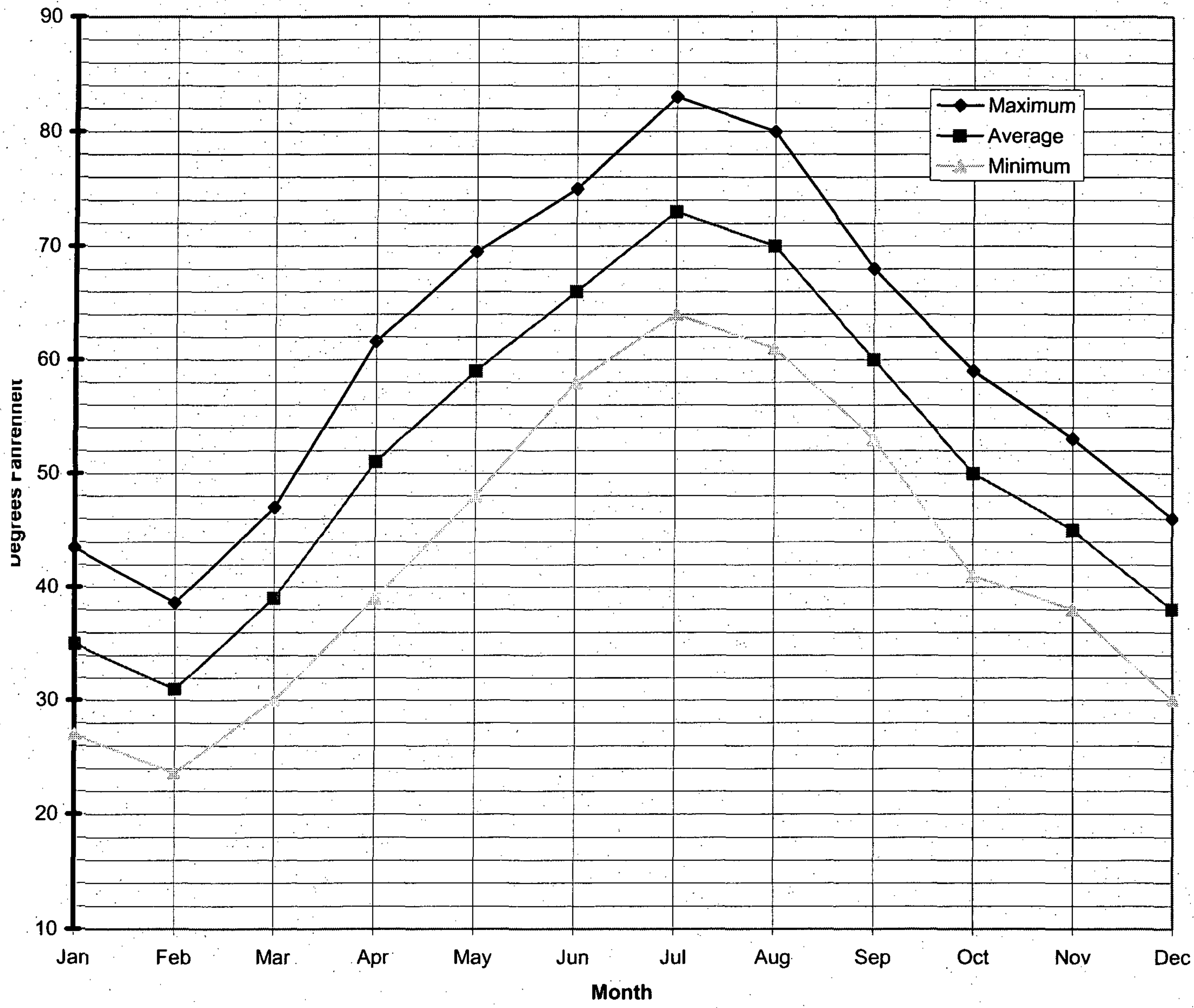
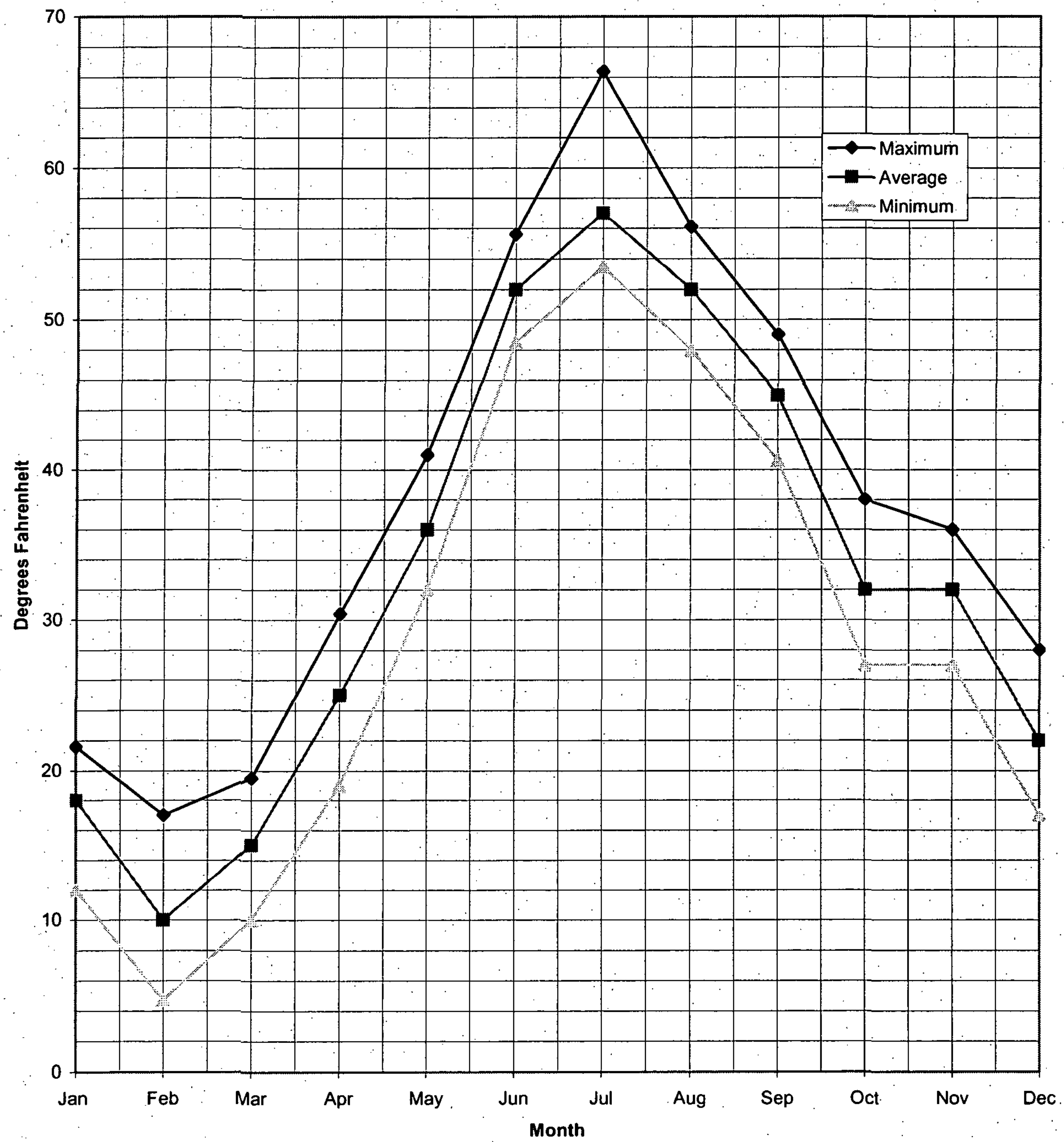


Figure 12. SSES 2006 Monthly Average of the Daily Maximum, Minimum and Average of 10M Ambient Temperature Primary Tower



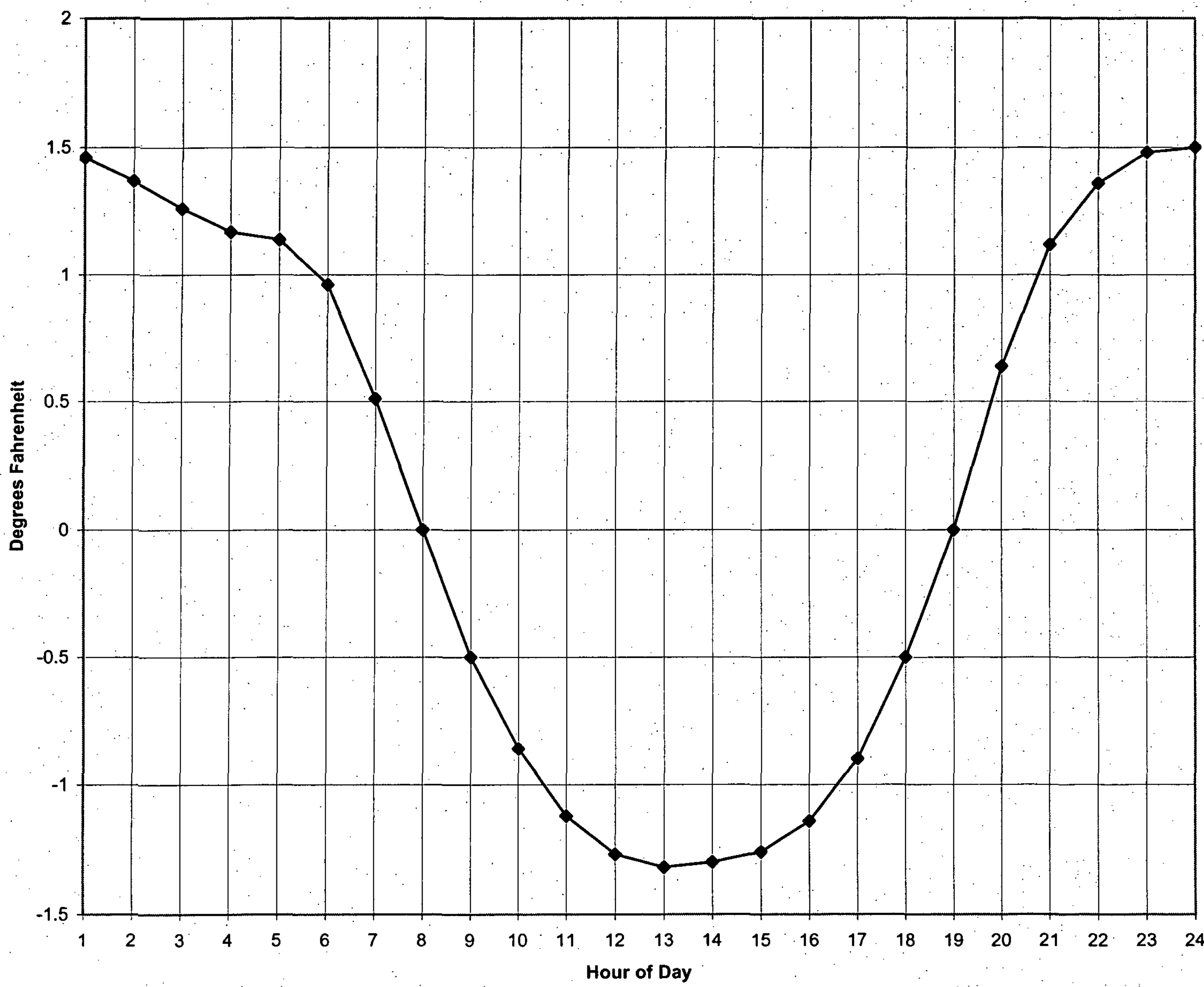
This plot shows the average of daily maximum and minimum ambient temperatures by month as well as the overall monthly average temperature.

Figure 13. SSES 2005 Monthly Average of the Daily Maximum, Minimum and Average of 10M Dew Point
Primary Tower



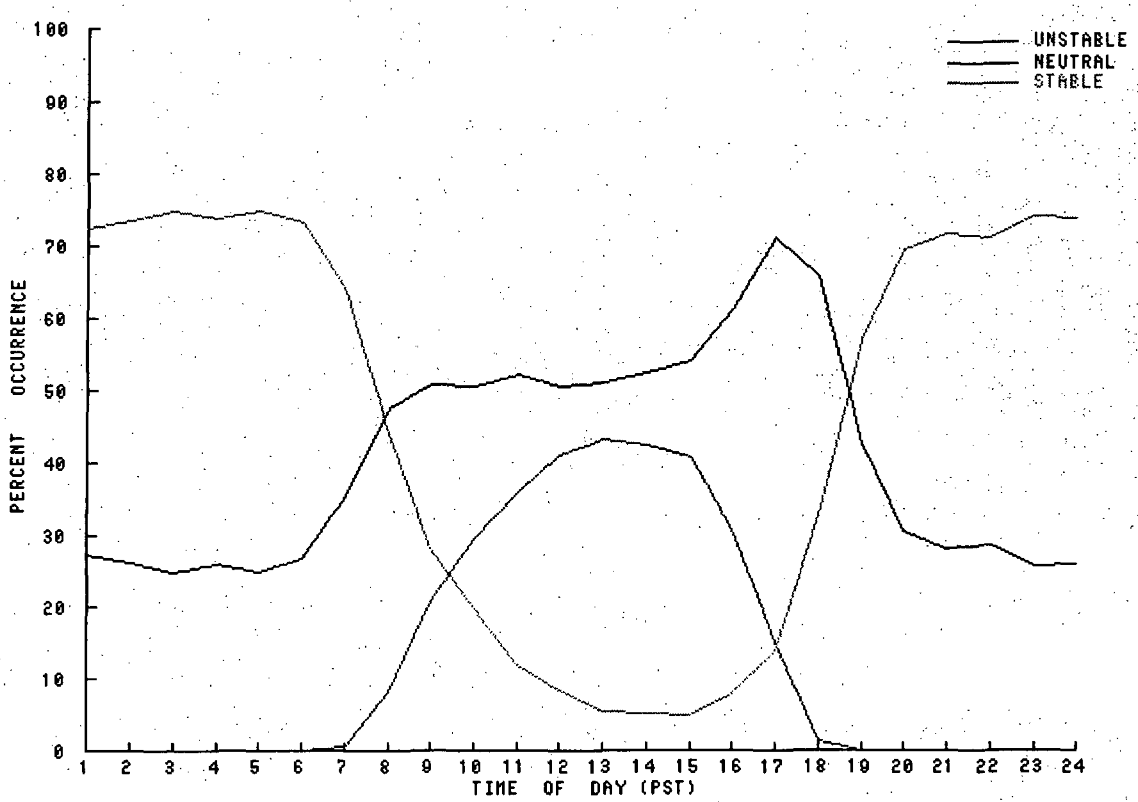
This plot shows the average of the daily maximum and minimum dew point temperatures by month as well as the overall monthly average dew point.

Figure 14. SSES 2006 Diurnal Variation of Average Delta Temperature Primary Tower 60-10M Level



This plot show the effects of daytime radiational heating causing negative delta temperatures and nighttime radiational cooling, resulting in a positive delta temperatures at night.

Figure 15. Percentage of Stability Category by Time-of-Day for 2006



Percent Occurrence of Unstable(A-C), Neutral(D) and
Stable(E-G) Stability Classes vs. Time of Day for 2006

FIGURE 16. LOCATION OF
METEOROLOGICAL TOWERS
SUSQUEHANNA STEAM ELECTRIC STATION

Figure 17. Interpolated Sector Average X/q Values (sec m3) at the EAB (2006)

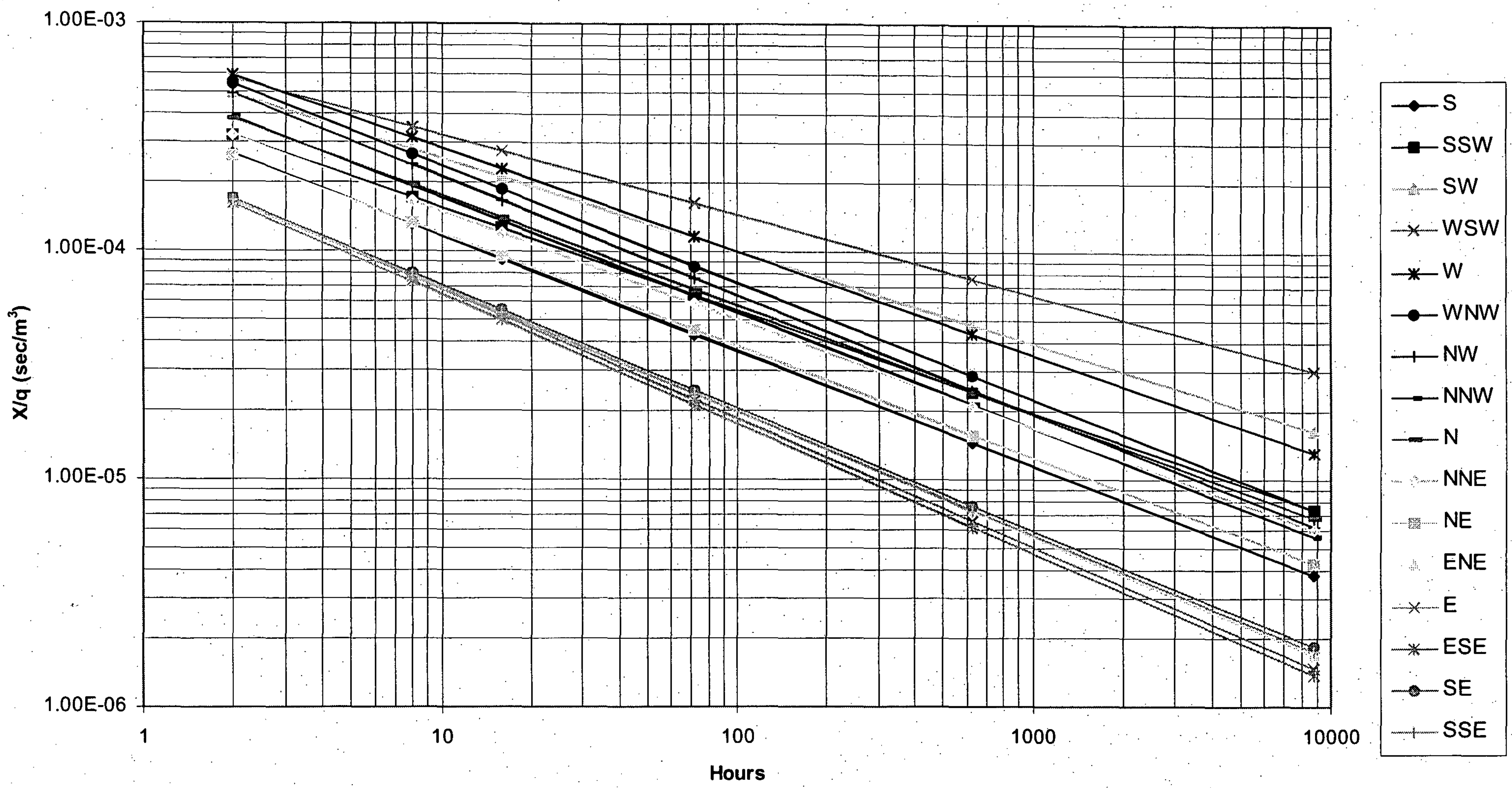


Figure 18. Interpolated Sector Average X/Q Values (sec/m3) at LPZ (2006)

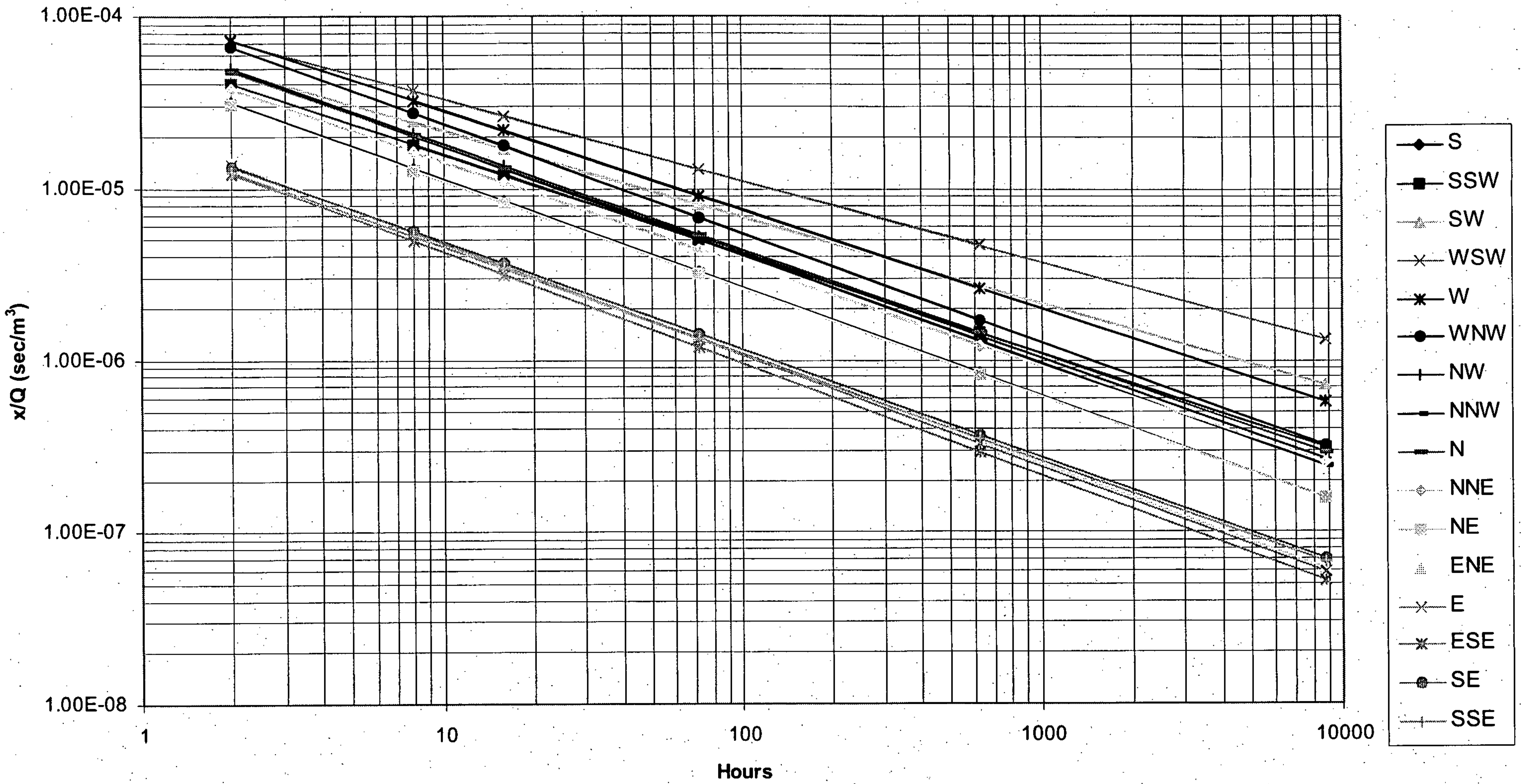


Figure 19. 5 Percent Overall Site X/Q Values for Exclusion Area Boundary, SSES 2006

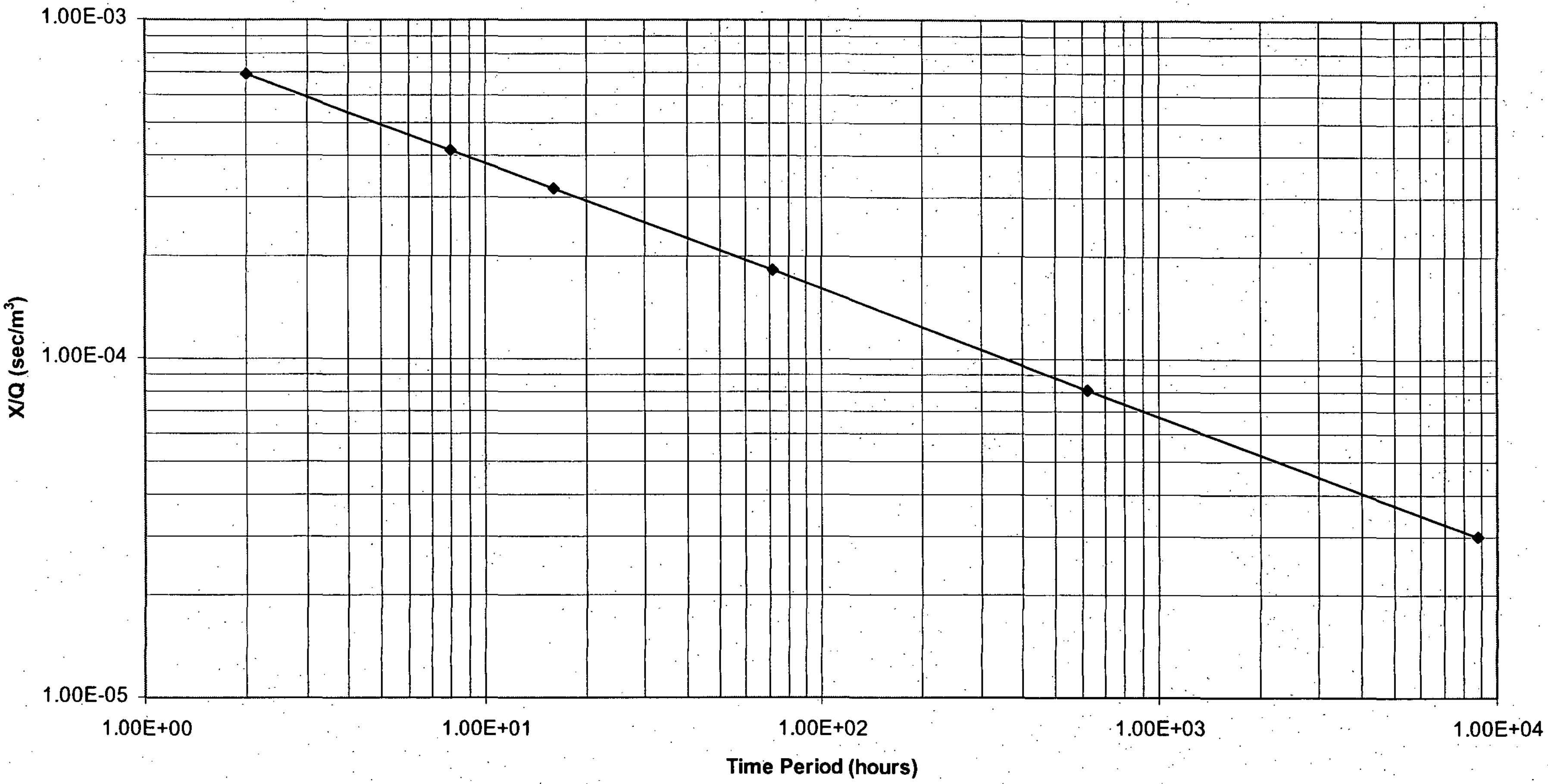
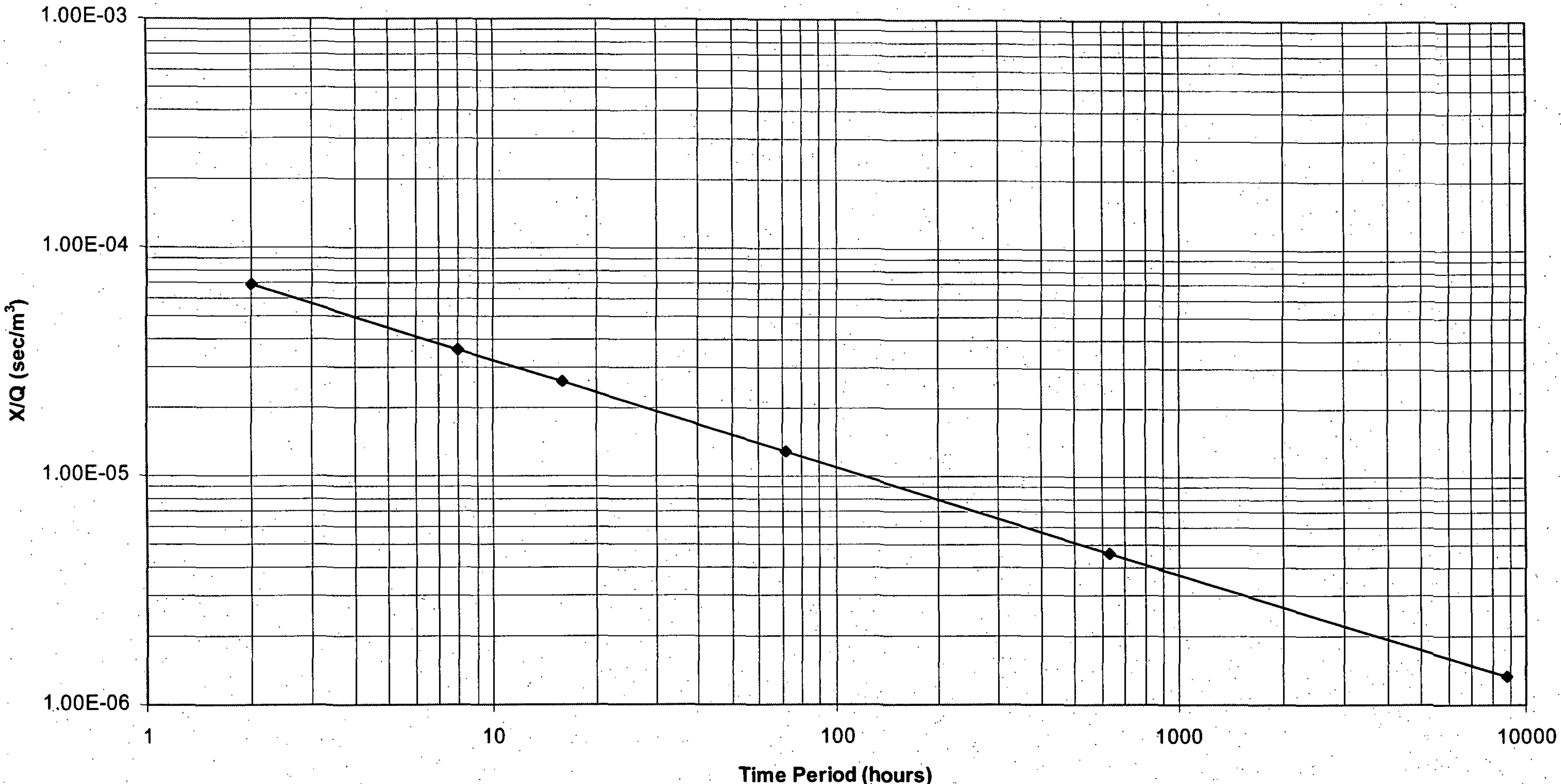


Figure 20. 5 Percent Overall Site X/Q Values for Low Population Zone, SSES 2006



APPENDIX A

SSES
METEOROLOGICAL INSTRUMENTATION
DESCRIPTION

APPENDIX A

SSES METEOROLOGICAL INTRUMENTATION DESCRIPTION

A. PRIMARY TOWER

- **Wind-Speed Sensor,** Climatronics Model 100075

Locations:	10m and 60m above surface
Threshold:	0.5 mph
Accuracy:	± percent or ±0.15 mph, whichever is greater
Sensing Technique:	Anemometer cup set attached to shaft and 30-hole photochopper assembly
Operating Range:	0 to 50 mph
Operating Temperature Range:	-40°F to +140°F
Distance Constant:	5 feet of air maximum

- **Wind-Direction Sensor**, Climatronics Model 100076

Locations:	10m and 60m above surface
Threshold:	0.5 mph
Accuracy:	±2°
Sensing Technique:	Vane attached to a shaft which is coupled to a precision low torque potentiometer
Damping Ratio:	0.4 at 10° initial angle of attack
Operating Range:	0 to 540°
Operating Temperature Range:	-40°F to +140°F
Distance Constant:	3.7 feet of air maximum

- **Standard Deviation Computer**, Climatronics Model 101035

Receives input from 10m and 60m wind direction. Sampling time is one second and computation time is 15 minutes.

Accuracy: ±2°

Operating Range: 0 to 100°

- **Motor Aspirated Temp/Dew-Point Shield**, Climatronics Model 100325

Locations: 60m above surface (two)
10m above surface (one)

Motor aspirated shield limits radiation errors to 0.2°F under maximum solar radiation

Aspiration Rate: 10 feet per second

Operating Temperature Range: -40°F to +130°F

- **Temperature Sensor**, Climatronics Model 100093

Locations: 10 m and 60 m above surface

Sensing element is a thermistor enclosed in a stainless steel sheath (use as a matched pair for 10-60m delta temperature)

Operating Range: -20°F to +100°F (-5°F to +5°F for delta temperature)

Accuracy: ±0.15°C (same for matched pairs)

Linearity: ±0.16°C (same for matched pairs)

Time Constant: 3.6 seconds in still air

- **Dew-Point Sensor**, Climatronics Model 101197

Location: 10m above surface

Sensor consists of bifilar gold electrodes wound on a lithium chloride impregnated wick.

Operating Range: -40°F to 100°F

Accuracy: ±0.5°C

- **Rain Gauge (Heated),** Climatronics Model 100097-1

A tipping bucket precipitation gauge (0.01 inches water/tip)

Location: near base of tower (approximately 650 feet MSL)

Accuracy: ±1.0 percent at 3 inches per hour

- **Analog Recording System**

Location: control room

Analog strip chart recorders for the various measured or computed parameters

- **Digital Data Acquisition System**, Campbell Scientific Model 21X

Location: base of tower

Digital recording system parallels the analog recorders

B. BACKUP TOWER

- **Wind-Speed Sensor**, Climatronics Model 100075

  Location: 10m above surface

  Specifications: same as for primary tower

- **Wind-Direction Sensor**, Climatronics Model 100076

  Location: 10m above surface

  Specifications: same as for primary tower

- **Standard Deviation Computer**, Climatronics Model 101035

  Accuracy: $\pm 2^\circ$

  Range: 0 to 100°

C. SUPPLEMENTAL TOWERS

- **Wind-Speed Sensor**, Weathertronics Model 2030

Location:	10m above surface

Threshold: 0.5 mph

Accuracy:	±0.15 mph or 1%
Sensing Technique:	photon coupled chopper
Operating Range:	0 to 100 mph
Response:	distance constant equals 5 feet of flow

- **Wind-Direction Sensor**, Weathertronics Model 2020

Location:	10m above surface
Threshold:	0.5 mph
Resolution:	less that 1.0°
Potentiometer Linearity:	0.5%
Damping ratio:	0.4
Range:	0 to 540°

- **Sigma Computer**, Weathetronics Model 1620

Input from 10-M wind direction transmitter

Accuracy:	±0.1% full scale
Range:	0 to 100 °
Samples/Period:	100

Temperature Probe, Weathertronics Model 4470

Location:	2m above surface
Sensing element:	platinum wire

Range: -50°C to +100°C

Time Constant: 15 seconds

Accuracy: ±0.3°C

- **Dew-Point Probe**, Weathertronics Model 5321

Location: 2m above surface

Probe consists of a bifilar, wound heating element over a cavity encasing a precision platinum temperature measuring sensor. The bifilar heater is wound over a fiberglass cloth which, is treated with lithium chloride salt solution.

Range: -50°C to 100°C

Accuracy: ±0.5°C over 0 to 50°C