2.3S Meteorology

2.3S.1 Regional Climatology

This subsection addresses various aspects of the climate in the site region and area in the vicinity of the STP 3 & 4 site. Subsection 2.3S.1.1 identifies data resources used to develop these descriptions. Subsection 2.3S.1.2 describes large-scale general climatic features and their relationship to conditions in the site area and vicinity.

Severe weather phenomena considered in the design and operating bases for STP 3 & 4 are discussed in Subsections 2.3S.1.3.1 through 2.3S.1.3.6. These subsections describe observed and/or probabilistic: extreme wind conditions; tornados and related wind and pressure characteristics; tropical cyclones and related effects; precipitation extremes; the frequency and magnitude of hail, snowstorms, and ice storms; and the frequency of thunderstorms and lightning.

Subsection 2.3S.1.4 discusses the long-term temperature and humidity characteristics used to evaluate the performance of the ultimate heat sink (UHS) for STP 3 & 4. Subsection 2.3S.1.5 provides design-basis dry- and wet-bulb temperature statistics representative of the site area to be considered in the design and operating bases of other safety- and nonsafety-related structures, systems, and components. Subsection 2.3S.1.6 characterizes conditions (from a climatological standpoint) in the site area and region that may be restrictive to atmospheric dispersion. Finally, trends in mean and extreme temperature, precipitation conditions, and the occurrences of severe weather events, are addressed in Subsection 2.3S.1.7 in the context of the site’s design bases.

The reference ABWR DCD Tier 1, Table 5.0 and Tier 2, Table 2.0-1, provide several climate-related site parameters on which the ABWR design is based, including extreme wind, tornado, precipitation (for roof design), and ambient design temperature. Site-specific characteristics which correspond to these site parameters are presented or addressed in Subsections 2.3S.1.3.1, 2.3S.1.3.2, 2.3S.1.3.4, and 2.3S.1.5, respectively. Table 2.0-2 compares the ABWR standard plant design parameters with the STP 3 & 4 characteristic values.

2.3S.1.1 Data Sources

Several sources of data are used to characterize regional climatological conditions pertinent to the site for STP 3 & 4. The primary sources of data used to characterize local meteorological and climatological conditions representative of the site for STP 3 & 4 include long-term summaries for the first-order National Weather Services (NWS) station at Victoria, Texas, and for 14 other nearby cooperative weather observing stations, as well as measurements from the onsite meteorological monitoring program operated in support of the existing STP 1 & 2. These climatological observing stations are in Matagorda, Wharton, Jackson, Calhoun, Brazoria, Victoria, Fort Bend and Aransas counties: all located in Texas. Table 2.3S-1 identifies the offsite observing stations and lists their approximate distance and direction from STP 3 & 4. Figure 2.3S-1 illustrates these station locations relative to the mid-point between the STP 3 & 4 reactors at the site.

The objective of selecting nearby, offsite climatological monitoring stations is to demonstrate that the mean and extreme values measured at those locations are reasonably representative of conditions that might be expected to be observed at the STP site. The 50-mile radius circle shown in Figure 2.3S-1 provides a relative indication of the distance between the climate observing stations and the STP site. However, a 50-kilometer (approximately 31-mile) grid spacing is considered to be a reasonable fine mesh grid in current regional climate modeling, so this distance was used as a nominal radius for the station selection process. The identification of stations to be included was based on the following general considerations:

- Proximity to the STP site (i.e., within the nominal 50-kilometer radius indicated above, to the extent practicable).
- Coverage in all directions surrounding the site (to the extent possible).
- Where more than one station exists for a given direction relative to the site, a station was chosen if it contributed one or more extreme conditions (e.g., rainfall, snowfall, maximum and/or minimum temperatures) for that general direction.

Nevertheless, if an overall extreme precipitation or temperature condition was identified for a station located within a reasonable distance beyond the nominal 50-kilometer radius and that extreme condition was considered to be reasonably representative of the site area, that station was also included, regardless of directional coverage.

Normals (i.e., 30-year averages), means, and extremes of temperature, rainfall, and snowfall are based on the following data sources found in References 2.3S-1 through 2.3S-5.

First-order NWS stations also record measurements, typically on an hourly basis, of other weather elements, including winds, several indicators of atmospheric moisture content (i.e., relative humidity, dew point, and wet-bulb temperatures), and barometric pressure, as well as other observations when those conditions occur (e.g., fog, thunderstorms). Victoria, Texas, NWS station is the closest first-order station with consecutive long-term data available. Although the Victoria weather station is located 53 miles to the west of the STP site (slightly longer than the distance defined by NUREG-0800 (Reference 2.3S-6) as “nearby”), the terrain between the STP site and the Victoria station is relatively flat. Additionally, the Victoria station is located at almost the same latitude as the STP site. Therefore, the long-term (30 years) data from the Victoria station was used to describe the general climatic conditions at the STP site. Table 2.3S-2, excerpted from the 2005 local climatological data (LCD) summary for the Victoria station, presents the long-term characteristics of these parameters.

In addition, data from References 2.3S-7 through 2.3S-17 was used in describing climatological characteristics of the STP 3 & 4 site area and region.

2.3S.1.2 General Climate

The STP site is located within the Coastal Prairie region, situated along the Coastal Plain that runs parallel to the Gulf of Mexico and extends from south central Texas to southwestern Louisiana (Reference 2.3S-1). The STP site area is relatively flat; elevation is generally 25 feet above MSL in this region.

The state of Texas is divided into 10 climate divisions. The STP 3 & 4 site is located within the Upper Coastal division, designated as Texas-08, which is situated south of East Texas, bordered by the state of Louisiana on the east, the Gulf of Mexico to the south, and Victoria and Calhoun Counties to the west (Reference 2.3S-17).

The general climate in this region is classified as maritime subtropical (or humid subtropical) and is characterized by mild, short winters; long periods of mild sunny weather in the autumn; somewhat more windy but mild weather in spring; and long, hot summers.

The regional climate is predominately influenced by the Azores high-pressure system (also known as the Azores High). Due to the clockwise circulation around the western extent of the Azores High, maritime tropical air mass characteristics prevail much of the year, especially during the summer with the establishment of the Bermuda High and the Gulf High. Collectively, these systems govern late spring and summer temperature and precipitation patterns. This macro-circulation feature also has an effect on the frequency of high air pollution potential in the STP site region. These characteristics and their relationship to the Bermuda High, especially during the summer and early autumn, are addressed in Subsection 2.3S.1.6.

The influence of this macro-scale circulation feature continues during the transitional seasons (spring and autumn) and winter months; however, it is occasionally disrupted by the passage of synoptic- and meso-scale weather systems. During winter, cold air masses may briefly intrude into the region with the cyclonic northerly flow that follows the passage of low-pressure systems. These systems frequently originate in the continental interior around Colorado or Canada, pick up moisture-laden air due to southwesterly through southeasterly airflow in advance of the system, and result in a variety of precipitation events that include rain, sleet, freezing rain, or mixtures, depending on the temperature characteristics of the weather system itself and the temperature of the underlying air (see Subsection 2.3S.1.3.5).

During the summer months, the Texas coastal sea breeze has a large influence on local and regional climatology near the STP site. The inland coastal plains of Texas heat rapidly during summer days causing a large temperature differential between the land and the relatively cooler Gulf of Mexico. The land/sea temperature contrast during the day creates circulation forming a sea breeze, where cooler, more saturated air pushes inland as the warm inland air rises. Also called the “gulf” breeze, it extends about 50 km inland throughout the day. During a sea breeze, cooler temperatures and higher relative humidity can be expected. The opposite occurs at night, where air over the inland plains cools rapidly while the air over the sea stays relatively warmer, thus forming a land breeze to push off-shore into the Gulf of Mexico.

Larger, persistent outbreaks of very cold, dry air associated with massive high-pressure systems that move southward out of Canada also occasionally affect the site region (Reference 2.3S-1). However, these weather conditions are moderated significantly by the Gulf of Mexico immediately to the south and due to heating as it passes over the land.

Monthly precipitation exhibits a cyclical pattern, with the predominant maximum occurring in May with 5.12 inches, and a secondary maximum in September with 5.00 inches (see Table 2.3S-2). Because the STP site is located close enough to the Gulf of Mexico (the distance, midpoint between Units 3 & 4 reactor buildings, is 14.67 miles), the strong winds associated with tropical cyclones can have a significant effect on the site area.

2.3S.1.3 Severe Weather

This subsection addresses severe weather phenomena that affect the STP site area and region and that are considered in the design and operating bases for STP 3 & 4. These phenomena include: observed and probabilistic extreme wind conditions (Subsection 2.3S.1.3.1); tornados and related wind and pressure characteristics (Subsection 2.3S.1.3.2); tropical cyclones and related effects (Subsection 2.3S.1.3.3); observed and probabilistic precipitation extremes (Subsection 2.3S.1.3.4); the frequency and magnitude of hail, snowstorms, and ice storms (Subsection 2.3S.1.3.5); and the frequencies of thunderstorms and lightning (Subsection 2.3S.1.3.6).

2.3S.1.3.1.1 Extreme Winds

To ensure that the design bases for SSCs important to safety include appropriate consideration for the most severe natural phenomena historically reported for the site and surrounding area, the design and operating bases wind loadings on plant structures were determined in accordance with the ASCE-SEI design standard, "Minimum Design Loads for Buildings and Other Structures," (Reference 2.3S-10). This is consistent with the guidance provided in NUREG-0800, Section 2.3.1 (Reference 2.3S-6).

Design wind loading is based on a basic wind speed, which is the "3-second gust speed at 33 feet (10 meters) above the ground in Exposure Category C," as defined in Sections 6.2 and 6.3 of Reference 2.3S-10. The basic wind speed for the STP 3 & 4 site is approximately 125 mph (201 km/h), based on a linear interpolation from the plot of basic wind speeds in Figure 6-1 of ASCE 2007 (Reference 2.3S-10) for that portion of the U.S. that includes the site for STP 3 & 4. From a probabilistic standpoint, a basic wind speed of 125 mph (201 km/h) for the STP 3 & 4 site is associated with a mean recurrence interval of 50 years. Section C6 (Table C6-7) of the ASCE-SEI design standard provides conversion factors for estimating 3-second-gust wind speeds for other recurrence intervals (Reference 2.3S-10). Based on this guidance, the 100-year return period value is determined by multiplying the 50-year return period value by a scaling factor of 1.07, which yields a 100-year return period 3 second-gust wind speed for the site of approximately 134 mph (215 km/h).

Three-second gust wind speed is always greater than the fastest mile wind speed. In the reference ABWR DCD, the listed extreme of 122 mph is the fastest mile wind speed. This corresponds to a 139 mph 3-second gust; therefore, the calculated 100-year fastest mile 3-second gust related to the reference ABWR DCD is not exceeded.

The reference ABWR DCD Tier 1, Table 5.0 and reference ABWR DCD Tier 2, Table 2.0-1 include the following site parameter values for Extreme Wind, for which the ABWR plant is designed:

- 177 km/h (110 mph) equivalent to 126 mph (3-second gust) - Basic Wind Speed, 50-year recurrence interval (for design of nonsafety-related structures only)
- 197 km/h (122 mph) equivalent to 139 mph (3-second gust) - 100-year recurrence interval (for design of safety-related structures only)

Using the data and the methodology recommended in Reference 2.3S-10, both the site-specific 50-year fastest mile basic wind speed and 100-year recurrence interval fastest mile wind for the STP 3 & 4 site are less than or equal to those specified in the reference ABWR.

The NOAA Coastal Services Center (CSC) Hurricane Track Query was also used to review the historical record of tropical cyclone tracks and intensities near the STP 3 & 4 site for the period from 1851 to the present. This review identified eleven tropical cyclones with wind speeds that exceed a design basis wind loading for the STP 3 & 4 site calculated in accordance with Reference 2.3S-10. The top five storms include: Not named 1886 (155 mph sustained wind speed); Not named 1900 (144 mph sustained wind speed); Not named 1932 (144 mph sustained wind speed); Not named 1945 (138 mph sustained wind speed); and Hurricane Carla 1961 (144 mph sustained wind speed). The maximum wind speeds are not measured by anemometers for these eleven storms and estimates are from other data. Additionally, CSC Hurricane Track Query is typically not used for the determination of design wind loading for buildings. However, as explained in Subsection 2.3S.1.3.3.2, Site Specific Design-Basis Hurricane, the STP site specific design-basis hurricane windspeed, which is listed in Table 2.0-2, was determined in accordance with Regulatory Guide 1.221 (Reference 2.3S-70).

Using the data and the methodology recommended in Reference 2.3S-10 to verify design basis wind loadings are less than or equal to those specified in the reference ABWR, without specific consideration of the CSC Hurricane Track Query data, satisfies the requirements of ASCE/SEI-7 (Reference 2.3S-10) and NUREG-0800 (Reference 2.3S-6). The ASCE/SEI-7 design standard wind speed map considered wind speeds of historically reported hurricanes and is updated periodically. However, as explained in Subsection 2.3S.1.3.1.2, STP Site Hurricane Wind Speed and Associated Missile Hazard, the STP 3 & 4 design incorporates the guidance provided in Regulatory Guide 1.221 for hurricane wind speed and the associated missile hazard. Therefore, appropriate consideration has been given to the most severe tropical cyclones and the consequences of these storms.

2.3S.1.3.1.2 STP Site Hurricane Wind Speed and Associated Missile Hazard

Regulatory Guide 1.221, "Design-Basis Hurricane and Hurricane Missiles for Nuclear Power Plants," (Reference 2.3S-70) provides guidance for selecting the design-basis hurricane windspeed and hurricane-generated missiles.

The STP 3 & 4 design incorporates the guidance provided in Regulatory Guide 1.221 by the inclusion of a Site Characteristic requirement in Table 2.0-2 for hurricane wind speed and the associated missile hazard. Subsection 2.3S.1.3.3.2, Site Specific Design-Basis Hurricane, describes how hurricane windspeed and hurricane missiles are addressed consistent with guidance provided in Regulatory Guide 1.221.

2.3S.1.3.2 Tornados

The design-basis tornado (DBT) characteristics applicable to structures, systems, and components important to safety include the following parameters as identified in Regulatory Guide (RG) 1.76,(Reference 2.3S-18).

Based on Figure 1 of RG 1.76, (Reference 2.3S-18), the STP site is located within Tornado Intensity Region II, but is directly adjacent to Tornado Intensity Region I. In determining the tornado intensity region applicable to the STP site, information in Revision 2 of NUREG/CR-4461 (Reference 2.3S-19), was taken into consideration. That document was the basis for most of the technical revisions to RG 1.76, (Reference 2.3S-18). Based on Rev. 1 of RG 1.76, (Reference 2.3S-18), the DBT characteristics for Tornado Intensity Region II applicable STP 3 & 4 site are:

- Maximum wind speed = 200 mph (89 m/sec)
- Translational speed = 40 mph (18 m/sec)
- Maximum rotational speed = 160 mph (72 m/sec)
- Radius of maximum rotational speed = 150 ft (45.7 m)
- Pressure drop = 0.9 pound per square inch (psi) (63 mb), and
- Rate of pressure drop = 0.4 psi/sec (25 mb/sec)

In the reference ABWR DCD Tier 1, Table 5.0 lists two tornado-related site parameters (i.e., maximum tornado wind speed and maximum pressure drop) and corresponding site parameter values. A complete list of tornado-related site parameters (consistent with the DBT parameters in RG 1.76, (Reference 2.3S-18) is given in the reference ABWR DCD Tier 2, Table 2.0-1, and includes the following site parameter values for which the ABWR plant is designed:

- Maximum tornado wind speed = 483 km/h (300 mph)
- Translational velocity = 97 km/h (60 mph)
- Maximum rotational speed = 386 km/h (240 mph)

- Radius = 45.7 m (150 ft)
- Maximum pressure drop = 13.827 kPaD (2.0 psi), and
- Rate of pressure drop = 8.277 kPa/sec (1.2 psi/sec)

The reference ABWR DCD DBT values bound the STP site-specific DBT values.

Tornadoes reported in the contiguous United States from 1950 through 2006 were used to determine tornado frequency (NCDC, Storm Events, http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms, accessed July 2007).

The STP site is located about N 28° 48’ (latitude) and W 96° 3' (longitude). Figure 1 of Regulatory Guide 1.76 uses the 2° boxes to classify tornado intensity regions for the contiguous United States. As a time saving alternative to account for number of tornadoes that occurred nearby the STP site, a circular area was used in order to be equivalent to the approach used by a data retrieval application developed by the National Severe Storms Laboratory (NSSL), called Severe Plot. (http://www.spc.noaa.gov/software/svrplot2). A circle with a 77.91 mile-radius centered at the STP site covers the same area as the 2° box. To be conservative, all tornadoes were included in this analysis for counties that are either totally or partially covered by the 77.91 mile-radius circle.

Based on the NCDC Storm Events database referenced above, there are 902 tornado occurrences within these counties. For tornadoes that occurred within the nearby counties, on a monthly basis, May and September had the highest frequencies. Among the 902 tornado counts, 153 (17%) occurred in May and 130 (14.4%) occurred in September. On seasonal basis, Fall had the highest count (34.2%) and Spring had the second highest count (31%).

2.3S.1.3.3.1 Tropical Cyclones

Tropical cyclones include not only hurricanes and tropical storms, but systems classified as tropical depressions, subtropical depressions, and extra-tropical storms, among others. This characterization considers all tropical cyclones (rather than systems classified only as hurricanes and tropical storms) because storm classifications are generally downgraded once landfall occurs and the system weakens, although they may still result in significant rainfall events as they travel through the site region.

National Oceanic and Atmospheric Administration’s (NOAA) Coastal Services Center provides a comprehensive historical database, extending from 1851 through 2006, of tropical cyclone tracks based on information compiled by the National Hurricane Center. This database indicates that a total of 76 tropical cyclone centers or storm tracks have passed within a 100-nautical-mile radius of the STP 3 & 4 site during this historical period (Reference 2.3S-12). Storm classifications and respective frequencies of occurrence over this 155-year period of record are as follows:

- Hurricanes – Category 5 (1), Category 4 (6), Category 3 (4), Category 2 (5), Category 1 (22)
- Tropical storms – 35
- Tropical depressions – 3
- Subtropical storms – 0
- Subtropical depressions – 0
- Extra-tropical storms – 0

Tropical cyclones within this 100-nautical-mile radius have occurred as early as June and as late as October, with the highest frequency (22 out of 76 events) recorded during September. August accounts for 19 events, indicating that almost 54% of the tropical cyclones that affect the site area occur from late summer to early autumn. Frequencies during the months of June and July are approximately equal to one another but approximately 30% lower than during the peak months of September and August; intensity levels are lower as well.

Hurricanes of all categories have passed within 100 nautical miles of the site during the month of September; 6 of these 10 occurrences were classified as Category 1 storms. The only Category 5 storm track within this radial distance was Hurricane Carla in September 1961. Twelve hurricanes have been recorded within 100 nautical miles of the site during August. While none of these reached Category 5 status, the distribution of other hurricane classifications indicates August as having higher intensities on a long-term climatological basis - that is, Category 4 (4), Category 3 (2), Category 2 (2), and Category 1 (4).

Only one-third of the individual NWS station 24-hour rainfall records were established as a result of precipitation associated with tropical cyclones that passed within a 100-nautical-mile radius of the STP site. In July 1979, tropical depression Claudette set 24-hour rainfall records at Freeport 2 NW (16.72 inches.) and Angleton 2 W (14.36 inches) cooperative weather stations (Reference 2.3S-2). In June 1960, a tropical depression that had not been named set 24-hour rainfall records at Danevang 1W (12.96 inches), Maurbro (14.80 inches) and Point Comfort (14.65 inches) cooperative weather stations (Reference 2.3S-2).

2.3S.1.3.3.2 Site Specific Design-Basis Hurricane

The STP site specific design-basis hurricane windspeed listed in Table 2.0-2 was determined in accordance with Regulatory Guide 1.221 (Reference 2.3S-70). The resulting hurricane generated missile spectrum was determined in accordance with Regulatory Guide 1.221 as described in Subsection 3H.11.

2.3S.1.3.4 Precipitation Extremes

Because precipitation is a point measurement, mean and extreme statistics, such as individual storm totals, or daily totals, or cumulative monthly totals, typically vary from station to station. Assessing the variability of precipitation means and extremes over the STP site area, in an effort to evaluate whether the available long-term data is representative of conditions at the site, is largely dependent on station coverage. Monthly and daily historical precipitation extremes for rainfall and snowfall are presented in Table 2.3S-3 for the nearby climatological observing stations.

The highest 24-hour rainfall total in the site area, 20.85 inches, on October 19, 1983, at the Bay City Waterworks cooperative weather observing station (Reference 2.3S-57), approximately 13 miles NNE of the STP site, was not associated with a tropical cyclone originating in or passing through the Gulf of Mexico. This extreme rainfall event was one of many over southeast Texas caused by a synoptic situation that included a steady stream of tropical moisture into the region, and a slow moving frontal boundary that provided a source of lift and supported widespread and continual thunderstorm development (Reference 2.3S-59).

The highest monthly rainfall total for the site area, 31.61 inches during September 1979, was recorded at the Freeport 2NW cooperative observing station, located approximately 43 miles ENE of the STP site. There does not appear to be any clear relationship between the rainfall recorded during extreme events, whether on a 24-hour or monthly basis, and distance inland within the area considered around the STP site (see Figure 2.3S-1). Therefore, based on the range of the maximum recorded 24-hour and monthly rainfall totals among these stations, the areal distribution of these climatological observing stations around the site, and their proximity to the site, the data suggests that rainfall extremes close to the upper limits of the respective maxima might reasonably be expected to occur at the STP site.

Although the disruptive effects of any winter storm accompanied by frozen precipitation can be significant in South Texas, storms that produce large measurable amounts of snow are rare. As Table 2.3S-3 indicates, 24-hour and monthly total station records have been established over a number of years based on the available periods of record. The most recent event, the Christmas Storm of 2004, was responsible for the overall highest 24-hour and monthly totals recorded for the site area - 10.5 inches, in both cases – measured at the Danevang 1W observing station, approximately 20 miles NNW of the STP site (Reference 2.3S-5).

Assessing normal and extreme winter precipitation loads on the roofs of seismic category I structures considers these climate-related components:

- The normal winter precipitation event, which is defined as the highest ground-level weight (in lb/ft^2) among (1) the 100-year return period snowpack, (2) the historical maximum snowpack, (3) the 100-year return period snowfall event, or (4) the historical maximum snowfall event in the site region.
- The extreme frozen winter precipitation event, which is defined as the higher ground-level weight (in lb/ft^2) between (1) the 100-year return period snowfall event and (2) the historical maximum snowfall event in the site region.
- The extreme liquid winter precipitation event, which is defined as the theoretically greatest depth of precipitation (in inches of water) for a 48-hour period that is

physically possible over a 25.9-square-kilometer (10-square-mile) area at a particular geographical location during those months with the historically highest snowpacks.

From a probabilistic standpoint, the estimated weight of the 100-year return period ground-level snowpack for the STP site area is 0 lb/ft, as determined in accordance with the guidance in Section C7.0 of the ASCE-SEI design standard, “Minimum Design Loads for Buildings and Other Structures” (Reference 2.3S-10).

Due to temperatures at the surface, the site region is not favorable for snowpack accumulation. In addition, there are not enough available snow observations to calculate a 100-year return snowfall. Therefore, the weight of the historic maximum snowfall event, 10.5 inches at the Danevang 1 W station (Table 2.3S-3), would represent both the normal winter precipitation event and the extreme frozen winter precipitation event. To convert the historical maximum snowfall into a snow load, the following formula was used:

$$L = S \times 5.2$$

Where:

- S is the liquid equivalent (in inches) associated with the maximum snowfall event. Reference 2 presents the observed snowfall at Danevang 1 W station (12/25/2004) of 10.5" and the observed equivalent liquid precipitation of 1.05".
- 5.2 is the weight of one inch of water in lb/ft^2

Thus, the weight of the normal winter precipitation and extreme frozen winter precipitation would both be

$$L = 1.05 \times 5.2 = 5.5 \text{ lb/ft}^2$$

The extreme liquid water precipitation [Probable Maximum Winter Precipitation (PMWP)] event at the STP site was determined to be 34.0 inches. The 48-hour PMWP event is derived through logarithmic interpolation of the 48-hour precipitation value from the 6-hr, 24-hr, and 72-hr PMWP values in Hydrometeorological Report No. 53 (Reference 2.3S-11).

The 48-hour PMWP value for evaluating extreme live loads is derived from plots of 6-, 24- and 72-hour, 10-square mile area, monthly probable maximum precipitation (PMP) estimates as presented in NUREG/CR-1486 (Reference 2.3S-11). Based on this information, the month of December represents the worst-case (highest) PMP value, in the STP site area, during the winter season in the 6-hour illustration. The months of January and February represent the worst-case PMP values during the winter season in the 24-hour and 72-hour illustrations. The values for the 6-, 24-, and 72-hour PMP values are 17, 28, and 36 inches, respectively. The 48-hour PMWP value, estimated by logarithmic interpolation on the curve defined by the 6-, 24-, and

72-hour PMP values is 34.0 inches liquid depth. The weight of this 34.0 inches of water is approximately 177 lbs/ft^2.

To account for the worst case freezing precipitation that could occur in combination with the worst case 48-hour PMWP, the weight of the maximum snowfall value is converted to a liquid water equivalent. The maximum snowfall event (10.5 inches), mentioned above, is equal to 1.05 inches of liquid precipitation with a corresponding weight of approximately 5.5 lbs / ft^2.

The appropriate combination of freezing precipitation and subsequent liquid precipitation (rainfall) is a factor in determining the structural loading conditions for roof design. The standard ABWR Seismic Category I structures have roofs without parapets, or parapets with scuppers to supplement roof drains so that large inventories of water cannot accumulate. Appendix 3H.6 states that the roof structure of the site-specific Seismic Category I structures (e.g., reactor service water pump houses) are designed without parapets so that excessive ponding of water cannot occur. Therefore, the combination of the worst case freezing precipitation and the 48-hour PMWP will not result in an increase in the roof design loading and therefore will not affect the design of these structures.

2.3S.1.3.5 Hail, Snowstorms, and Ice Storms

Frozen precipitation in the STP site area typically occurs in the form of hail, snow, sleet, and freezing rain. The frequency of occurrence of these types of weather events is based on the following two references: 1) the latest version of The Climate Atlas of the United States (Reference 2.3S-13), which has been developed from observations made over the 30-year period of record from 1961 to 1990, and 2) the storm events for Texas (Reference 2.3S-14) based on observations for the period January 1950 to March 2007.

Though hail can occur at any time of the year, and is associated with well-developed thunderstorms, it is observed primarily during the spring and early summer months and least often during the late summer and autumn months. The Climate Atlas of the United States (Reference 2.3S-13) indicates that Matagorda County can expect on average, hail with diameter 0.75 inch or greater one day per year. The adjacent counties of Calhoun, Jackson, Wharton, and Brazoria can also expect hail with diameter 0.75 inch or approximately 1 day per year on average. The occurrence of hailstorms with hail greater than or equal to 1.0 inch in diameter averages less than one day per year in Matagorda County and also in the adjacent counties (Reference 2.3S-13).

NCDC cautions that hailstorm events are point observations and somewhat dependent on population density. Hailstorm events within Matagorda and surrounding counties have generally reported the maximum hail stone diameters between 2.0 and 4.5 inches. The maximum diameter of hail observed in Matagorda County was approximately 2 inches, approximately nine miles south-southeast of the STP 3 & 4. Hailstones having a diameter of approximately 2.5 inches have been reported in Pearland, Texas (Brazoria County), approximately 61 miles northeast of STP 3 & 4. Several nearby counties have reported hail measuring approximately 2.75 inches in diameter. These locations include Granado, Texas (Jackson County), Arcola, Texas

(Fort Bend County), and Victoria, Texas (Victoria County), which are 33 miles west, 61 miles northeast, and 52 miles west, respectively, from the STP 3 & 4 site. In terms of extreme hailstorm events, the NCDC publication Storm Data indicates that grapefruit size hail (approximately 4.5 inches in diameter) was observed on two occasions at two different locations in the general STP site area, on April 11, 1995, in Calhoun, Texas, in Calhoun County approximately 67 miles north-northwest of the STP site and June 20, 1996 in Egypt, Texas, in Wharton County, approximately 43 miles north-northwest of the STP site (Reference 2.3S-14).

From central Texas southward, most winters bring no accumulation of snowfall. Freak snowstorms occur only once every few decades, but no corner of the state is immune (Reference 2.3S-22). Snow forms if the air temperature in a cloud is below freezing. The water vapor in the cloud turns to ice and tiny ice crystals stick together until they form snowflakes. As the snowflake falls through the cloud, the crystal continues to grow by picking up more water vapor. When they get heavy enough to fall, they drop out of the clouds. If the air temperature on the way down to the ground remains below freezing, then the snowflakes will fall without melting and so fall as snow.

Any accumulation of snow is a rare occurrence on the Upper Coastal division within the Coastal Prairie region where the STP site is located, with normal annual totals at all observing stations averaging less than 0.5 inch. Historical records for the area (see Table 2.3S-3) indicate that maximum 24-hour and monthly snowfalls have occurred during the months of November, December, January, and February (see Table 2.3S-2). The greatest snowfall on record in the STP area was measured at the Danevang 1W weather observing station located 20 miles north-northwest of the STP site. 24-hour and monthly total station records of 10.5 inches were recorded during the Christmas Storm of 2004 (Reference 2.3S-14). Additional details of maximum 24-hour and cumulative monthly record snowfall totals are given in Subsection 2.3S.1.3.4 and Tables 2.3S-3 and 2.3S-5.

Depending on the temperature characteristics of the air mass, snow events are often accompanied by or alternate between sleet and freezing rain (ice). In most cases, freezing rain results from the process of warm moist air "overrunning" colder air. Freezing rain is caused by rain falling into a relatively shallow layer of cold air with temperatures either at or just below the freezing point (Reference 2.3S-23). Arctic air masses that reach the Upper Coastal division in the winter season are typically very shallow and have been known to produce ice storms. According to the Climatic Atlas (Reference 2.3S-13), freezing precipitation occurs only approximately 2.5 to 5.4 days per year at the STP Site.

An ice storm occurred January 12 - 13, 1997, and impacted the Texas counties of Matagorda, Brazoria, Fort Bend, Jackson, and Wharton. Trees, power lines and roadways were all affected. The weight of the ice caused trees and power lines to fall. Estimated damage was set at $800,000. Another reported winter weather event with sleet, snow and rain mix impacted the counties of Victoria and Calhoun on December 8, 2006. Light ice accumulations were reported on roadways. Widespread ice accumulation on roads, bridges, and the roofing of general structures was reported on

January 16 - 17, 2007, in nearby Fort Bend and Wharton counties. Property damage was reported to be estimated at $51,000 (Reference 2.3S-14).

Dust and sand storms are short-term meteorological conditions and there have been no reported records of probable annual frequency of dust storms at the STP site area.

2.3S.1.3.6 Thunderstorms and Lightning

Thunderstorms can occur in the STP 3 & 4 site area at any time during the year. According to a 43-year period of record, Victoria, Texas, averages approximately 56 thunderstorm-days (i.e., days on which thunder is heard at an observing station) per year. On average, August has the highest monthly frequency of occurrence — approximately 9.7 days. Annually, nearly 45% of thunderstorm-days are recorded during July, August, and September. From November through February, a thunderstorm might be expected to occur approximately one to two days per month (Reference 2.3S-1).

The mean frequency of lightning strokes to earth can be estimated using a method attributed to the Electric Power Research Institute, as reported by the U.S. Department of Agriculture Rural Utilities Service in the 1998 publication titled “Summary of Items of Engineering Interest” (Reference 2.3S-24). This methodology assumes a relationship between the average number of thunderstorm-days per year (T) and the number of lightning strokes to earth per square mile per year (N), where:

$N = 0.31T$

Based on the average number of thunderstorm-days per year at Victoria (i.e., 56; see Table 2.3S-2) the frequency of lightning strokes to earth per square mile is approximately 17 per year for the site area. This frequency is similar to the mean of the 10 year (1989 to 1999) cloud-to-ground flash density for the area that includes the site for STP 3 & 4, as reported by the NWS, of approximately 7 flashes/km/year or 18 flashes/mi^2/year (Reference 2.3S-25).

2.3S.1.4 Meteorological Data for Evaluating the Ultimate Heat Sink

As discussed in Subsection 9.2.5, each UHS water storage basin is located partially below grade and is sized for a water volume sufficient to meet the cooling requirements for 30 days following a design basis accident with no makeup water and without exceeding the design basis temperature and chemistry limits. The primary makeup water source is well water, and the backup source is water from the 7000-acre Main Cooling Reservoir (MCR). Makeup water to the MCR is provided from the Colorado River using the existing makeup water system.

Each reactor has a safety-related Reactor Service Water (RSW) system available during all modes of system operation to provide cooling water to the Reactor Building Cooling Water (RCW) system heat exchangers located in the Control Building. Each unit has a counterflow mechanically induced draft cooling tower with six cooling tower cells, of which two cells are dedicated to each of the three RSW divisions to remove heat from their respective RCW/RSW division.

The UHS thermal performance, design meteorology, conditions that maximize water temperature, and conditions that maximize water usage are presented in FSAR subsection 9.2.5.5 and in Tables 9.2-23a and 9.2-23b. The meteorological data presented in the Tables was developed in accordance with the requirements of Regulatory Guide 1.27, Revision 2 using 45 years of hourly surface weather data from Victoria, Texas. The weather data was analyzed to determine the highest average dry bulb temperature, highest average wet bulb temperature and highest average evaporation potential for 30 consecutive day and 1 day periods using a running average. The evaporation potential is the difference between the moisture content of saturated air at the dry bulb temperature minus the actual moisture content of the air. The UHS thermal performance analysis was then performed using the 3 sets of processed meteorological data with the highest average wet bulb temperature, highest average dry bulb temperature, and highest average evaporation potential as different cases. The results were then evaluated to determine maximum evaporation (30 day data sets) and maximum basin water temperature (1 day data sets). The meteorological conditions summarized in Tables 9.2-23a and 9.2-23b represent the worst-case for evaporation and temperature, respectively.

An evaluation was also performed using a recent 18-year period of sequential data for Palacios, Texas, to determine the effect on UHS performance for comparison to performance using the Victoria data. The results of the evaluation are discussed in Subsection 9.2.5.5.

2.3S.1.5 Design Basis Dry- and Wet-Bulb Temperatures

Long-term, engineering-related climatological data summaries, prepared by the ASHRAE from observations at the nearby Palacios Municipal Airport (Reference 2.3S-9), are used to characterize design basis dry- and wet-bulb temperature conditions representative of the site for STP 3 & 4. These characteristics include:

- Maximum ambient threshold dry-bulb temperatures at annual exceedance probabilities of 2.0%, 1.0%, and 0.4%, along with the mean coincident wet-bulb (MCWB) temperatures at those values.
- Minimum ambient threshold dry-bulb temperatures at annual exceedance probabilities of 99.0 and 99.6%.
- Maximum ambient threshold wet-bulb temperatures at annual exceedance probabilities of 2.0%, 1.0%, and 0.4% (noncoincident).

Based on the 15-year period of record from 1987 to 2001 for Palacios, the maximum dry-bulb temperature with a 2.0% annual exceedance probability is 90.2°F (32.3°C), with a MCWB temperature of 79.2°F (26.2°C). The maximum dry-bulb temperature with a 1.0% annual exceedance probability is 91.0°F (32.8°C), with a corresponding MCWB temperature value of 79.3°F (26.3°C). The maximum dry-bulb temperature with a 0.4% annual exceedance probability is 92.2°F (33.4°C), with a corresponding MCWB temperature value of 79.5°F (26.4°C) (Reference 2.3S-9).

For the same period of record, the minimum dry-bulb temperatures with 99.6 and 99.0% annual exceedance probabilities are 31.7°F (-0.2°C) and 35.8°F (2.1°C), respectively (Reference 2.3S-9).

The maximum wet-bulb temperatures with 2.0%, 1.0%, and 0.4% annual exceedance probabilities (noncoincident) are 80.5°F (26.9°C), 81.2°F (27.3°C), and 81.9°F (27.7°C), respectively (Reference 2.3S-9).

The data summaries from which the preceding statistical values were obtained do not include values that represent return intervals of 100 years. Maximum dry-bulb, minimum dry-bulb, and maximum wet-bulb temperatures corresponding to a 100-year return period were derived through linear regression using individual daily maximum and minimum dry-bulb temperatures and maximum daily wet-bulb temperatures recorded over a 30-year period, from 1971 to 2000, at the Victoria, Texas, NWS station (References 2.3S-7 and 2.3S-8). Because the 100-year return period dry-bulb temperature values are extrapolated from a regression curve, no corresponding MCWB temperatures are available for this return interval.

Based on the linear regression analyses of the Victoria data sets for a 100-year return period, the 0% exceedance dry-bulb temperature is estimated to be 111.3°F (44°C). The minimum dry-bulb temperature is estimated to be approximately 3.6°F (-15.8°C), and the maximum wet-bulb temperature is estimated to be 86.1°F (30°C).

The maximum and minimum recorded dry-bulb and maximum recorded wet-bulb temperatures as well as the corresponding 100-year return period values are considered. The higher of either the maximum recorded value or the 100-year return period value for either Victoria or Palacios are then determined in order to compare with the ABWR standard plant design parameters. This approach meets the requirements of 10CFR 52.79(a)(1)(iii).

Palacios is located about 13 miles WSW of the proposed site. Unlike Victoria, 30 years of the meteorological data are not available from Palacios; therefore, a shorter period of meteorological data was used to estimate the 100-year return period values. Using the 20-year (1998-2007) Palacios hourly data set (References 2.3S-60 through 2.3S-68), the maximum recorded dry-bulb and coincident wet-bulb temperatures are 106°F and 77.8°F, respectively. The maximum recorded non-coincident wet-bulb temperature was 86.1°F.

Additionally, using a linear regression analysis, the 100-year return period maximum drybulb temperature was estimated to be 108.1°F. The 100-year return period non-coincident wet-bulb temperature was estimated to be 88.3°F. This value is slightly higher than the Victoria 100-year return period non-coincident wet-bulb temperature of 86.1°F. This is expected as Palacios is located closer to the Gulf of Mexico than Victoria.

Based on a comparison of the maximum recorded and 100-year return period values for Victoria and Palacios, the Victoria dry-bulb temperature of 111.3°F is determined as the 0% exceedance dry-bulb temperature for comparison with the corresponding

DCD value. The wet-bulb temperature coincident with this dry-bulb temperature at Victoria is 72.4°F.

The reference ABWR DCD Tier 1, Table 5.0 and Tier 2, Table 2.0-1 include the following site parameter values for ambient design temperatures, as indicated below, for which the ABWR plant is designed:

- 0% Exceedance Values (Historical Limit) - Maximum:
  - 46.1°C (115°F) dry-bulb, 26.7°C (80.1°F) wet-bulb (coincident)
  - 27.2°C (81.0°F) wet-bulb (noncoincident)
- 0% Exceedance Values (Historical Limit) - Minimum:
  - -40°C (-40°F) dry-bulb
- 1% Exceedance Values - Maximum:
  - 37.8°C (100°F) dry-bulb, 25°C (77°F) wet-bulb (coincident)
  - 26.7°C (80°F) wet-bulb (noncoincident)
- 1% Exceedance Value - Minimum:
  - -23.3°C (-9.9°F) dry-bulb

The above results indicate that the reference ABWR DCD 1% maximum dry-bulb (100°F) bounds the site-specific (Palacios) value of 91°F. The reference ABWR DCD 0% maximum dry-bulb (115°F) and coincident wet-bulb (80°F) also bounds the site-specific (Victoria) 100-year return dry-bulb (111.3°F) and the coincident wet-bulb (72.4°F). The reference ABWR DCD 1% minimum dry-bulb (-9.9°F) bounds the corresponding site-specific (Palacios) value of 35.8°F. The reference ABWR DCD 0% minimum dry-bulb (-40°F) bounds the corresponding site-specific (Victoria) 100-year return value of 3.6°F. The reference ABWR DCD 1% noncoincident maximum wet - bulb (80°F) and 0% maximum wet-bulb (81°F) do not bound the corresponding site-specific 1% value (81.2°F, Palacios) or the 100-year return value (88.3°F, Palacios), respectively. The maximum dry-bulb in combination with coincident wet-bulb provides the annual cooling, dehumidification, and enthalpy design condition, which is used as input to determine the HVAC system cooling loads. The enthalpy of the air based on STP site-specific conditions is not bounded by the reference ABWR DCD value for 1% exceedance condition. The maximum noncoincident wet-bulb is typically used as input for sizing the cooling towers and evaporative coolers. The 1% maximum coincident and noncoincident wet-bulb temperatures and the 0% maximum noncoincident wet-bulb temperature have been identified as departures to ABWR Tier 1 Table 5, and Tier 2 Table 2.0-1 parameters (see STP DEP T1 5.0-1). As discussed in Table 2.0-2, the slight temperature exceedances from the DCD site parameters have no adverse impact on either the HVAC, or UHS performance as determined in accordance with R.G. 1.27, for STP 3 & 4.

2.3S.1.6 Restrictive Dispersion Conditions

Atmospheric dispersion can be described as the horizontal and vertical transport and diffusion of pollutants released into the atmosphere. Horizontal and along-wind dispersion is controlled primarily by wind direction variation, wind speed, and atmospheric stability. Subsection 2.3S.2.2.1 addresses wind direction characteristics for the STP 3 & 4 site vicinity based on measurements from the existing meteorological monitoring program at STP 1 & 2. The persistence of wind conditions at STP 1 & 2 are discussed in Subsection 2.3S.2.2.2. The seasonal and annual atmospheric stability conditions representative of conditions at STP 3 & 4 are discussed in Subsection 2.3S.2.2.3.

In general, lower wind speeds represent less-turbulent air flow, which restricts horizontal and vertical dispersion. And, although wind direction tends to be more variable under lower wind speed conditions (which increases horizontal transport), air parcels containing pollutants often recirculate within a limited area, thereby increasing cumulative exposure.

Major air pollution episodes are usually related to the presence of stagnating high-pressure weather systems (or anti-cyclones) that influence a region with light and variable wind conditions for four or more consecutive days. An updated air stagnation climatology report entitled Air Stagnation Climatology for the United States (Reference 2.3S-16) has been published with data for the continental US based on over 50 years of observations. In this study, stagnation conditions were defined as four or more consecutive days when meteorological conditions were conducive to poor dispersion. Although inter-annual frequency varies, the data in Figures 1 and 2 of that report indicates that on average, STP 3 & 4 can expect approximately 30 days with stagnation conditions, or about six cases per year, with the mean duration of each case lasting about five days (Reference 2.3S-16).

Air stagnation conditions primarily occur during an “extended” summer season that runs from May through October. This is a result of the weaker pressure and temperature gradients, and therefore weaker wind circulations, during this period (as opposed to the winter season). Based on Wang and Angell, 1999, Figures 17 to 67 (Reference 2.3S-16), the highest incidence is recorded between July and September, typically reaching its peak during August, when the Bermuda High pressure system has become established. As the LCD summary for Victoria, Texas, in Table 2.3S-2 indicates, this 3-month period also coincides with the lowest monthly mean wind speeds during the year. Air stagnation is at a relative minimum within the “extended” summer season during May and June (Reference 2.3S-16).

The dispersion of air pollutants is also a function of the mixing height. The mixing height (or depth) is defined as the height above the surface through which relatively vigorous vertical mixing takes place. Lower mixing heights (and wind speeds), therefore, are a relative indicator of more restrictive dispersion conditions. USDA Forest Service Ventilation Climate Information System (Reference 2.3S-26) reports statistical data for mean monthly morning and afternoon mixing heights and wind speeds for locations in the contiguous U.S., Alaska, and Hawaii. The data used to compute the statistics is based on observations over the periods 1961–1990 for mixing heights and 1959–1998 for wind speed. Monthly statistics for these parameters include minimum, maximum, and mean values, average wind direction, and most frequent wind direction and are based on the longitude and latitude of the site location.

Table 2.3S-4 summarizes the mean seasonal and annual morning and afternoon mixing heights and wind speeds for the STP site area. From a climatological perspective, the lowest morning mixing heights occur in the autumn and the highest during spring. As might be expected, the afternoon mixing heights are lowest in the winter and highest in the summer, due to more intense summertime heating.

The wind speeds listed in Table 2.3S-4 for the location of STP 3 & 4 are consistent with the mean seasonal wind speeds summarized in the LCD for Victoria, Texas (see Table 2.3S-2) and the STP onsite data (see Table 2.3S-9) in that the lowest mean wind speeds are shown to occur during the summer and autumn. This period of minimum wind speeds also coincides with the “extended” summer season described by Wang and Angell that is characterized by relatively higher stagnation conditions.

2.3S.1.7 Climate Changes

That climatic conditions change over time, and that such changes are cyclical in nature on various time and spatial scales, is a given. The timing, magnitude, relative contributions to, and implications of these changes is generally more speculative, even more so for specific areas or locations.

With regard to the operating life for STP 3 & 4, it is reasonable to evaluate the record of readily-available and well-documented climatological observations of temperature and rainfall (normals, means and extremes) as they have varied over time (i.e., the last 60 to 70 years or so), and the occurrences of severe weather events, in the context of the plant’s design bases.

Trends of temperature and rainfall normals and standard deviations have been identified over a 70-year period for successive 30-year intervals, updated every 10 years, beginning in 1931 (e.g., 1931–1960, 1941–1970, etc.) through the most recent normal period (i.e., 1971–2000) in the NCDC publication Climatography of the United States, No. 85 (Reference 2.3S-17). The publication summarizes observations for the 344 climate divisions in the 48 contiguous states.

A climate division represents a region within a state that is as climatically homogeneous as possible. Division boundaries generally coincide with county boundaries except in the Western U.S. In Texas, the STP site is located within Climate Division Texas-08 (Upper Coast). A summary of successive annual temperature and rainfall normals as well as the composite 70-year average, are provided below for this climate division (Reference 2.3S-17).

Period	Temperature (°F) Texas-08	Rainfall (inches) Texas-08
1931–2000	69.3	47.75
1931–1960	69.5	46.17
1941–1970	69.4	46.41
1951–1980	69.1	45.93
1961–1990	68.9	47.63
1971–2000	69.2	50.31

This data indicate a slight cooling trend over most of the 70-year period with a slight increase of approximately to 0.3°F during the most recent normal period. In general, total annual rainfall decreased slightly up through the 1951 to 1980 normal period and has trended upward by approximately 4.5 inches during the two succeeding 30-year normal periods. Despite the varying climatic regimes that characterize the state of Texas, similar trends in temperature normals and total annual rainfall normals are observable in nearly all of the other climate divisions in the state (Reference 2.3S-17).

The preceding values represent variations of average temperature and rainfall conditions over time. The occurrence of extreme temperature and precipitation (rainfall and snowfall) events do not necessarily follow the same trends. However, the occurrence of such events over time are indicated by the summaries for observed extremes of temperature, rainfall and snowfall totals recorded in the STP site area (see Table 2.3S-3).

The data summarized in Table 2.3S-3 shows that individual station records for maximum temperature have been set between 1954 and 2005 – that is, there is no discernable trend for these extremes in the site area. Similarly, record-setting 24-hour rainfall totals were established between 1911 and 1991; station records for the maximum monthly rainfall have been set between 1945 and 1994—again, no clear trend. Cold air outbreaks that result in overall extreme low temperature records occur infrequently; record-setting snowfalls are even more rare events. The few dates of occurrence between 1940 and 1989, 1940 and 2004, 1940 and 2004, over which minimum temperatures and maximum daily and monthly snowfall totals have been recorded, respectively, are indicative of this characteristic.

Characteristics and/or effects of other types of severe weather phenomena have been discussed previously, including tornados (see Subsection 2.3S.1.3.2) and tropical cyclones (see Subsection 2.3S.1.3.3).

The number of recorded tornado events has increased since detailed records were routinely documented beginning around 1950. However, some of this increase is attributable to a growing population, greater public awareness and interest, and technological advances in detection. These changes are superimposed on normal year-to-year variations.

The occurrence of all tropical cyclones within a 100-nautical mile radius of the STP site has been somewhat cyclical over the available 155-year period of record when considered on a decadal (i.e., 10-year) basis, having reached a peak of 10 such storms during the 1940s, with a secondary peak of eight tropical cyclone events some 60 years earlier in the 1880's. Both the frequency and intensity of hurricanes passing within 100 nautical miles of the site have generally decreased since the peak period from 1940 to 1949. The frequency of tropical storms has been fairly steady since the 1960's, totaling approximately three such storms each decade; this is relatively more frequent than in the decades preceding the peak during the 1940's. Many of the 24-hour and monthly total rainfall records identified in Table 2.3S-3 and discussed in Subsection 2.3S.1.3.3 are associated with these tropical cyclone events (Reference 2.3S-12).

Nevertheless, the regulatory guidance for evaluating the climatological characteristics of a site from a design basis standpoint is not event-specific, but rather is statistically based and for several parameters includes expected return periods of 100 years or more and probable maximum event concepts. These return periods exceed the design life of the proposed units. The design-basis characteristics determined previously under Subsection 2.3S.1.3 are developed consistent with the intent of that guidance and incorporate the readily-available, historical data records for locations considered to be representative of the site for STP 3 & 4. These site characteristic values are summarized and compared in Table 2.0-2 and in the applicable subsections under Subsection 2.3S.1.3.

2.3S.2 Local Meteorology

The following site-specific supplement addresses COL License Information Item 2.9.

This section addresses various meteorological and climatological characteristics of the site and vicinity surrounding STP 3 & 4. FSAR Subsection 2.3S.2.1 identifies data resources used to develop the climatological descriptions and provides information about the onsite meteorological monitoring program used to characterize the site-specific atmospheric dispersion conditions.

Site-specific characteristics related to atmospheric transport and diffusion are discussed in Subsections 2.3S.2.2.1, 2.3S.2.2.2 and 2.3S.2.2.3.

Climatological normals, means and extremes (including temperature, rainfall and snowfall), based on the long-term records from nearby observing stations, are described in Subsections 2.3S.2.2.4 through 2.3S.2.2.7 and evaluated to substantiate that these observations are representative of conditions that might be expected to occur at the site for STP 3 & 4.

Subsection 2.3S.2.3 describes topographic features of the site, as well as in the broader site and surrounding area out to 50 miles. Subsection 2.3S.2.4 addresses the potential influence on these normal, mean and extreme climatological conditions due to the presence and operation of STP 3 & 4 and their related facilities, and those associated with STP 1 & 2.

Finally, Subsection 2.3S.2.5 discusses current ambient air quality conditions in the site area and region that have a bearing on plant design and operations, describes the types of non-radiological air emission sources at the facility, briefly summarizes expected air quality impacts during facility operations, and identifies related regulations and permits.

2.3S.2.1 Data Sources

The primary sources of data used to characterize local meteorological and climatological conditions representative of the site for STP 3 & 4 includes long-term summaries from the first-order NWS station at Victoria, Texas and from 14 other nearby cooperative network observing stations, as well as measurements from the onsite meteorological monitoring program operated in support of STP 1 & 2. Table 2.3S-1 identifies the offsite observing stations and provides the approximate distance and direction of each station relative to the site for STP 3 & 4; their locations are shown in Figure 2.3S-1.

There are several first-order NWS stations located along the western Gulf of Mexico coast (Palacios, Victoria, Corpus Christi and Galveston) that could have long-term (30-year) hourly meteorological data available to describe the general STP site area meteorological and climatological conditions. Galveston and Corpus Christi are located approximately 81 (east-northeast) and 100 miles (southwest) from the STP site, respectively. They are too far from the STP site since the “nearby” stations are defined in Section 2.3.2 of NUREG-0800 (Reference 2.3S-6).

Palacios is located approximately 13 miles to the west-southwest, and Victoria is located approximately 53 miles to the west of the STP site. Based on the climatological data recorded at Palacios and Victoria (Reference 2.3S-2), the monthly mean daily maximum temperatures are slightly higher at Victoria than those measured at Palacios; and the monthly mean daily minimum temperatures at Victoria are slightly lower than those measured for Palacios. To be conservative, Victoria data was used to describe the site extreme climatology. In addition, consecutive hourly meteorological data is not available at Palacios during the period of March 1959 through December 1999 (Reference 2.3S-27). Although the Victoria station is located 53 miles from the STP site (slightly longer than the distance defined by NUREG-0800 (Reference 2.3S-6) as “nearby”), the terrain between the STP site and the Victoria station is relatively flat. Additionally, the Victoria station is located at almost the same latitude as the STP site. Therefore, the long-term (30 years) data from the Victoria station was used to describe the general climatic conditions at the STP site.

The locations of the existing onsite primary and backup meteorological towers with respect to STP 1 & 2 and the STP 3 & 4 are shown in Figure 2.3S-15. The primary tower is located approximately 2.1 kilometers (1.3 miles) east of STP 3 & 4, and the backup tower is located approximately 670.5 meters (2200 ft) south of the primary tower. Both locations are clear of man-made and natural obstructions which could influence the collection of meteorological data. Detailed information regarding the meteorological monitoring program for STP 1 & 2 is provided in Subsection 2.3S.3.3.

The first-order NWS station and cooperative observing station summaries were used to characterize climatological normals (i.e., 30-year averages), and period-of-record means and extremes of temperature, rainfall, and snowfall in the vicinity of STP 3 & 4. In addition, first-order NWS stations record measurements, typically on an hourly basis, of other weather elements, including winds, relative humidity, dew point, and wet-bulb temperatures, as well as other observations (e.g., fog, thunderstorms). This information was based on the following resources (References 2.3S-13, 2.3S-3, 2.3S-2, 2.3S-4, and 2.3S-5).

Wind direction, wind speed, and atmospheric stability data obtained from the meteorological monitoring program operated in support of STP 1 & 2 forms the basis for determining and characterizing atmospheric dispersion conditions in the vicinity of the site.

RG 1.23 (Reference 2.3S-28) specifically states that the minimum amount of onsite meteorological data to be provided at the time of a COL application that does not reference an Early Site Permit is a consecutive 24-month period of data that is defendable, representative, and complete, but not older than 10 years from the date of the application. Adequacy and accuracy of the STP 1 & 2 meteorological measuring systems were assessed based on NUREG-1555, Standard Review Plans for Environmental Reviews for Nuclear Power Plants (Reference 2.3S-29). The findings conclude that the instrument heights and locations, system accuracies, methodologies for data acquisition and reduction, as well as procedures for instrumentation surveillance conform to the applicable guidance provided in RG 1.23 (Reference 2.3S-28). Therefore, data collected by the existing STP 1 & 2 meteorological monitoring systems provides a suitable data set for STP 3 & 4. Further information regarding the STP meteorological monitoring systems is presented in Subsection 2.3S.3.

A consecutive 24-month period (1999-2000) of data was identified to be the most defendable (using validated data with the least data substitution), representative (tower siting and sensor location in accordance with RG 1.23), and complete (with annual data recovery rate greater than 90%), but not older than 10 years from the date of the application. Since three or more years of data are RG 1.23 (Reference 2.3S-28) preference, three years (1997, 1999 and 2000) of the STP 1 & 2 data is used in this application.

2.3S.2.2 Normal, Mean, and Extreme Values of Meteorological Parameters

Meteorological data obtained from the monitoring program operated in support of STP 1 & 2 is used to characterize atmospheric transport and diffusion conditions in the vicinity of the site for STP 3 & 4. Details regarding these wind and atmospheric stability characteristics are described in Subsections 2.3S.2.2.1 through 2.3S.2.2.3. This site-specific data also provide input to dispersion modeling analyses of onsite and offsite impacts due to accidental and routine radiological releases to the atmosphere (see Subsections 2.3S.4.2 and 2.3S.5, respectively), and at Control Room air intakes and ingress/egress points under accident conditions (see Subsection 2.3S.4.2).

Subsection 2.3S.2.2 also provides summaries of normals, period-of-record means and period-of-record extremes for several standard weather elements – that is, temperature, atmospheric water vapor, precipitation, and fog (see FSAR Subsections 2.3S.2.2.4 through 2.3S.2.2.7, respectively).

The normals, means, and extremes of the more extensive set of measurements and observations made at the Victoria, Texas first-order NWS station are summarized in Table 2.3S-2. Table 2.3S-5 compares the annual normal daily maximum, minimum, and mean temperatures, as well as the normal annual rainfall and snowfall totals for these stations. Historical extremes of temperature, rainfall and snowfall are listed in Table 2.3S-3 for the NWS and cooperative observing stations in the STP site area.

2.3S.2.2.1 Average Wind Direction and Wind Speed Conditions

The distribution of wind direction and wind speed is an important consideration when characterizing the dispersion climatology of a site. Long-term average wind motions at the macro- and synoptic scales (i.e., on the order of several thousand down to several hundred kilometers) are influenced by the general circulation patterns of the atmosphere at the macro-scale and by large-scale topographic features (e.g., land-water interfaces such as coastal areas). These characteristics are addressed in Subsection 2.3S.1.2.

Site-specific or micro-scale (i.e., 2 km or less) wind conditions, while they may reflect these larger-scale circulation effects, are influenced primarily by local and, generally, to a lesser extent, by meso- or regional-scale (i.e., up to about 200 km) topographic features. Wind measurements at these smaller scales are currently available from the meteorological monitoring program operated in support of STP 1 & 2 and from long-term data recorded at the nearby Victoria, Texas NWS station and shorter-term measurements at the cooperative observation station at Palacios Municipal Airport. Subsection 2.3S.3.3 presents a summary description of the STP onsite monitoring program. In its current configuration, wind direction and wind speed measurements are made at two levels (10-m and 60-m) on an instrumented 60-m guyed tower.

Figures 2.3S-2 through 2.3S-6 present annual and seasonal wind rose plots. Wind rose plots are graphical distributions of the direction from which the wind is blowing and wind speeds for each of sixteen, 22.5° compass sectors centered on north, north-northeast, northeast, etc. for the 10-meter level based on measurements over the composite 3-year period of record that includes calendar years 1997, 1999, and 2000.

The wind direction distribution at the 10-meter level generally follows a southeast orientation on an annual basis (see Figure 2.3S-2). The prevailing wind (i.e., defined as the direction from which the wind blows most often) is from the south-southeast, with nearly 40% of the winds blowing from the southeast through south sectors.

During the winter months (i.e., December through February), north winds prevail, although a bimodal directional distribution is exhibited. Northerly winds (i.e., from the north-northwest through the north-northeast sectors) occur with about the same frequency as winds from the southeast through the south sectors (28 percent of the time) for each group of sectors (see Figure 2.3S-3). The prevalence of northerly winds during the winter season is attributable to increased cold frontal passages as continental, polar air masses intrude the region. Winds from the southeast quadrant predominate during the spring and summer with prevailing seasonal directions shifting from the southeast to the south, respectively, as spring moves into summer (see Figures 2.S3-4 and 2.3S-5). The autumn months (i.e., September through November) represent a transitional period that is predominated by winds from the southeast and northeast quadrants (see Figure 2.3S-6). Wind directions with a westerly component are relatively infrequent until late in the autumn and early in the winter. Plots of individual monthly wind roses at the 10-meter measurement level are presented in Figure 2.3S-7.

Wind rose plots based on measurements at the 60-meter measurement level are shown in Figures 2.3S-8 through 2.3S-13. The wind direction distributions for the 60-meter level are fairly similar to the 10-meter level wind roses on a composite annual (see Figure 2.3S-8) and seasonal basis (see Figures 2.3S-9 through 2.3S-12). Plots of individual monthly wind roses at the 60-meter measurement level are presented in Figure 2.3S-13.

Wind information summarized in the Local Climatological Data (LCD) for the Victoria, Texas NWS station (Table 2.3S-2) over a 25-year period of record indicates a prevailing south-southeasterly wind direction (Reference 2.3S-1) that appears to be similar to the 10-m level wind flow at the STP site, at least on an annual basis (see Figure 2.3S-2). The monthly variation of prevailing wind directions for the Victoria station follows a similar pattern from March through August and November and December, but differs during September, October, January and February. However, the variations for the months of September, October, January and February are most likely due to the much shorter period of record for the STP meteorological data, as compared to Victoria station (Reference 2.3S-1).

Based on the 5-year period of record from 1995 through 1999, wind direction measurements from the cooperative observing station at the Palacios Municipal Airport (Reference 2.3S-27) show reasonably similar characteristics in predominant directions on an annual basis. At both locations, reasonably similar variations in the predominant wind direction sectors over the course of the year are also evident.

Table 2.3S-6 summarizes seasonal and annual mean wind speeds based on measurements from the upper and lower levels of the meteorological tower operated in support of STP 1 & 2, over the composite 3-year period, and from wind instrumentation at the Victoria station (28-year mean) (Reference 2.3S-1). The elevation of the wind instruments at the Victoria station is nominally 20 feet (about 6.1 meter) (Reference 2.3S-1), and are comparable to the lower (10-meter) level measurements at the STP site.

On an annual basis, mean wind speeds at the 10- and 60-meter levels are 4.1 m/sec and 6.0 m/sec, respectively, at the STP site. The annual mean wind speed at Victoria (i.e., 4.3 m/sec) is similar to the 10-meter level at the STP site, differing by only 0.2 m/sec; seasonal average wind speeds at Victoria are likewise slightly higher. Seasonal mean wind speeds for both measurement levels at the STP site follow the same pattern discussed in Subsection 2.3S.1.6 with respect to the seasonal variation of relatively higher air stagnation and restrictive dispersion conditions in the site region.

Mean wind speeds at Palacios for the 5-year period from 1995 through 1999 are similar, although somewhat higher, throughout the year compared to the lower-level, seasonal and annual wind speeds at the STP site and the Victoria NWS station as summarized in Table 2.3S-6. Mean wind speeds are higher by less than 1.0 m/sec on an annual basis, ranging from 0.4 to 1.3 m/sec higher depending on season and measurement location.

Specific differences in directional frequencies and mean wind speeds may be due to station siting and instrumentation, and to different periods of record among the three stations. Nevertheless, the wind direction and wind speed data show reasonable intermediate-field (Palacios) and far-field (Victoria) similarity to the wind conditions measured at the STP site.

There were no occurrences of calm wind conditions (less than 0.27 m/sec) at the STP site over the 3-year period of record that includes calendar years 1997, 1999, and 2000 at either the 10- or 60-meter levels. This is due primarily to the fact that the STP site is a relatively high wind site with annual mean wind speeds of 4.1 and 6.0 m/sec at the lower and upper measurement levels, respectively (see Table 2.3S-6), and because of a starting threshold wind speed of 0.6 mph for the cup-type anemometers in place at the time (see Table 2.3S-15).

2.3S.2.2.2 Wind Direction Persistence

Wind direction persistence is a relative indicator of the duration of atmospheric transport from a specific sector-width to a corresponding downwind sector-width that is 180° opposite. Atmospheric dilution is directly proportional to the wind speed (other factors remaining constant). When combined with wind speed, a wind direction persistence/wind speed distribution further indicates the downwind sectors with relatively more or less dilution potential (i.e., higher or lower wind speeds, respectively) associated with a given transport wind direction.

Tables 2.3S-7 and 2.3S-8 present wind direction persistence/wind speed distributions based on measurements at the STP site for the 3-year, preoperational period of record that includes calendar years 1997, 1999, and 2000. The distributions account for durations ranging from 1 to 48 consecutive hours for wind directions from 22.5° upwind sectors centered on each of the 16 standard compass radials (i.e., north, north-northeast, northeast, etc.), and for wind speed groups greater than or equal to 5, 10, 15, 20, 25, and 30 mph. Distributions are provided for wind measurements made at the lower (10-meter) and the upper (60-meter) tower levels, respectively.

Wind direction persistence hours as listed in Table 2.3S-7 are the lower limits within the ranges. At the 10-m level, the longest persistence period is 30 to 36 hours for winds from the southeast sector. This duration appears only in the lowest two wind speed groups (i.e., for wind speeds greater than or equal to 5 mph and 10 mph). Persistence periods of 24 to 30 hours for winds greater than or equal to 5 mph are indicated for several direction sectors, including winds from the east, south-southeast, southeast, south, west-southwest, and north-northwest. For wind speeds greater than or equal to 20 mph, maximum persistence periods are limited to 8 to 12 hours.

Wind direction persistence hours as listed in Table 2.3S-8 are the lower limits within the ranges. At the 60-meter level, the longest persistence period is 30 to 36 hours, and occurred for two different sectors (i.e., winds from the north and east-northeast). This duration appears only in the lowest two wind speed groups for the north and east-northeast sectors and for the lowest three wind speed groups for the east-northeast sector (i.e., for wind speeds greater than or equal to 5, 10, and 15 mph). Persistence periods of 24 to 30 hours are indicated for multiple direction sectors for the lowest three wind speed groups. For wind speeds greater than or equal to 25 mph, maximum persistence periods are limited to 8 to 12 hours with the exception of one 12 to 18 hour duration from the south sector.

2.3S.2.2.3 Atmospheric Stability

Atmospheric stability is a relative indicator of the potential diffusion of pollutants released into the ambient air. Atmospheric stability is based on the delta-temperature (ΔT) method defined in Table 1 of RG 1.23 (Reference 2.3S-28). The approach classifies stability based on the temperature change with height (i.e., the difference in °C/100 meter). The diffusion capacity is greatest for extremely unstable conditions and decreases progressively through the remaining unstable, neutral stability, and stable classifications.

The diffusion capacity is greatest for extremely unstable conditions and decreases progressively through the remaining unstable, neutral stability, and stable classifications.

During the 3-year period of record, ΔT was determined from the difference between temperature measurements made at the 60- and 10-meter tower levels. Seasonal and annual frequencies of atmospheric stability class and associated 10-meter level mean wind speeds for this period of record are presented in Table 2.3S-9.

The data indicates a predominance of neutral stability (Class D) and slightly stable (Class E) conditions throughout the year, ranging from approximately 45% of the time during the autumn to approximately 63% of the time during the winter and spring. Extremely unstable conditions (Class A) occur approximately 14% of the time on an annual basis and are most frequent during the summer and occur least often during the winter months owing, in large part, to greater and lesser insolation, respectively, and relatively lower and higher mean wind speeds, respectively. Extremely and moderately stable conditions (Classes G and F, respectively) are most frequent during autumn (approximately 30% of the time) and winter (approximately 20% of the time), owing in part to increased radiational cooling at night. The relatively lower percentage occurrences of stability classes B and C are believed to be due, in part, to the narrow ΔT ranges associated with those classifications (Reference 2.3S-28).

Joint frequency distributions (JFDs) of wind speed and wind direction by atmospheric stability class and for all stability classes combined for the 10-meter and 60-meter wind measurement levels at the STP site are presented in Tables 2.3S-10 and Table 2.3S-11, respectively, for the 3-year period of record. The 10-meter level JFDs are used to evaluate short-term dispersion estimates for accidental atmospheric releases (see

Subsection 2.3S.4) and long-term diffusion estimates for routine releases to the atmosphere (see Subsection 2.3S.5).

2.3S.2.2.4 Temperature

Daily mean temperatures are based on the average of the daily mean maximum and daily mean minimum temperature values. Normal annual daily mean temperatures are similar over the site area, ranging from 68.8°F at the Danevang 1W observing station to 71.1°F at the Point Comfort observing station (see Table 2.3S-5), which are separated by a distance of approximately 33 miles. Diurnal (day-to-night) temperature ranges, as indicated by the differences between the daily mean maximum and minimum temperatures, however, are more variable, ranging from 11.4°F at Port O'Connor to 21.7°F at the Pierce 1E station (Reference 2.3S-3). In general, the greater diurnal temperature ranges among the one NWS and 14 nearby cooperative observer stations occur at those stations farther from the Gulf of Mexico and adjacent bays, and are less for those stations closer to those waters (Figure 2.3S-1).

As Table 2.3S-3 indicates, extreme maximum temperatures recorded in the vicinity of the STP site have ranged from 102°F to 112°F, with the highest reading observed at the cooperative observing station at Pierce 1E on September 5, 2000. The record high temperatures for the Bay City Waterworks (109°F), Danevang 1W (109°F), Freeport 2NW (105°F), and Aransas Wildlife Refuge (102°F) observing stations have been reached on two or three occasions. Extreme minimum temperatures in the vicinity of the site for STP 3 & 4 have ranged from 4°F to 13°F, with the lowest reading on record observed at the Pierce 1E observing station on January 31, 1949 (References 2.3S-2, 2.3S-4, and 2.3S-20).

The extreme maximum and minimum temperature data, and the historical station records on which it is based, indicates that synoptic-scale conditions responsible for periods of record-setting excessive heat as well as significant cold air outbreaks tend to affect the overall STP site area (References 2.3S-2, 2.3S-4, and 2.3S-20). The general similarity of the respective extremes suggests that these statistics are representative of the site area. However, as with the variation in the station diurnal temperature ranges noted above, proximity to the water has a moderating influence on extreme maximum and minimum temperatures. Therefore, extreme temperature characteristics at the site for STP 3 & 4 will likely be within the range of maximum and minimum records reported in Table 2.3S-3 for the climatological observing stations located farther inland.

2.3S.2.2.5 Atmospheric Water Vapor

Based on a 20-year period of record, the LCD summary for the Victoria, Texas NWS station (see Table 2.3S-2) indicates that the mean annual wet-bulb temperature is 64.5°F, with a seasonal maximum during the summer months (June through August) and a seasonal minimum during the winter months (December through February). The highest monthly mean wet-bulb temperature is 76.2°F in July (and virtually the same during August); the lowest monthly mean value (50.0°F) occurs during January (Reference 2.3S-1).

The LCD summary shows a mean annual dew point temperature of 60.9°F, also reaching its seasonal maximum and minimum during the summer and winter, respectively. The highest monthly mean dew point temperature is 73.1°F, reaching its peak in July and August. The lowest monthly mean dew point temperature (46.0°F) occurs during January (Reference 2.3S-1).

The 30-year normal daily relative humidity averages 76% on an annual basis, typically reaching its diurnal maximum in the early morning (around 0600 hours) and its diurnal minimum during the mid-day (around 1200 hours). There is less variability in this daily pattern with the passage of weather systems, persistent cloud cover, and precipitation. Nevertheless, this daily pattern is evident throughout the year. The LCD summary shows that average early morning relative humidity levels are greater than or equal to 90% from May through November and are not much lower during the remaining months of the year (Reference 2.3S-1).

As discussed in FSAR Section 2.3S.1.5, due to the proximity of Palacios to the STP site, water vapor data from Palacios are also presented in this section. Using 20 years (1998-2007) of continuous hourly Palacios meteorological data obtained from National Climatological Data Center (References 2.3S-60-68), the 100-year return period noncoincident wet bulb temperature was estimated to be 88.3°F.

The mean annual wet bulb temperature is 66.3°F at Palacios (Reference 2.3S-69). This is slightly higher than that found at Victoria (64.5°F). The slight increase in wet-bulb temperature is expected as Palacios is located closer to Gulf of Mexico than Victoria. The 20-year data shows the mean annual dew point temperature is 63.2°F at Palacios (Reference 2.3S-69). As expected, this value is also slightly higher than that value at Victoria (60.9°F).

The Palacios 20-year annual average relative humidity is 80% (Reference 2.3S-69). Because the proximity to the Gulf of Mexico, it is higher than that found at Victoria (76%).

2.3S.2.2.6 Precipitation

As Table 2.3S-5 indicates, normal annual rainfall totals vary substantially, ranging from 34.78 inches at the Port O'Connor observing station to 57.24 inches at the Angleton 2W observing station (Reference 2.3S-3). This data, in conjunction with Figure 2.3S-1, also indicate that total annual rainfall tends to decrease more from east to west more than as a function of distance inland from the Gulf of Mexico and adjacent bay waters.

However, when the four climatological observing stations closest to, and surrounding, STP 3 & 4 are considered (i.e., Matagorda 2, Palacios Municipal Airport, Bay City Waterworks, and Danevang 1W), all within 20 miles, normal annual rainfall totals are quite similar, ranging from 43.75 inches at Matagorda 2 to 48.03 inches at Bay City Waterworks (Reference 2.3S-3). Therefore, long-term average annual total rainfall at STP 3 & 4 could reasonably be expected to be within this range.

Measurable snowfall occurs only rarely in the STP 3 & 4 site area, as discussed in Subsection 2.3S.1.3.4, with normal annual totals at all observing stations averaging less than 0.3 inches (Reference 2.3S-2).

2.3S.2.2.7 Fog

The closest station to the STP site at which observations of fog are made and routinely recorded is the Victoria, Texas NWS station approximately 53 miles to the west. The NWS defines heavy fog as fog that reduces visibility to ¼ mi or less. The 2005 LCD summary for this station (Table 2.3S-2) indicates an average of 41.7 days per year of heavy fog conditions, based on a 43-year period of record (Reference 2.3S-1).

On average, the occurrence of heavy fog conditions follows a cyclical pattern over the course of the year, being recorded most often from November through March when normal daily minimum temperatures are relatively lower. The peak frequency is reached during January, averaging approximately seven days per month. Heavy fog occurs least often during the summer (June, July and August), averaging less than one day per month in each of those months.

2.3S.2.3 Topographic Description

The STP 3 & 4 site is located in Matagorda County, Texas, approximately 12 miles SSW of the city limits of Bay City, Texas, and 10 miles north of Matagorda Bay. The terrain elevation at the site is approximately 25 feet above MSL.

Topographic features within a 50-mile (80-kilometer) radius of the STP site, based on digital map elevations, are shown in Figure 2.3S-14 The terrain in the site area is basically flat to the northeast and southwest of the site, decreases to sea level to the south and southeast as the Gulf of Mexico and adjacent bay waters are reached, and increases gradually in the northwest quadrant relative to the site to a maximum elevation of about 165 feet (about 50 meters) above MSL within this radial area.

More detailed topographic features within a 5-mile (8-kilometer) radius of the STP site, also based on digital map elevations, are shown in Figure 2.3S-15, including elevation characteristics in the immediate vicinity of STP 3 & 4.

Terrain elevation profiles along each of the 16 standard 22.5° compass radials out to a distance of 50 miles (80 kilometers) from the site are illustrated in Figure 2.3S-16. Because STP 3 & 4 are located relatively close to one another and because of the distance covered by these profiles, the locus of these radial lines is the center point between the STP 3 & 4 reactor buildings.

2.3S.2.4 Potential Influence of the Plant and Related Facilities on Meteorology

The dimensions and operating characteristics of STP 3 & 4, and the STP 1 & 2, and the associated paved, concrete, or other improved surfaces are considered to be insufficient for generating discernible, long-term effects to local- or micro-scale meteorological conditions.

Wind flow will be altered in areas immediately adjacent to and downwind from larger site structures. However, these effects will likely dissipate within ten structure heights downwind of the intervening structure(s) (Reference 2.3S-28). Similarly, while ambient temperatures immediately above any improved surfaces could increase, these temperature effects will be too limited in their vertical profile and horizontal extent to alter local-, area-, or regional-scale ambient temperature patterns.

While there will be site clearing, grubbing, excavation, leveling, and landscaping activities associated with the construction of STP 3 & 4, these alterations to the existing site terrain will be localized and will not represent a significant change to the gently rolling topographic character of the site vicinity or the surrounding site area. Neither the mean and extreme climatological characteristics of the site area nor the meteorological characteristics of the site and vicinity will be affected as a result of plant construction.

STP 1 & 2 use the main cooling reservoir (MCR) as a means of heat dissipation. Under normal operation, STP 3 & 4 will use a Circulating Water System (CWS) to dissipate waste heat rejected from the main condenser. The CWS will use the existing 7000-acre Main Cooling Reservoir (MCR) for heat dissipation. As discussed in Subsection 9.2.5, each new unit will also have an Ultimate Heat Sink (UHS) to remove heat load from the Reactor Service Water (RSW) System. Each new unit has a counterflow mechanically induced draft cooling tower with six cooling tower cells, of which two cells are dedicated to each of the three RSW divisions to remove heat from their respective RCW/RSW division.

Potential meteorological effects due to the operation of the MCR and these cooling towers may include enhanced ground-level fogging and icing, cloud shadowing and precipitation enhancement, and increased ground-level humidity. These effects and other potential, related environmental impacts (e.g., solids deposition, visible plume formation, transport, and extent) are addressed below and in ER Subsections 5.3.3.1 and 5.3.3.2.

Reactor Service Water System

The effects of added salt and moisture from the RSW system were determined using the Seasonal/Annual Cooling Tower Impact (SACTI) model.

The STP Unit 3 & 4 reactor service water (RSW) system was modeled as two towers with a maximum drift rate of 0.005%. Site-specific meteorological data acquired from the STP 1 & 2 meteorological tower for 1997, 1999 and 2000 was used as input for the code. The site-specific data included the wind speed, wind direction, and dry bulb temperature. Additional meteorological data required for the SACTI analysis was acquired from the National Weather Service for the Palacios Municipal Airport Weather Station, also for the years 1997, 1999, and 2000. This data included the total sky clearness value, the dew point temperature, and the ceiling height. The site dry bulb temperature and the Palacios Municipal Airport dew point temperature were used to calculate the wet bulb temperature and the relative humidity.

For the SACTI model, the towers were assumed to be operating during emergency reactor shutdown where the towers are running at full capacity. Under normal operating conditions the RSW system will operate at only half capacity. Sodium concentration of the makeup water is discussed in COLA Part 3 Environmental Report (ER) Section 2.3.1 and it was assumed that all sodium would be associated with chloride for a corresponding NaCl concentration.

Salt Deposition:

The Unit 4 transformers are located approximately 380 meters north northwest of the Ultimate Heat Sink (UHS). Maximum salt deposition rates at this location are predicted by SACTI to be between 4165 Kg/ (Km^2-Mo.) (at 300 meters) and 1139 Kg/ (Km^2-Mo.) (at 400 meters). This represents medium to heavy contamination levels over the course of a month according to IEEE Standard C57.19.100-1995 (Reference 1). Since the model assumes that the RSW system will be running at full capacity, when in reality it is expected to run closer to half capacity, actual salt deposition rates are expected to be lower. Natural wash off from rain, which SACTI does not consider, is expected to further decrease these values. The Unit 4 transformers are considered bounding for electrical equipment and transmission lines because they are positioned to receive the greatest amount of salt deposition, as predicted by the SACTI model.

Moisture:

The SACTI model predicts a maximum of zero hours of fogging annually in any location and zero hours seasonally.

Temperature:

As discussed in Section 9.4 of the ABWR DCD, safety-related HVAC systems are designed for an outdoor summer temperature of 115°F. The temperature of the exhaust plume from the UHS will not exceed the RSW return water temperature of 109.4°F, which is below the 115°F outdoor summer temperature. Therefore, added heat from the UHS will not have adverse effects on the HVAC systems.

Main Cooling Reservoir

The SACTI model is used to analyze cooling towers; therefore, the code was not considered when addressing potential effects from the MCR.

Salt Deposition:

Any salt deposits on the HVAC systems and electrical equipment from the MCR will be a result of evaporation of the cooling water. Since there is no exit velocity from the evaporative process as in a cooling tower, most of the salt content will remain in the pond. Therefore, salt deposits on HVAC intakes, transmission lines and other electrical equipment as a result of evaporation from the MCR is not expected to affect these plant components.

Moisture:

The additional water flow from STP Units 3 & 4 to the MCR will increase ambient moisture as a result of raised pond temperatures and evaporation. Although additional fogging may result from the UHS cooling tower plume, the MCR was designed for four units and the HVAC intakes, transmission lines and onsite electrical equipment are designed for outdoor operation, which include environmental conditions such as fog and rain. Thus, no adverse effects to these plant features are expected. Furthermore, HVAC systems are designed to regulate relative humidity which will further mitigate any potential effects.

Temperature:

As discussed above, safety-related HVAC systems are designed for an outdoor summer temperature of 115°F. The analysis described in COLA Part 3, Environmental Report (ER) Table 3.4-3 shows the maximum predicted monthly MCR temperature at the Circulating Water System (CWS) discharge for 4-unit operation from 2003-2005 is 112.3°F. As discussed in ER Section 3.4.2.4, the design MCR intake temperature for STP 3 & 4 is 100°F. Since both the intake design temperature and maximum monthly overall CWS discharge are lower than the outdoor HVAC design temperature, added heat from the MCR is not expected to adversely affect the HVAC systems. Furthermore, since the design basin temperatures for the UHS are lower than that of the MCR intake temperature values, combined temperature effects from the UHS and the MCR will be similar to those from the MCR.

Subsections 2.3S.3.4.1, 2.3S.3.4.2, and 2.3S.3.4.3 provide additional details regarding the considerations made in siting and equipping the meteorological towers in support of STP 3 & 4 in relation to the construction of, and/or major structures associated with, those units.

2.3S.2.5 Current and Projected Site Air Quality

This section addresses current ambient air quality conditions in the site area and region that could have a bearing on plant design, construction, and operating basis considerations (Subsection 2.3S.2.5.1). This section also cross-references other sections of this FSAR that address the types and characteristics of non-radiological emission sources associated with plant construction and operation, and the expected impacts associated with those activities, (Subsection 2.3S.2.5.2), and characterizes climatological conditions in the site area and region that may be restrictive to atmospheric dispersion (Subsection 2.3S.1.6).

2.3S.2.5.1 Current Air Quality Conditions

STP 3 & 4 are located within the Metropolitan Houston-Galveston Intrastate Air Quality Control Region and includes Matagorda, Austin, Brazoria, Chambers, Colorado, Fort Bend, Galveston, Harris, Liberty, Montgomery, Walker, Waller, and Wharton Counties (Reference 2.3S-30). The STP site is located in Matagorda County. Attainment areas are areas where the ambient levels of criteria air pollutants are designated as being “better than,” “unclassifiable/attainment,” or “cannot be classified or better than” the

Environmental Protection Agency-promulgated National Ambient Air Quality Standards (Reference 2.3S-31). Criteria pollutants are those for which National Ambient Air Quality Standards have been established: sulfur dioxide; particulate matter (i.e., PM_{10} and $PM_{2.5}$ — particles with nominal aerodynamic diameters less than or equal to 10.0 and 2.5 microns, respectively); carbon monoxide; nitrogen dioxide; ozone; and lead (Reference 2.3S-31).

The Metropolitan Houston-Galveston Intrastate Air Quality Control Region (AQCR 216) is in attainment for all criteria pollutants with the exception of the 8-hour ozone standard in Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller counties and for lead. The EPA has granted a request from the Governor of the State of Texas to reclassify the ozone nonattainment status in Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller counties as severe (73 CR 56983, October 1, 2008, Reference 2.3S-55). The attainment status for lead has not been designated for any county in AQCR 216 (Reference 2.3S-56). All of these counties are located either northeast or north-northeast of Matagorda County, with the closest being Brazoria County directly northeast.

Three pristine areas in the states of Texas and Louisiana with Class 1 Areas are designated as “Mandatory Class I Federal Areas Where Visibility is an Important Value.” They include: Big Bend and Guadalupe Mountains National Parks in Texas (Reference 2.3S-33) and the Breton Wilderness Area in Louisiana (Reference 2.3S-34). The Big Bend National Park is the closest of these Class I areas; about 432 miles west of the STP site. The Breton Wilderness Area and Guadalupe Mountains National Parks are located approximately 442 miles east-northeast and 564 miles west-northwest, respectively, from the STP site.

2.3S.2.5.2 Projected Site Air Quality Conditions

The new nuclear steam supply system and other related radiological systems are not sources of criteria pollutants or other air toxics emissions. Supporting equipment (e.g., emergency diesel generators, fire pump engines, combustion turbine) and other non-radiological emission-generating sources (e.g., storage tanks) or activities are not expected to be a significant source of criteria pollutant emissions especially with respect to ozone-precursor emissions (e.g., CO, NO_x and volatile organic compounds) in light of the non-attainment status for the 8-hour average ozone NAAQS in nearby Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller Counties.

Supporting equipment will only be operated on an intermittent test or emergency-use basis. Therefore, these emission sources will not be expected to impact ambient air quality levels in the vicinity of STP 3 & 4, nor within the 8-hour average ozone moderate non-attainment area in nearby Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller Counties. Likewise, because of the relatively long distance of separation from STP 3 & 4, visibility at any of the identified Class I Federal Areas will not be expected to be significantly impacted by project construction or facility operations.

Nevertheless, these non-radiological emission sources will be regulated by the Texas Commission on Environmental Quality (TCEQ) as required under Code of Federal Regulations, Title 30, Part 1, Chapters 101 through 122 depending on the source type, source emissions, and permitting requirements for construction and operation. Currently, STP 1 & 2 are covered by a Federal (Title V) operating permit. The Title V permit is a legally enforceable document that the TCEQ issues to certain air pollution sources after the source has begun to operate, for the purpose of reducing violations of air pollution laws and improving enforcement of those laws. In the case of STP 1 & 2, the Title V permit was renewed on January 25, 2006 and is valid until January 25, 2011 (Reference 2.3S-35). In addition, STP 1 & 2 has been issued a standard exemption or permit by rule for backup emergency generators. Under the permit by rule regulation, the maximum annual operating hours for the backup emergency generator shall not exceed 10% of the normal annual operating schedule of the primary equipment.

2.3S.3 Onsite Meteorological Measurements Program

The following site-specific supplement addresses COL License Information Item 2.10.

This section provides a discussion of the preoperational and operational meteorological monitoring programs for STP 3 & 4, including a description and site map showing tower locations with respect to manmade structures, topographic features, and other site features that can influence site meteorological measurements. In addition, a description of measurements made, including elevations and exposure of instruments; instruments used, including instrument performance specifications, calibration and maintenance procedures; data output and recording systems and locations; and data processing, archiving, and analysis procedures is provided (Reference 2.3S-36).

The STP 3 & 4 meteorological monitoring program consists of two phases:

- Preoperational Monitoring – Because of the proximity of STP 1 & 2, data collected by the STP 1 & 2 meteorological towers during 1997, 1999, and 2000 has been used to establish a baseline for identifying and assessing environmental impacts resulting from operation of STP 3 & 4. Additional relative humidity/temperature instrumentation at 10 and 60 meters were added in 2006 to baseline moisture content in the environment for a range of mechanical draft cooling towers to be considered for STP 3 & 4.

- Operational Monitoring – The current meteorological monitoring program for STP 1 & 2 is conducted in conformance with RG 1.23 (Reference 2.3S-28), and will continue to be used during the operational phase for all four units.

Data collected by the meteorological monitoring system is used to:

- Describe local and regional atmospheric transport and diffusion characteristics

- Calculate the dispersion estimates for both postulated accidental and expected routine airborne releases of effluents

- Evaluate environmental risk from the radiological consequences of a spectrum of accidents
- Provide an adequate meteorological database for evaluation of the effects from plant construction and operation, including radiological and non-radiological impacts and real-time predictions of atmospheric effluent transport and diffusion

2.3S.3.1 Site Description, Topographic Features of the Site Area and Location of Towers

The STP site is located in a rural area of south-central Matagorda County. Matagorda County lies in the Coastal Prairie region in the southeastern part of Texas, along the Gulf of Mexico. The prominent natural features of the region include: the Colorado River, which bisects the county from north to south; East and West Matagorda Bays, which are protected by the Matagorda Peninsula; and Tres Palacios Bay and River. The west branch of the Colorado River, along with several sloughs, flows through the STP site boundary.

The major local effect on site meteorology is the presence of the Gulf of Mexico, which is approximately 15 miles south of the STP site at its closest point. The site vicinity and site area maps with an 8-kilometer (5-mile), 16-kilometer (10-mile) and 80-kilometer (50-mile) radius are shown on Figures 2.3S-15, 2.3S-17, and 2.3S-14, respectively. As shown on Figure 2.3S-14, terrain within 80 kilometers (50 miles) of the STP site is generally flat with variations less than 31 meters (100 feet) to the north and west. A 30-mile long broad band of open prairie extends inland along the Gulf of Mexico, with elevations averaging approximately 7 meters (23 feet) above MSL.

A 60-meter guyed meteorological tower serves as the primary data collection system and a 10-meter freestanding tower serves as a backup to the primary system. The backup meteorological system is a completely independent system installed and maintained for the purpose of providing redundant site-specific meteorological information (10-meter wind speed, wind direction, temperature, and sigma theta), representative of the site environment. The locations of the meteorological towers with respect to the existing and proposed units are shown on Figure 2.3S-18. The primary tower is located approximately 2.1 kilometers (1.3 miles) east of STP 3 & 4, while the backup tower is approximately 670.5 meters (2200 feet) south of the primary tower. Both locations are clear of man-made and natural obstructions which could influence the collection of meteorological data.

Factors considered in determining the location and installation of the instruments include prevailing wind direction, topography, and location of man-made and vegetative obstructions.

2.3S.3.2 Preoperational Monitoring Program

RG 1.23 (Reference 2.3S-28) specifies the minimum amount of onsite meteorological data to be provided at the time of application for a combined license that does not reference an early site permit as a consecutive 24-month period of data that is defendable, representative, and complete, but not older than 10 years from the date of the application. It further states that three or more years of data are preferable.

The 1999 and 2000 consecutive 24-month period of data taken for STP 1 & 2 was determined to be the most defendable (using validated data with least data substitution), representative (tower and sensor siting in accordance with RG 1.23 (Reference 2.3S-28), and complete (with annualized data recovery rate well in excessive of 90%), without being older than 10 years. Since RG 1.23 specifies that three or more years of data is preferable, three years (i.e., 1997, 1999, and 2000) of STP 1 & 2 data is used in support of the preoperational monitoring program for STP 3 & 4.

The findings presented below indicate that these three years of data are suitable for use in characterizing the atmospheric dispersion conditions for STP 3 & 4.

2.3S.3.2.1 Measurements Made, Elevation and Exposure of Instruments

The meteorological monitoring system block diagrams reflecting the monitoring system configuration during 1997, 1999, and 2000 are provided as Figures 2.3S-19 and 2.3S-20 for the primary and backup towers, respectively.

2.3S.3.2.1.1 Measurements Made

The following measurements made during 1997, 1999, and 2000 constitute the preoperational monitoring program for STP 3 & 4:

- Primary Tower – Wind speed, wind direction and ambient temperature at two levels, with dew point temperature, solar radiation and precipitation at one level
- Backup Tower – Wind speed, wind direction and ambient temperature at a single level

2.3S.3.2.1.2 Instrument Elevations

The meteorological instrumentation is located at multiple levels on the 60-meter guyed primary tower, and at a single level on the 10-meter backup tower. The meteorological instrumentation on these towers is summarized in Table 2.3S-12.

On the primary tower, wind speed and wind direction are measured at 10 meters (33 feet) and 60 meters (197 feet) above ground level. The reactor building plant stack has a height of 76 meters (249 feet) above ground. The accident atmospheric release points for the ABWR include the plant stack and several other elevations below the upper wind measurement height (i.e., 60 meters). Meteorological parameters measured for these releases are consistent with the guidelines in RG 1.23 (Reference 2.3S-28).

Ambient temperature is monitored both at the 10- and the 60-meter levels. Vertical differential temperature (i.e., ΔT) is calculated as the difference between the temperatures measured at 10 meters and at 60 meters. Dew point temperature is measured at the 3-meter level. Additional relative humidity/temperature instrumentation at 10 and 60 meters were added in 2006 for calculation of dew point temperature. These measurement heights represent water vapor release from a range of mechanical draft cooling towers to be considered for STP 3 & 4. Precipitation is measured at ground level near the base of the primary tower, while the solar radiation is measured at 2.5 meters above ground.

Wind speed, wind direction, wind direction standard deviation (i.e., sigma theta for atmospheric stability class determination), and ambient temperature are obtained at the 10-meter level on the backup tower.

2.3S.3.2.1.3 Exposure of Instruments

The bases of both towers are at an elevation of approximately 8.5 meters (28 feet) MSL, while the finished plant grade of STP 3 & 4 is at 10.4 meters (34 feet) MSL along the road between STP 3 & 4, sloping to 9.8 meters (32 feet) MSL at the 4 corners of the power block. Because the base of the towers is at approximately the same elevation as the finished plant grade, and because there are minimal terrain variations within 8 kilometers (5 miles) of the site, as discussed in Subsection 2.3S.3.1, it is concluded that the locations of the meteorological tower sites and the proposed STP 3 & 4 have similar meteorological exposures. The tower and instrument siting conformance status in relation to RG 1.23 (Reference 2.3S-28) are summarized in Tables 2.3S-13 and 2.3S-14, respectively.

Obstructions

RG 1.23 states that the wind sensors should be located over level, open terrain at a distance of at least 10 times the height of any nearby natural or man-made obstructions (e.g., terrain, trees and buildings), if the height of the obstruction exceeds one-half the height of the wind measurements (Reference 2.3S-28). An assessment of instrument obstructions was made and is described below:

- The sizes of the environmental shelters housing the processing and recording equipment are: 3.4 meters x 3.4 meters x 3.3 meters (11 feet x 11 feet x 10.8 feet) for the primary system, and 2.4 meters x 3.0 meters x 2.7 meters (8 feet x 10 feet x 8.9 feet) for the backup system. These shelters are less than five meters in height, which is less than half of the lower level wind measurement height (10 meters), and are located downwind of the meteorological towers under the prevailing wind direction (i.e. south-southeast) to minimize wind turbulence and/or thermal effects on the meteorological measurements.
- The surrounding terrain, nearby trees, and plant structures (existing and planned) were evaluated below to determine whether they could affect the meteorological measurements:
  - As shown on Figure 2.3S-15, surrounding terrain of the meteorological towers is generally flat and no terrain-induced-airflow influence on the meteorological measurements is expected.
  - Both the primary and backup meteorological towers are located in open fields. The nearby trees and brush range from 15 feet to 30 feet tall and mostly at 300 feet or more from the towers. These trees are trimmed periodically to ensure that the 10 times obstruction-height requirement is met (Reference 2.3S-28).

- The tallest existing and planned buildings, which are located greater than 1.6 kilometers (1 mile) from the meteorological towers, for all four units are less than 76 meters (250 feet) in height. Separations between the meteorological towers and these buildings are much greater than 10 times their heights.

- Wind sensors are mounted on a boom extending eight feet outward on the upwind side of the tower to minimize tower structure influence.

Therefore, it is concluded that the meteorological measurements are free of influence from any nearby natural or man-made obstructions.

Heat and Moisture Sensors

Based on the structure layout as shown in Figures 2.3S-19 through 2.3S-22, the ambient temperature and dew point instrumentation on the existing towers were assessed to determine whether they would be affected by any heat or moisture sources (e.g., ventilation sources, cooling towers, water bodies, large parking lots, etc.) and the findings are presented below:

- Both the primary and backup towers are located on open fields with grassy surfaces underlying the tower. As shown in Figure 2.3S-18, there are no large concrete or asphalt parking lots or temporary land disturbances such as plowed fields or storage areas nearby. The closest large concrete or asphalt parking lots and ventilation sources are located at STP 1 & 2, which is more than one mile from the meteorological towers.

- The proposed plant cooling system for STP 3 & 4 includes the existing Main Cooling Reservoir (MCR) and two banks of mechanical draft cooling towers. As shown on Figure 2.3S-18, the MCR is approximately one mile southwest of the primary meteorological tower at its closest point, while the cooling towers are located directly west, at a distance greater than 1.3 miles from the meteorological towers. The STP 1 & 2 essential cooling pond is approximately 3500 feet and 2600 feet from the primary and backup towers, respectively.

With the large separation distance between the meteorological towers and the cooling towers and Essential Cooling Pond, their influence on the ambient temperature, dew point and relative humidity instrumentation is expected to be minimal. However, due to the relatively large size of the MCR (>7000 acres), it is expected that the MCR would have an influence on the observed meteorological data when the meteorological tower is downwind (south to southwest winds) from the MCR. For example, the dew point measurement is expected to be somewhat higher when the tower is downwind of the MCR and warmer temperatures from the MCR would tend to increase the lower level temperature and increase thermal instability. This effect would enhance the dispersion of releases occurring near the plant site under the south to southwest winds.

In addition, temperature sensors are mounted in fan-aspirated radiation shields, which are pointing downward to minimize the impact of thermal radiation and precipitation.

Wind Loss

The precipitation gauge is equipped with wind shields to minimize the loss of precipitation caused by wind.

2.3S.3.2.2 Description of Instruments Used

Sensor type, manufacturer, and model for the STP 1 & 2 meteorological data collection system during the preoperational monitoring period of 1997, 1999 and 2000 are provided in Table 2.3S-15. Block diagrams of the primary and backup systems are presented in Figures 2.3S-19 and 2.3S-20.

2.3S.3.2.2.1 Instrument Performance Specification

Sensor specifications (including sensor starting threshold, range, and measurement resolution), and system accuracy for the data collection system during the preoperational monitoring period are provided in Table 2.3S-15.

2.3S.3.2.2.2 Sensor Operating Experience

Meteorological sensors used on both the primary and backup meteorological towers are designed to operate in the environmental conditions found at the STP site. Specifically, this instrumentation is capable of withstanding the following environmental conditions

- Ambient temperature range of –4°F to +248°F
- Wind load up to 125 mph (55.88 m/s) @ 30 feet on a 100-year recurring interval
- Relative humidity range of 0% to 100%

In July of 2003, the eye of a small hurricane (Claudette) passed south of the site and both towers and their equipment at the 10-meter level survived winds in excess of 80 mph.

The instruments on the towers are off-the-shelf components and are used universally throughout the nuclear industry and others for the purpose of meteorological measurement. Based on operating experience, the only adverse operational effects that have been noted was the susceptibility of the rotating-cup and weather vane instruments to bearing wear and degradation due to the site environmental conditions that required the instruments to be replaced approximately every 6 months. This type of wind sensor was replaced in 2005 with an ultrasonic sensor that has no moving parts.

2.3S.3.2.3 Calibration and Maintenance Procedures

Calibration and maintenance of the onsite meteorological monitoring system are performed in accordance with RG 1.23, Regulatory Position C.5, Instrument Maintenance and Servicing Schedules (Reference 2.3S-28) and ANSI/ANS 3.11, Section 7, System Performance (Reference 2.3S-37).

The existing meteorological monitoring system is calibrated semi-annually at both the primary and backup towers, and channel checks are performed daily in order to achieve maximum data recovery. System operability is also checked by using the system dial-up capability to remotely monitor the system status.

Detailed instrument calibration procedures and acceptance criteria are strictly followed during system calibration. Calibrations verify and, if necessary, reestablish accuracies of sensors, associated signal processing equipment and displays. Routine calibrations include obtaining both “as-found” (prior to maintenance) and “as-left” (final configuration for operation) results. The end-to-end results are compared with expected values. Any observed anomalies which may affect equipment performance or reliability are reported for corrective action. If any acceptance criteria is not met during the performance of calibration procedures, timely corrective measures (e.g., adjusting response to conform with desired results by onsite qualified personnel or returning the sensor to the vendor for calibration) are initiated.

Inspection, service and maintenance, including preventive and/or corrective maintenance on system components for transmitting, manipulating, and/or processing meteorological data for computer display and storage, are performed according to the instrument manuals and plant surveillance program procedures to maintain at least 90% data recovery.

Maintenance and calibration activities on the primary tower are facilitated by the addition of an instrument elevator. The monitoring system is equipped with lightning protection and a redundant power supply.

2.3S.3.2.4 Data Output and Recording System and Location

Independent microprocessors are used as the primary data collection system for the primary and backup meteorological towers, with digital data recorders used as a backup data collection system.

The microprocessors sample the meteorological processor modules once per second for each parameter measured except for precipitation. Water collected by the rain gauge is automatically drained and counted each time an internal bucket fills with 0.01 inch of rainfall.

The microprocessors provide current sampling values as well as the 15- and 60-minute averages. Sigma theta is computed for each wind direction channel via the microprocessor. These calculated averages are output to the digital data recorders and on diskette and/or CD for system monitoring, data verification, and processing uses. In addition, the current values and the calculated averages including the data quality status flags are sent electronically to the Emergency Response Facility Data Acquisition and Display System (ERFDADS).

As shown on Figures 2.3S-19 and 2.3S-20, data was collected and stored by a RM21A computer independent of the meteorological tower and the local plant computers. From the retirement of the RM21A computer at the beginning of 2002 to present, data has been averaged on the meteorological tower computers and transmitted to the local plant computers for storage and report generation. Refer to Figures 2.3S-21 and 2.3S-22 for the system block diagrams for the current configuration.

Since December 2006, hourly average data from the new 10- and 60-meter dew point instruments has been recorded by a data logger attached to the base of the primary meteorological tower. Approximately once a week, the data is transmitted to a personal computer (PC) for review and electronic storage. A printed copy of the data is transmitted to the records management system for permanent storage approximately once per month.

The processing and recording equipment are housed in environmentally controlled (air conditioned) shelters. A direct readout capability from these recorders is included.

2.3S.3.2.5 Data Display, Processing, Archiving and Analysis

Following an upgrade of the meteorological instrumentation in 1994 to meet emergency preparedness requirements, data has been collected and electronically transmitted to various plant computers for data validation, screening, display, storage and report generation.

2.3S.3.2.5.1 Data Display

The ERFDADS provides 15-minute averages of meteorological data for real-time display in the Control Room, Technical Support Center, and Emergency Operations Facility in accordance with RG 1.97 (Reference 2.3S-36). The STP 1 & 2 control rooms also display current 15 minute and 60-minute averages for the 10-meter level wind speed and direction via analog meters.

The 15- and 60-minute averaged wind speed, wind direction, and atmospheric stability data are submitted as inputs to the NRC's ERDS and this data can be accessed by the NRC.

2.3S.3.2.5.2 Data Processing and Analysis

Computer programs are used in the screening process to identify recurring types of data errors, including the following items:

- Missing data (out-of-range values) and unchanging data for the 10-meter wind speed, wind direction, and ΔT for the primary tower.
- The daily average difference between the primary and backup tower wind speeds and wind directions measured at 10 meters.
- Periods of daytime stable and nighttime unstable conditions.

In addition, visual scanning of the 10-meter wind speed and direction data is routinely performed for abnormal values or inconsistency.

Hourly average data is downloaded and formatted monthly for review and editing. Acceptable data editing methods have been established and implemented. Missing or invalid primary tower 10-meter wind speed, wind direction, and ΔT data are manually replaced with backup tower data.

Dew point data screening consists of plotting the ground level (approximately 3 meters), 10 meter, and 60-meter dew point temperatures using a spreadsheet program. Periods of strong divergence suggest questionable data.

2.3S.3.2.5.3 Data and System Validation

The microprocessors provide validation checks on the 15-minute averaged data. These checks consist of electrical status (i.e., system within predefined calibration test limits) and meteorological validations. System validations include the following checks: AC power, generator on-line, propane level, aspirators (to reduce temperature measurement errors), and hard-disk availability. Meteorological validations are performed to ensure accurate data transmission from the sensors and include checks such as minimum wind speed, minimum wind direction, wind speed, and wind direction comparisons between the 10- and 60-meter levels, temperature ranges, and hourly ΔT limits.

2.3S.3.2.5.4 Data Archiving

An additional feature of the Data Acquisition System is the storage of the 15- and 60-minute averaged meteorological data. At a minimum, the latest 12 months of averaged data resides on the system hard-drive. The historical data can be retrieved, archived, displayed, or printed.

Hourly averaged data is stored on local plant computers for trending and reporting purposes in accordance with RG 1.21, (Reference 2.3S-39).

2.3S.3.2.6 System Accuracy

Sources of error for time-averaging digital systems include: sensors, cables, signal conditioners, temperature environments for signal conditioning and recording, equipment, recorders, processors, data displays, and data reduction process.

The system accuracies of the proposed STP 3 & 4 meteorological data collection system were compared against the regulatory requirements and the findings are summarized in Table 2.3S- 15. As shown in the table, the system accuracies of the proposed system meet the regulatory guidance in accordance with RG 1.23 (Reference 2.3S-28) and ANSI/ANS 3.11 (Reference 2.3S-37). In addition, the associated recording equipment accuracies are reported in Table 2.3S-16 (Reference 2.3S-40).

2.3S.3.3 Operational Program

The STP 1 & 2 onsite meteorological monitoring program is conducted in accordance with the guidance and system accuracy specified in RG 1.23 (Reference 2.3S-28). This program, including the calibration and maintenance procedures described in Subsection 2.3S.3.2.3, and the data display, processing, archiving, and analysis procedures described in Subsection 2.3S.3.2.5 will continue to be used as the operational onsite meteorological monitoring program for STP 1, 2, 3 & 4.

2.3S.3.3.1 Meteorological Instrumentation

The meteorological monitoring system block diagrams for the current system are provided in Figures 2.3S-21 and 2.3S-22 for the primary and backup towers, respectively. Sensor specifications (including sensor starting threshold, range, and measurement resolution), and system accuracy for the current configuration are provided in Table 2.3S-17.

All meteorological parameter data signals from the existing tower come through an analog-to-digital converter processor at the meteorological tower shelter, and then to the data logger for conversion, storage and transmission. The data logger converts, tracks, trends and transmits the data to shared data files located on two local computers. These shared data files are transmitted via wireless antenna to the Integrated Computer System (ICS), where the data is transmitted to all ICS workstations in the plants as well as in the emergency facilities. The ICS stores the data for 18 months, after which it is transferred to a designated facility for permanent storage.

Separate, independent data links to the new units, including data recording system, display, processing, analysis, and archiving for STP 3 & 4 will be designed and installed in accordance with the applicable regulatory requirements. The architecture of these systems and programs will be similar to those of the current meteorological data collection system for STP 1 & 2.

2.3S.3.3.2 Emergency Preparedness Support

The STP 3 & 4 onsite data collection system is used to provide representative meteorological data for use in real-time atmospheric dispersion modeling for dose assessments during and following any accidental atmospheric radiological releases. The data is also used to represent meteorological conditions within the 10-mile Emergency Planning Zone radius (References 2.3S-41, 2.3S-42, 2.3S-43, and 2.3S-44).

Similar to the STP 1 & 2 onsite meteorological monitoring program, the microprocessors sample the meteorological processor modules once per second for each of the following parameters in order to provide near real-time meteorological data for use in atmospheric dispersion modeling: wind speed, wind direction, and ambient temperature for calculations of vertical temperature difference. Dose assessment calculations are performed using the most recent 15-minute averaged data in accordance with RG 1.97 (Reference 2.3S-44).

In order to identify rapidly changing meteorological conditions for use in performing emergency response dose consequence assessments, 15-minute average values are compiled for real-time display in the STP 3 & 4 Control Room, Technical Support Center, and Emergency Operations Facility. All of the meteorological channels required for input to the dose consequence assessment models are available and presented in a format compatible for input to these dose assessment models.

Provisions are currently in place to obtain representative regional meteorological data from the NWS or Impact Weather Service (current meteorological contractor for STP 1 & 2) during an emergency if the site meteorological system becomes unavailable. The current (or similar) emergency plan procedures and the monitoring system arrangement will continue to be used for STP 3 & 4.

2.3S.3.4 Meteorological Data

Three years (1997, 1999, and 2000) of STP onsite meteorological data is provided with the application. This data was used to calculate (1) the short-term atmospheric dispersion estimates for accident releases discussed in Subsection 2.3S.4 and (2) the long-term atmospheric dispersion estimates for routing releases discussed in Subsection 2.3S.5.

2.3S.3.4.1 Representativeness and Adequacy of Data

The three years of data used in the atmospheric dispersion estimates was determined to be (1) the most defendable, because the data has been validated and require the least data substitution as discussed in Subsections 2.3S.3.2.3 and 2.3S.3.2.5, (2) representative, because the meteorological tower and sensor siting were performed in accordance with RG 1.23 (Reference 2.3S-28), as discussed in Subsection 2.3S.3.2.1, and (3) complete with annualized data recovery rate well in excessive of 90% as shown in Table 2.3S-18.

2.3S.3.4.1.1 Climatic Representativeness

Long-term meteorological data from Victoria, Corpus Christi, and Galveston NWS stations, along with onsite data from the STP site, has been examined extensively in the STP 1 & 2 UFSAR (Reference 2.3S-40). Comparisons show relatively close agreement between the offsite NWS data and the onsite data for average wind direction and speed, frequency of calm, wind direction persistence, prevailing wind direction, and atmospheric stability. Therefore, the onsite meteorological data is considered to be reasonably representative of the long-term climatological average.

2.3S.3.4.1.2 Long-Term Conditions

The annual wind rose for the 3-year data period 1997, 1999 and 2000 (Subsection 2.3S.2, Figure 2.3S-2), was compared against the wind rose from onsite data collected for the periods July 21, 1973 through July 20, 1976 and October 1, 1976 through September 30, 1977 (Reference 2.3S-40, Figure 2.3S-3) to show how well this data represents long-term conditions at the STP site.

Although the data periods are more than thirty years apart, the comparison shows that there is close correlation in wind distribution with predominant winds from the south-southeast as shown in Table 2.3S-19. The annual frequency of calms, as presented in the STP 1 & 2 UFSAR (Reference 2.3S-40, Table 2.3S-9), was 0.32%, which is just slightly higher than the percent of calm winds specified in the STP 3 & 4 FSAR 2.3S.2,

Figure 2.3S-2 (0.00%). The annual average wind speed (Reference 2.3S-39, Table 2.3S-9) is also slightly higher than the annual average wind speed presented in Table 2.3S-6 (10.7 mph vs. 9.2 mph, respectively). Therefore, these figures show relatively close agreement to each other.

The distribution of stability class for these two data sets is presented in Table 2.3S-20. As shown in the table, the two data sets show close agreement to each other.

The STP 1 & 2 UFSAR (Reference 2.3S-40) provides an evaluation showing that the onsite meteorological data is representative of the long-term climatological average; therefore, it is appropriate to conclude that the recent onsite data (i.e., 1997, 1999 and 2000) used in support of STP 3 & 4, is also reasonably representative of the long-term climatological average.

2.3S.3.4.1.3 Need for Additional Data Sources for Airflow Trajectories

Topographic features and the dispersion characteristics of the site area were examined in Subsections 2.3.2 and 2.3.3.1. The site area is generally flat and is concluded to be an open terrain site. The airflow in the site area is dominated mostly by large-scale weather patterns and infrequent recirculation of airflow during periods of prolonged atmospheric stagnation.

The NRC-sponsored computational model (XOQDOQ), based on RG 1.111 (Reference 2.3S-45), is a constant mean wind direction model, using meteorological data from a single station to calculate dispersion estimates out to 50 miles from a site of interest. Terrain induced airflow-recirculation factor options are provided in the model to account for the effects of airflow recirculation phenomenon occurring within the area of interest, when meteorological data from a single station is used to represent the entire modeling domain. However, application of airflow-recirculation factors for sites located within open terrain is not required. This methodology implies that the meteorological data from an onsite station is reasonably representative of the entire modeling domain and adjustment to the dispersion estimates calculated by the model out to 50 miles of a site located within open terrain is not required.

For coastal sites located within open terrain such as the STP site, an airflow-recirculation factor provided in the XOQDOQ model is used to account for potential airflow recirculation due to sea breeze and land breeze effects, and during the infrequent stagnation conditions that could lead to more restrictive dispersion estimates. With application of the appropriate airflow recirculation factor, this methodology further implies that using data collected from an onsite meteorological monitoring station located within open terrain for making dispersion estimates out to 50 miles of a coastal site is considered to be adequate and acceptable.

Therefore, data collected by the STP 1 & 2 collection system can be used for the description of atmospheric transport and diffusion characteristics within 80 kilometers (50 miles) of STP 3 & 4 and for making dispersion estimates out to 50 miles from the site. No other offsite data collection systems are necessary to determine the dispersion characteristics of the STP site area.

2.3S.3.4.1.4 Supplemental Data for Environmental Impact Evaluations

Meteorological data collected at the Palacios Municipal Airport was used to supplement the onsite STP data for environmental impact evaluations resulting from operation of STP 3 & 4. The weather station at Palacios Municipal Airport is an Automated Service Observation System (ASOS) Coop Station, at which continuous, hourly meteorological measurements (e.g., wind speed, wind direction, temperature, dew point, relative humidity, precipitation, visibility, cloud cover and altimeter) have been made since April 1, 1940. This ASOS Station is the closest national weather station, which is located on the west bank of the Palacios Bay and approximately 13.5 miles southwest of the STP site. The major local effect on the area meteorology is the presence of the Gulf of Mexico. Due to the relatively short distance between the Palacios ASOS station and the STP site and the similarity in meteorological exposure between these two locations, data collected at the Palacios ASOS station is considered to be representative of the STP site.

Data collected at the Palacios ASOS station (i.e., dew point, relative humidity, visibility, cloud cover and altimeter) from 1997 through 2001, in conjunction with the concurrent wind speed, wind direction and stability class determined from the existing STP meteorological monitoring program, was used to evaluated cooling tower plume impacts resulting from operation of STP 3 & 4.

For evaluation of the environmental risk from the radiological consequences of a spectrum of severe accidents, the same period of hourly precipitation data collected at the Palacios ASOS Station in conjunction with the concurrent wind speed, wind direction and stability class determined from the existing meteorological data collection system for STP 1 & 2 was used.

2.3S.3.4.2 Data Recovery Rate and Annual Joint Frequency Distribution of Data

Three years of representative data (i.e., 1997, 1999, and 2000) collected at the existing primary and backup towers are used in preparing the STP 3 & 4 COLA. The data set satisfies the guidance provided in RG 1.23 (Reference 2.3S-28).

The annualized data recovery rates for 1997, 1999, and 2000 are presented in Table 2.3S-18 for the individual parameters (i.e., wind speed and wind direction by stability class) and the composite parameters. As shown in the table, all data recovery rates exceed 90% as specified in RG 1.23 (Reference 2.3S-28).

The required joint frequency distributions are presented in Subsection 2.3S.2, Tables 2.3S-10 and 2.3S-11 in the format described in RG 1.23 for the following: wind speed and wind direction by stability class and by all stability classes combined for the 10- and 60-meter levels measurements.

2.3S.3.4.3 Supplemental Submittal to the Application

An electronic sequential, hour-by-hour listing of the data set, including stability class covering the three-year period (i.e., 1997, 1999, and 2000) in the format described in RG 1.23, has been generated and is provided with the application.

2.3S.4 Short-Term Atmospheric Diffusion Estimates for Accident Releases

The following site-specific supplement addresses COL License Information Item 2.11.

2.3S.4.1 Objective

To evaluate potential health effects of design-basis accidents at STP 3 & 4, a hypothetical accident is postulated to predict upper-limit concentrations and doses that might occur in the event of a containment release to the atmosphere. Site-specific meteorological data covering the 3-year period of record for 1997, 1999 and 2000 was used to quantitatively evaluate such a hypothetical accident at the site. Onsite data provide representative measurements of local dispersion conditions appropriate to the STP site and a 3-year period is considered to be reasonably representative of long-term conditions as discussed in Subsection 2.3S.3.2.3.

According to 10 CFR Part 100, (Reference 2.3S-46) it is necessary to consider the doses for various time periods immediately following the onset of a postulated radioactive airborne release at the exclusion area boundary (EAB) and for the duration of the exposure for the low population zone (LPZ) and the population center distances. The relative atmospheric dispersion factors (χ/Qs) are estimated for various time periods ranging from 2 hours to 30 days.

Meteorological data has been used to determine various postulated accident conditions as specified in RG 1.145 (Reference 2.3S-47). Compared to an elevated release, a ground-level release usually results in higher ground-level concentrations at downwind receptors due to less dispersion as a result of shorter traveling distances. Since the ground-level release scenario provides a bounding case, elevated releases are not considered. Approaches used in estimating χ/Qs follow guidance suggested in RG 1.145 (Reference 2.3S-47).

Portions of the EAB and the outer boundary of the LPZ extend over the MCR. Smaller surface roughness induced by the MCR would result in less turbulence, and consequently generates slightly higher χ/Qs at portions of the EAB and the LPZ that extend over the MCR. However, reduced surface roughness would also increase ambient wind speed slightly and reduce the χ/Qs due to better dispersion. The above effects counter each other and subsequently minimize the net effect of reduced surface roughness on the offsite short-term atmospheric dispersion estimates.

2.3S.4.2 Calculations

The PAVAN computer code, as described in NUREG/CR-2858 (Reference 2.3S-48), is used to estimate ground-level χ/Qs at the EAB and LPZ for potential accidental releases of gaseous radioactive material to the atmosphere. This assessment is required by 10 CFR Part 100 (Reference 2.3S-46).

As shown on Figure 2.1S-3 and as described in Subsection 2.1S.2, the EAB for STP 3 & 4 is an oval, centered at a point (305 ft) directly west of the center of the Unit 2 Reactor Building. Since the EAB is centered on the existing STP 1 & 2, the distances to the EAB from the envelope surrounding the STP 3 & 4 power block are different for each directional sector. These distances are specified in Table 2.3S-21.

The LPZ is a 3-mile radius circle centered at the same point as the EAB (Subsection 2.1S.2). The distances from the envelope surrounding the STP 3 & 4 power block to the LPZ are specified in Table 2.3S-21.

The PAVAN program implements the guidance provided in RG 1.145 (Reference 2.3S-47). The code computes χ/Qs at the EAB and LPZ for each combination of wind speed and atmospheric stability class for each of 16 downwind direction sectors (i.e., north, north-northeast, northeast, etc.). The χ/Q values calculated for each direction sector are then ranked in descending order, and an associated cumulative frequency distribution is derived based on the frequency distribution of wind speeds and stabilities for the complementary upwind direction sector. The χ/Q value that is equaled or exceeded 0.5% of the total time becomes the maximum sector-dependent χ/Q value.

The calculated χ/Q values are also ranked independent of wind direction to develop a cumulative frequency distribution for the entire site. The PAVAN program then selects the χ/Qs that are equaled or exceeded 5% of the total time.

The larger of the two values (i.e., the maximum sector-dependent 0.5% χ/Q or the overall site 5% χ/Q value) is used to represent the χ/Q value for a 0-2 hour time period. To determine χ/Qs for longer time periods, the program calculates an annual average χ/Q value using the procedure described in RG 1.111 (Reference 2.3S-45). The program then uses logarithmic interpolation between the 0-2 hours χ/Qs for each sector and the corresponding annual average χ/Qs to calculate the values for intermediate time periods (i.e., 0-8 hours, 8-24 hours, 1-4 days, and 4-30 days).

The PAVAN model has been configured to calculate offsite χ/Q values assuming both wake-credit allowed and wake-credit not allowed. For all sectors, the EAB and LPZ are located beyond the wake influence zone induced by the Reactor Building. Therefore, the “wake-credit not allowed” scenario of the PAVAN results has been used for the χ/Q analyses at both the EAB and the LPZ.

The PAVAN model input data is presented below:

- Meteorological data: 3-year (1997, 1999 and 2000) composite onsite joint frequency distributions (JFDs) of wind speed, wind direction, and atmospheric stability (see Subsection 2.3S.3).
- Type of release: Ground-level
- Wind sensor height: 10 meters
- Vertical temperature difference: as measured at the 10-meter and 60-meter levels of the primary meteorological tower
- Number of wind speed categories: 11
- Release height: 10 meters (default height)

- Distances from release point to EAB for all downwind sectors
- Distances from release point to LPZ for all downwind sectors

The PAVAN model uses building cross-sectional area and containment height to estimate wake-related χ/Q values. If the EAB and the LPZ are both located beyond the building wake influence zone, these two input parameters have no effect in calculating the non-wake χ/Q values.

To be conservative, the shortest distance in each sector from the STP 3 & 4 power block envelope to the EAB was entered as input for each downwind sector to calculate the χ/Q values at the EAB. Similarly, the shortest distance from the STP 3 & 4 power block envelope to the LPZ is entered as input to calculate the χ/Q values at the LPZ.

2.3S.4.2.1 Postulated Accidental Radioactive Releases

2.3S.4.2.1.1 Offsite Dispersion Estimates

Based on the PAVAN modeling results, the maximum 0 to 2-hour, 0.5 percentile, direction-dependent χ/Q value is compared with the 5 percentile overall site 0 to 2-hour χ/Q value at the EAB. The higher of the two is used as the proper χ/Q at the EAB for each time period. The same approach is used to determine the proper χ/Qs at the LPZ.

The PAVAN-generated 0.5% value maximum χ/Qs presented in Tables 2.3S-23 and 2.3S-24 for the EAB and the LPZ, respectively, are summarized below for the 0 to 2-hour time period, the annual average time period, and other intermediate time intervals evaluated by the PAVAN model.

Receptor Location	0 – 2 hours	0 – 8 hours	8 – 24 hours	1 – 4 days	4 – 30 days	Annual Average
EAB	2.74E-04	1.85E-04	1.52E-04	1.02E-04	5.96E-05	3.09E-05
LPZ	5.27E-05	2.45E-05	1.67E-05	7.57E-06	2.59E-06	7.09E-07

The results provided in Tables 2.3S-23 and 2.3S-24 show that the χ /Q values determined by the PAVAN modeling analyses at the EAB and LPZ, respectively, are bounded by the ABWR standard plant site design parameters as defined in Table 2.0-1 of the reference ABWR DCD. The PAVAN-predicted maximum 0-2 hours EAB 0.5% χ/Q (2.74E-04), as well as the maximum 2-hour EAB 5% χ/Q value (1.62E-04), is lower than the corresponding reference ABWR DCD EAB χ/Q value (1.37E-03). Similarly, the PAVAN-predicted maximum 0-2 hours LPZ 0.5% χ/Q value (5.27E-05), as well as the maximum 2-hour 5% χ/Q value (3.99E-05), is lower than the corresponding reference ABWR DCD LPZ χ/Q value (4.11E-04).

2.3S.4.2.1.2 Onsite Dispersion Estimates

In addition, χ/Qs are estimated at the control room and the Technical Support Center (TSC) for postulated accidental radioactive airborne releases.

Control room χ/Qs are estimated using the ARCON96 model as described in NUREG/CR-6331 (Reference 2.3S-50) and considers the control room air intake height, release height, release type, and building area. Hourly meteorological data collected onsite during 1997, 1999, and 2000 is used as part of the input for the ARCON96 program. The three years of meteorological data identified above in Subsection 2.3S.4.1 all have data recovery rates of greater than 90%, and are representative of the site dispersion characteristics as described in Subsection 2.3S.3.

As discussed in Subsection 15.6.5.5.3 of the reference ABWR DCD, the control room may be contaminated from two sources: the Reactor Building stack base or the Turbine Building truck doors. Subsection 11.3.10 of the reference ABWR DCD also provides information on radioactive releases. The locations of the sources and receptors are provided in Figure 2.3S-23. RG 1.194 (Reference 2.3S-51) provides guidance on the use of ARCON96 for determining χ/Qs to be used in design basis evaluation of control room radiological habitability. The Reactor Building stack base, at 26.2 meters and the Turbine Building truck doors, located at the ground level, were treated as ground-level sources. For STP 3 & 4, each unit has two control room air intakes and a TSC air intake (as shown in Figure 2.3S-23). These three intakes were treated as receptors in ARCON96 modeling.

The reactor building plant stack is located close to the middle of the west side of the Reactor Building; the turbine building truck doors are located to the north-west corner of the Turbine Building. The control room air intakes are located to the north-west (designated as B in Table 2.3S-25) and north-east (designated as C in Table 2.3S-25) corners of the Control Building; the TSC air intake is conservatively assumed to be located at the southwest comer ofthe Service Building for Reactor Builqing releases and at the northwest corner of the Service Building for Turbine Building releases. Guidelines provided in RG 1.194 (Reference 2.3S-51) were followed in estimating the χ/Q values at the control room and TSC air intakes.

The 95 percentile control room and TSC χ/Qs for time averaging (0 to 2 hours, 2 to 8 hours, 8 to 24 hours, 1 to 4 days and 4 to 30 days) obtained from the ARCON96 modeling results are summarized in Table 2.3S-25.

The results provided in Table 2.3S-25 show that the χ/Q values determined by the ARCON96 modeling analyses at the control room and TSC air intakes for Reactor Building stack releases are bounded by the corresponding χ/Q values in Tables 15.6-3, 15.6-7, 15.6-13, 15.6-14, and 15.6-18 of the reference ABWR DCD, except in two instances.

The ARCON96 modeling results show that the maximum 4-30 day χ/Q value at one of the control room air intakes due to Reactor Building stack base releases is 5.59 E-04, which is slightly greater than the maximum 4-30 day χ/Q value of 5.12E-04 from DCD table 15.6-14. Also, the maximum 4-30 day χ/Q value at the same intake for turbine building truck door releases is 9.15E05. As discussed in a foot note for DCD Table 15.6-14, the control room χ/Q values for releases from turbine building are a factor of six less than reactor building χ/Q values. Therefore, the 4-30 day average control room χ/Q value (5.12E-04) due to reactor building releases (see DCD Table 15.6-14) is equivalent to a control room χ /Q value of 8.53E-05 for turbine building releases. The ARCON96-calculated 4-30 day control room χ/Q values due to reactor building plant stack (5.59E-04) and turbine building truck door (9.15E-05) releases slightly exceeds the corresponding DCD χ/Q values of 5.12E-04 and (8.53E-05), respectively. The maximum 4-30 days χ/Q values exceed the corresponding reference ABWR DCD χ/Q values by 9% and 7%, respectively. The exceedance of a χ/Q value does not result in the violation of the NRC dose limit. The ultimate factor that would affect the plant design is the radiation dose as discussed in FSAR Section 15.6.

2.3S.4.2.2 Hazardous Material Releases

Pollutant concentrations are also estimated at the STP 3 & 4 control room and the TSC air intakes for postulated accidental releases of hazardous materials (i.e., flammable vapor clouds, toxic chemicals, and smoke from fires) from materials stored onsite, offsite and for toxic or flammable material transported on nearby transport routes. The concentrations at the control room and TSC intakes due to accidental hazardous chemical releases (toxic vapor and flammable cloud) were determined using the guidance specified in RG 1.78 (Reference 2.3S-52).

Detailed description of potential accidents to be considered as design-basis events and their impacts are discussed in Subsection 2.2S.3.1. The effects of the potential explosion events from both internal and external sources are summarized in Tables 2.2S-9 and 2.2S-10. Estimated values of control room concentrations due to potential hazardous material releases are presented in Table 2.2S-11. The analyses indicate that none of the potential events would adversely affect the safe operation or shutdown of STP 3 & 4.

2.3S.5 Long-Term Atmospheric Dispersion Estimates for Routine Releases

The following site-specific supplement addresses COL License Information Item 2.12.

2.3S.5.1 Objective

This section provides estimates of annual average atmospheric dispersion factors (χ/Q values) and relative dry deposition factors (D/Q values) to a distance of 50 miles (80 kilometers) from the STP site for annual average release limit calculations and person-rem estimates.

The NRC-sponsored XOQDOQ computer program (Reference 2.3S-53) was used to estimate χ/Q and D/Q values from routine releases of gaseous effluents to the atmosphere. The XOQDOQ computer code has the primary function of calculating annual average χ/Q and D/Q values at receptors of interest (e.g., site boundaries, nearest milk animal, nearest resident, nearest vegetable garden, and nearest meat animal). RG 1.206 (Reference 2.3S-36) calls for χ/Q and D/Q estimates at the above receptor of interest. 10 CFR Part 100 (Reference 2.3S-46) requires an "exclusion area" surrounding the reactor in which the reactor licensee has the authority to determine all activities, including exclusion or removal of personnel and property. Since the Exclusion Area Boundary (EAB) encompasses the shortest site boundary, the direction-dependent exclusion area boundaries were conservatively used in χ/Q and D/Q estimates.

The XOQDOQ dispersion model implements the assumptions outlined in RG 1.111 (Reference 2.3S-45). The program assumes that the material released to the atmosphere follows a Gaussian distribution around the plume centerline. In estimating concentrations for longer time periods, the Gaussian distribution is assumed to be evenly distributed within a given directional sector. A straight-line trajectory is assumed between the release point and all receptors.

Since the NRC-sponsored XOQDOQ model was used in the analysis, diffusion parameters (σ_y and σ_z) as specified in RG 1.145 (Reference 2.3S-47) and implemented by the XOQDOQ code were used in estimating the χ/Q and D/Q values. The following input data and assumptions have been used in the XOQDOQ modeling analysis:

- Meteorological data: 3-year (1997, 1999, and 2000) composite onsite joint frequency distributions of wind speed, wind direction, and atmospheric stability (see Subsection 2.3S.3). The determinations for the atmospheric stability classes were based on the vertical ΔT method as specified in RG 1.145 (Reference 2.3S-47).
- Type of release: Ground-level
- Wind sensor height: 10 meters
- Vertical temperature difference: (10 meters - 60 meters)
- Number of wind speed categories: 11
- Release height: 10 meters (default height)
- Minimum building cross-sectional area: 2134 m^2 (reactor building structure, including building tapers and all appurtenances)
- Reactor building height: 37.7 meters above grade
- Distances from the release point to the nearest residence, nearest EAB boundaries, vegetable garden, milk animal, and meat animal.
- No residential milk cows have been identified within 5 miles of the STP site, and no dairies have been identified within 50 miles. It is conservatively assumed that all residents have a vegetable garden and are fattening a calf for residential consumption.

- χ/Q and D/Q values at the Unit 4 reactor were estimated based on the assumption that the Unit 3 reactor is operational while the Unit 4 reactor is still under construction.

The ABWR reactor design has been used to calculate the minimum building cross-sectional area as called for in NUREG/CR-2919 (Reference 2.3S-53) for evaluating building downwash effects on dispersion.

Distances from the STP 1 & 2 reactors to various receptors of interest (i.e., nearest residence, meat animal, site boundary, and vegetable garden) for each directional sector are provided in the STP 1 & 2 Offsite Dose Calculation Manual (Reference 2.3S-54). The shortest distances from the STP 3 & 4 Reactor Building plant stacks to these same receptors of interest are recalculated for each directional sector. The results are presented in Table 2.3S-26. Tables 2.3S-26a and 2.3S-26b provide downwind distances to the EAB and site boundary in each sector that were used to derive the set of maximum annual EAB and site boundary χ/Q and D/Q values.

Smaller surface roughness leads to minimal changes in χ/Q values. Lower surface roughness over the MCR would increase wind speeds resulting in lower χ/Q values. This is balanced by decreasing production of mechanical turbulence, leading to decreased dispersion and higher χ/Q. The decrease in turbulence is also offset by the increased destabilization over the MCR due to the heating from below of the overwater trajectories. Warm water in the MCR heating ambient air from below will destabilize the atmosphere passing over the MCR. Increased instability will, in turn, enhance local dispersion, lowering overall routine release χ/Q values. In addition, Sea Breezes from the Gulf of Mexico will tend to increase routine release χ/Q values due to local air recirculation. The cool air moving from the Gulf of Mexico will tend to stabilize the atmosphere, in addition to the recirculation of polluted air.

Because cooling water temperatures will slightly increase local ambient air temperatures, the presence of the MCR will increase local air instability. Increased instability will, in turn, enhance local dispersive properties, lowering overall routine release χ/Q values. In addition, sea breezes from the Gulf of Mexico will tend to increase routine release χ/Q values due to local air recirculation.

To account for possible effects from Matagorda Bay and the Gulf of Mexico on local meteorological conditions, default correction factors were implemented in the XOQDOQ (and PAVAN) model(s). These factors were implemented to satisfy section C2.c of RG 1.111 (Reference 2.3S-45) and properly account for possible recirculation due to land-water boundaries, which could raise χ/Q values in an open terrain area such as the STP plant site.

As discussed in Subsection 2.3S.3, the onsite meteorological data provides representative measurements of local dispersion conditions appropriate to the STP 3 & 4 site, and a 3-year period is considered to be reasonably representative of long-term conditions for routine releases. Therefore, the lower level (10 meter) 3-year (1997, 1999 and 2000) joint frequency distributions of wind speed, wind direction, and atmospheric stability were used as input in the XQODOQ modeling analysis.

2.3S.5.2 Calculations

Table 2.3S-27 summarizes the maximum relative concentration and relative deposition (i.e., χ/Q and D/Q) values predicted by the XOQDOQ model for identified sensitive receptors of interest in the STP site area due to routine releases of gaseous effluents. The listed maximum χ/Q values reflect several plume depletion scenarios that account for radioactive decay: no decay and the default half-life decay periods of 2.26 and 8 days. The no decay and 2.26 day decay χ/Q values assume no dry deposition and the 8 day decay χ/Q values assume dry deposition.

The overall maximum annual average χ/Q value with no decay is 8.3E-05 sec/m^3 and occurs at the Unit 4 Reactor Building due to the releases from the Unit 3 Reactor Building. The maximum annual average χ/Q values with no decay (along with the direction and distance of the receptor locations relative to the STP site) for the other sensitive receptor types are:

- 6.3E-07 sec/m^3 for the nearest resident occurring in the WSW sector at a distance of 2.18 miles.
- 6.3E-07 sec/m^3 for the nearest vegetable garden and meat animal occurring in the WSW sector at a distance of 2.18 miles.
- 8.1E-06 sec/m^3 for the nearest site boundary occurring in the NNW sector at a distance of 0.69 mi.

Tables 2.3S-28 and 2.3S-29 summarize the annual average χ/Q values (for no decay) and D/Q values for 22 standard radial distances between 0.25 mile and 50 miles, and for 10 distance-segment boundaries between 0.5 mile and 50 miles downwind along each of the 16 standard direction radials separated by 22.5°.

2.3S.6 References

2.3S-1 "2005 Local Climatological Data, Annual Summary with Comparative Data, Victoria, Texas," National Climatic Data Center (NCDC), NESDIS, NOAA, 2006.

2.3S-2 "Climatography of the United States, No. 20, 1971-2000, Monthly Station Climate Summaries," NCDC, CD-ROM, NESDIS, NOAA, July 2005.

2.3S-3 "Climatography of the United States, No. 81, 1971-2000, U.S. Monthly Climate Normals," NCDC, CD-ROM, National Environmental Satellite, Data and Information Service (NESDIS), NOAA, February 2002.

2.3S-4 "Cooperative Summary of the Day, TD3200, Period of Record (POR) through 2001 (Includes Daily Weather Data from the Central United States)," NCDC, Version 1.0 (CD-ROM), data listings Danevang 1W, Aransas WR, Matagorda 2, Edna Highway 59 Bridge, and Thompsons 3 WSW, NOAA, June 2002.

2.3S-5 "U.S. Summary of Day Climate Data (DS 3200/3210), POR 2002-2005," NCDC, CD-ROM, NOAA, July 2006.

2.3S-6 Standard Review Plan, NUREG-0800, Revision 3, Local Meteorology, March 2007.

2.3S-7 Solar and Meteorological Surface Observation Network, 1962-1999, Volume II, Central U.S, National Climate Data Center – National Renewal Energy Lab, 1993.

2.3S-8 "Hourly United States Weather Observations," NCDC 1990-1995, CD-ROM, NCDC, National Oceanic and Atmospheric Administration (NOAA), October 1997.

2.3S-9 "2005 ASHRAE Handbook – Fundamentals, Chapter 28, Climatic Design Information," American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Atlanta, Georgia, 2005.

2.3S-10 ASCE Standard ASCE/SEI-7-05, Minimum Design Loads for Buildings and Other Structures, American Society of Civil Engineers (ASCE) and Structural Engineering Institute, 2005.

2.3S-11 "Seasonal Variation of 10-Square Mile Probable Maximum Precipitation Estimates, United States East of the 105^{th} Meridian," NRC, NUREG/CR-1486, Hydrometerological Report No. 53, June 1980.

2.3S-12 "Coastal Services Center, Historical Hurricane Tracks Storm query, 1851 through 2005," NOAA, National Ocean Service. Available at http://hurricane.csc.noaa.gov/hurricanes/viewer.html, accessed June 29, 2007.

2.3S-13 "The Climatic Atlas of the United States," NCDC, Version 2.0 (CD-ROM), NCDC, Climate Services Division, NOAA, September 2002.

2.3S-14 "Storm Events for Texas, Hail Event, and snow and Ice Event Summaries," NCDC, NOAA. Available at http://wwwr.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms, accessed June 2007.

2.3S-15 "Storm Data (and Unusual Weather Phenomena with Late Reports and Corrections), January 1959 (Volume 1, Number 1) to January 2004 (Volume 46, Number 1)," NCDC, complete set of monthly hardcopy issues purchased as PDF files on CD-ROM from NCDC, NCDC, NESDIS, NOAA, June 2004.

2.3S-16 "Climatology for the United States (1948-1998)," Wang, J.X.L., and J.K. Angell, Air Stagnation NOAA Air Resources Laboratory Atlas No. 1, Air Resources Laboratory, Environmental Research Laboratories, Office of Oceanic and Atmospheric Research, Silver Spring, Maryland, April 1999.

2.3S-17 "Climatography of the United States, No. 85, Divisional Normals and Standard, Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000 (and previous normal periods), Section 1 (Temperature) and Section 2 (precipitation)," NCDC, NESDIS, NOAA, June 15, 2002.

2.3S-18 "Design Basis Tornado and Tornado Missiles for Nuclear Power Plants," RG 1.76, Revision 1, March 2007.

2.3S-19 "Tornado Climatology of the Contiguous United States," NUREG/CR-4461, (PPNL-15112, Rev.1) February 2007.

2.3S-20 "Texas Climate for Angleton 2W, Aransas WR, Bay City Waterworks, Danevang 1W, Freeport 2NW, Palacios Municipal AP, Pierce 1E, Point Comfort, Port O'Connor, Thompsons 3 WSW, and Victoria Regional Airport," Utah State University, Utah Climate Center, 2007. Available at http://climate.usurf.
usu.edu/, accessed May 23, 2007.

2.3S-21 National Climatic Data Center, Cooperative Select Station, Cooperative Select Form, Texas, Port O'Connor, 2006-07, NCDC, NOAA, Available at http://www7.ncdc.noaa.gov/IPS/statuscooppdf.html, accessed May 22, 2007.

2.3S-22 "Climatology of the United States No. 60, Texas Climatology," NCDC, Available athttp://www5.ncdc.noaa.gov/climatenormals/clim60/states/Clim_Texas_01.pdf, accessed June 29, 2007.

2.3S-23 “Weather World 2010, the Online Guides for Meteorology – Precipitation,” University of Illinois at Urbana-Champaign (UIUC). Available at http://ww2010.atmos.edu (Gh)/guides/mtr/cld/prep/home.rxml, accessed June 27, 2007.

2.3S-24 “Summary of Items of Engineering Interest,” U.S. Department of Agriculture Rural Utilities Service, Rural Utilities Service, RUS Technical Publication 1998.

2.3S-25 Ten-year U.S. Flash Density, 1989-1999 Average U.S. Flashes/km^2/yr, http://www.nssl.noaa.gov/primer/lightning/imags/ltgflash_density.jpg.accessed July 18, 2007.

2.3S-26 Ventilation Database of Mean Monthly AM and PM Mixing Heights and Wind speed; http://airfire.org/vcis-cgi/graphics.htm, accessed April 13, 2007.

2.3S-27 National Climatic Data Center, Integrated Surface Hourly Data, 1995-1999, CDROM, Volume 8, Central United States of America, NCDC, NESDIS, NOAA, September 2002.

2.3S-28 “Meteorological Monitoring Programs for Nuclear Power Plants,” RG 1.23, Revision 1, March 2007.

2.3S-29 “Standard Review Plans for Environmental Reviews for Nuclear Power Plants,” NRC, NUREG-1555, October 1999.

2.3S-30 40 CFR, 1.38 Metropolitan. Houston-Galveston Intrastate Air Quality Control Region, 62 FR 30272, June 3, 1997.

2.3S-31 40 CFR Protection of the Environment, Part 50 - National Ambient Primary and Secondary Ambient Air Quality Standards for Criteria Pollutants, 2007.

2.3S-32 40 CFR 81.344, Designation of Areas for Air Quality Planning Purposes, Attainment Status Designations, Texas.

2.3S-33 40 CFR 81.429, Title 40 Protection of Environment, Part 81.429 Designation of Areas for Air Quality Planning – Texas, Designation of Areas for Air Quality Planning, Subpart D—Identification of Mandatory Class I Federal Areas Where Visibility Is an Important Value. Big Bend National Park and Guadalupe Mountains National Park.

2.3S-34 40 CFR 81.412, Title 40 Protection of Environment, Part 81.412 Designation of Areas for Air Quality Planning – Louisiana, Designation of Areas for Air Quality Planning Purposes, Subpart D—Identification of Mandatory Class I Federal Areas Where Visibility Is an Important Value: Breton Wildlife.

2.3S-35 Texas Commission on Environmental Quality (TCEQ), Air Permit Search Database (Title V and New Source Review). Available at http://www2.tceq.state.tx.us/airpermit/index.ctm, accessed July 16, 2007.

2.3S-36 "Combined License Applications for Nuclear Power Plants (LWR Edition)," RG 1.206, Revision 0, June 2007.

2.3S-37 ANS/ANSI American National Standard for Determining Meteorological Information at Nuclear Facilities, ANS/ANSI 3.11- 2005, December 2005.

2.3S-38 "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following An Accident," RG 1.97, Revision 3, May 1983.

2.3S-39 "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants," NRC, RG 1.21, Revision 1, June 1974.

2.3S-40 STPEGS Updated Safety Analysis Report, Units 1 and 2, Revision 13.

2.3S-41 "Functional Criteria for Emergency Response Facilities," NUREG-0696, Final Report, February 1981.

2.3S-42 "Clarification of TMI Action Plan Requirements," NUREG-0737, Final Report, November 1980.

2.3S-43 "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," NUREG-0654, Revision 1, Appendix 2, FEMA-REP-1, March 2002.

2.3S-44 "Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants," RG 1.97, Revision 4, June 2006.

2.3S-45 "Method for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors," RG 1.111, Revision 1, July 1977.

2.3S-46 10 CFR 100, Title 10, Energy, Part 100, Reactor Site Criteria.

2.3S-47 "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants," RG 1.145, Revision 1, November 1982 (Reissued February 1983).

2.3S-48 NRC, PAVAN: An Atmospheric Dispersion Program for Evaluating Design Basis Accidental Releases of Radioactive Materials from Nuclear Power Stations, NUREG/CR-2858, PNL-4413, November 1982.

2.3S-49 Not Used.

2.3S-50 "Atmospheric Relative Concentrations in Building Wakes," NUREG/CR 6331, Revision 1, May 1997.

2.3S-51 "Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants," RG 1.194, June 2003.

2.3S-52 "Assumptions for Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release," RG 1.78, Revision 1, December 2001.

2.3S-53 NRC, XOQDOQ: Computer Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations, NUREG/CR-2919, September 1982.

2.3S-54 Offsite Dose Calculation Manual (ODCM), Revision 15, South Texas Project.

2.3S-55 "TX068.46 Clean Air Act Reclassification of the Houston/Galveston/Brazoria Ozone Nonattainment Area; Texas; Final Rule" *Code of Federal Regulations* Title 40, Pt. 81, (1 October 2008) p. 56983-56995. [Available at http://www.regulations.gov].

2.3S-56 "Designation of Areas for Air Quality Planning Purposes". *Code of Federal Regulations*, Title 40, Pt. 81, Subpart C, Section 107. Accessed on December 9, 2008. [Available at http://ecfr.gpoaccess.gov].

2.3S-57 National Climatic Data Center, Climate Data Online, Surface Data, Monthly, NCDC, NOAA, Available at http://cdo.ncdc.noaa.gov/cgi-bin/cdo/cdostnsearch.pl, accessed November 20, 2008.

2.3S-58 National Climatic Data Center, Climate Data Online, Surface Data, Daily - US, Data Access, NCDC, NOAA, http://cdo.ncdc.noaa.gov/CDO/cdo, accessed November 24, 2008.

2.3S-59 NOAA Central Library U.S. Daily Weather Maps Project NCDC, NOAA, http://www.hpc.ncep.noaa.gov/dwm/dwm.shtml, accessed December 9, 2008.

2.3S-60 References Manual, WBAN Hourly Surface Observations 144, National Climatic Data Center, Revised, November 1970.

2.3S-61 National Climatic Data Center, Integrated Surface Hourly Data, 1995-99, CD-ROM, Volume 8, Central United States of America, NCDC, NESDIS, NOAA, September 2002.

2.3S-62 National Climatic Data Center. Integrated Surface Hourly Observations, 2000, CDROM, Volume 15, United States of America, NCDC, NESDIS, NOAA, September 2002.

2.3S-63 National Climatic Data Center. Integrated Surface Hourly Observations, 2001, CDROM, Volume 19, United States of America, NCDC, NESDIS, NOAA, January 2003.

2.3S-64 National Climatic Data Center. Integrated Surface Hourly Observations, 2002, CDROM, Volume 23, United States of America, NCDC, NESDIS, NOAA, August 2003.

2.3S-65 National Climatic Data Center. Integrated Surface Hourly Observations, 2003, DVDROM, Global Data Set, United States of America, NCDC, NESDIS, NOAA, October 2004.

2.3S-66 National Climatic Data Center. Integrated Surface Hourly Observations, 2004, DVDROM, Global Data Set, United States of America, NCDC, NESDIS, NOAA, June 2005.

2.3S-67 National Climatic Data Center. Integrated Surface Hourly Observations, 2005, DVDROM, Global Data Set, United States of America, NCDC, NESDIS, NOAA, August 2006.

2.3S-68 Palacios Municipal Airport, Quality Controlled Local Climatological Data,1988-1994, 2006 and 2007, National Climatic Data Center.

2.3S-69 Palacios Municipal Airport, Annual Climatological Summary, 2001-2007, National Climatic Data Center.

2.3S-70 Regulatory Guide 1.221, "Design-Basis Hurricane and Hurricane Missiles for Nuclear Power Plants," Revision 0, October 2011.

Table 2.3S-1 NWS and Cooperative Observing Stations Near the STP 3 & 4 Site

Station [1]	County	Approximate Distance (miles)	Direction Relative to Site	Elevation (feet)
Matagorda 2	Matagorda	10	SE	10
Palacios Municipal Airport	Matagorda	13	WSW	12
Bay City Waterworks	Matagorda	13	NNE	52
Danevang 1W	Wharton	20	NNW	70
Maurbro	Jackson	26	WNW	30
Pierce 1E	Wharton	31	NNW	105
Point Comfort	Calhoun	32	WSW	20
Port O’Connor	Calhoun	34	SW	5
Wharton	Wharton	36	N	111
Edna Highway 59 Bridge	Jackson	40	WNW	68
Freeport 2NW	Brazoria	43	ENE	8
Angleton 2W	Brazoria	44	NE	27
Victoria Regional Airport [2]	Victoria	53	W	115
Thompsons 3 WSW	Fort Bend	54	NNE	72
Aransas Wildlife Refuge	Aransas	56	SW	15

NOTES:

[1] Numeric and letter designators following a station name (e.g., Pierce 1E) indicate the station’s approximate distance in miles (e.g., 1) and direction (e.g., east) relative to the place name (e.g., Pierce).

[2] National Weather Service First-Order Station

Table 2.3S-2 Local Climatological Data Summary for Victoria, Texas

NORMALS, MEANS, AND EXTREMES

VICTORIA, TX (VCT)

LATITUDE: 28° 51′ 45″ N | LONGITUDE: 96° 55′ 47″ W | ELEVATION (FT): GRND: 103 BARO: 106 | TIME ZONE: CENTRAL (UTC + 6) | WBAN: 12912

	ELEMENT	POR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE °F	NORMAL DAILY MAXIMUM	30	62.8	66.6	73.4	79.2	85.1	90.3	93.4	93.7	89.9	83.0	73.0	65.2	79.6
	MEAN DAILY MAXIMUM	48	63.8	67.5	73.8	80.5	85.7	91.0	93.7	94.1	89.5	83.1	73.4	66.3	80.2
	HIGHEST DAILY MAXIMUM	44	88	95	97	98	101	106	104	107	111	99	93	88	111
	YEAR OF OCCURRENCE		1971	1986	1989	1963	1964	1998	1964	1962	2000	1991	1988	1964	SEP 2000
	MEAN OF EXTREME MAXS.	48	79.3	82.0	85.9	89.6	92.7	96.1	98.3	99.4	96.3	92.1	86.2	81.0	89.9
	NORMAL DAILY MINIMUM	30	43.6	46.7	53.9	60.1	68.1	73.3	75.0	74.6	70.3	61.6	52.3	45.2	60.4
	MEAN DAILY MINIMUM	48	43.6	46.6	53.3	61.4	68.2	73.4	75.1	74.7	70.6	61.6	52.3	45.5	60.5
	LOWEST DAILY MINIMUM	44	14	19	21	33	49	59	62	62	48	31	24	9	9
	YEAR OF OCCURRENCE		1982	1985	2002	1987	1978	1984	1967	2004	2000	1993	1976	1989	DEC 1989
	MEAN OF EXTREME MINS.	48	26.0	29.9	35.1	44.6	56.1	65.4	70.3	69.7	57.5	45.3	35.3	28.3	47.0
	NORMAL DRY BULB	30	53.2	56.7	63.7	69.7	76.6	81.8	84.2	84.2	80.1	72.3	62.7	55.2	70.0
	MEAN DRY BULB	48	53.8	57.0	63.6	70.9	77.0	82.2	84.4	84.3	80.2	72.3	62.8	56.1	70.4
	MEAN WET BULB	20	50.0	53.2	58.2	64.6	71.3	75.3	76.2	76.1	72.8	66.2	58.3	51.7	64.5
	MEAN DEW POINT	20	46.0	49.1	53.9	60.5	68.4	72.7	73.1	73.1	69.5	62.8	54.6	47.7	60.9
	NORMAL NO. DAYS WITH:														
	MAXIMUM $\geq$ 90°	30	0.0	0.1	0.4	0.8	6.3	20.2	28.0	27.9	18.5	4.9	0.1	0.0	107.2
	MAXIMUM $\leq$ 32°	30	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4
	MINIMUM $\leq$ 32°	30	4.1	2.2	0.5	0.0	0.0	0.0	0.0	0.0	0.0	*	0.6	3.1	10.5
	MINIMUM $\leq$ 0°	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H/C	NORMAL HEATING DEG. DAYS	30	372	249	113	28	1	0	0	0	1	22	145	317	1248
	NORMAL COOLING DEG. DAYS	30	18	26	84	181	368	514	601	597	454	248	83	29	3203
RH	NORMAL (PERCENT)	30	77	76	75	74	78	77	74	75	76	76	77	77	76
	HOUR 00 LST	30	84	84	84	85	89	90	89	88	88	88	87	85	87
	HOUR 06 LST	30	88	88	88	89	92	93	93	94	93	91	90	88	91
	HOUR 12 LST	30	65	63	60	59	62	60	55	56	59	58	61	64	60
	HOUR 18 LST	30	69	64	62	62	67	66	60	62	65	67	71	71	66
S	PERCENT POSSIBLE SUNSHINE														
W/O	MEAN NO. DAYS WITH:														
	HEAVY FOG(VISBY$\leq$1/4 MI)	43	7.1	5.1	5.2	3.9	2.3	0.6	0.3	0.3	1.3	3.5	6.0	6.1	41.7
	THUNDERSTORMS	43	1.5	1.9	2.9	3.4	6.3	7.0	7.3	9.7	8.0	3.8	2.2	1.5	55.5
CLOUDINESS	MEAN:														
	SUNRISE-SUNSET (OKTAS)	1			6.4			4.0							
	MIDNIGHT-MIDNIGHT (OKTAS)														
	MEAN NO. DAYS WITH:														
	CLEAR	1	3.0	5.0	8.0		5.0	9.0							
	PARTLY CLOUDY	1		1.0	3.0		9.0	6.0							
	CLOUDY	1	1.0	3.0	10.0		3.0	5.0							
PR	MEAN STATION PRESSURE(IN)	31	30.01	29.97	29.87	29.84	29.79	29.82	29.88	29.87	29.85	29.92	29.96	30.01	29.90
	MEAN SEA-LEVEL PRES. (IN)	20	30.15	30.10	30.02	29.96	29.93	29.94	30.01	29.99	29.98	30.04	30.09	30.14	30.03
WINDS	MEAN SPEED (MPH)	28	10.3	10.8	10.9	11.2	10.4	9.4	8.6	8.2	8.0	8.7	9.6	9.8	9.7
	PREVAIL.DIR(TENS OF DEGS)	25	36	36	16	16	16	16	18	18	04	36	36	36	16
	MAXIMUM 2-MINUTE:														
	SPEED (MPH)	9	43	43	39	47	41	39	62	43	41	43	40	40	62
	DIR. (TENS OF DEGS)		17	15	36	11	07	29	05	26	04	35	29	33	05
	YEAR OF OCCURRENCE		1996	2001	1996	2004	1999	2003	2003	1996	1998	1998	2003	1997	JUL 2003
	MAXIMUM 5-SECOND:														
	SPEED (MPH)	9	52	52	47	64	59	48	83	45	53	52	51	47	83
	DIR. (TENS OF DEGS)		30	15	35	11	22	30	04	27	12	35	30	33	04
	YEAR OF OCCURRENCE		1998	2001	1996	2004	2004	2003	2003	1996	2001	1998	2003	1997	JUL 2003
PRECIPITATION	NORMAL (IN)	30	2.44	2.04	2.25	2.97	5.12	4.96	2.90	3.05	5.00	4.26	2.64	2.47	40.10
	MAXIMUM MONTHLY (IN)	44	7.76	9.08	11.61	11.70	14.66	13.50	13.59	8.97	19.05	12.44	16.14	6.97	19.05
	YEAR OF OCCURRENCE		1991	1992	1997	1997	1993	2004	1990	2001	1978	1997	2004	1975	SEP 1978
	MINIMUM MONTHLY (IN)	44	0.02	0.23	0.18	T	0.01	T	0.05	0.34	1.11	0.34	0.02	0.36	T
	YEAR OF OCCURRENCE		1971	1988	1971	1987	1998	1980	1997	1965	1982	1987	1981	1972	APR 1987
	MAXIMUM IN 24 HOURS (IN)	44	4.70	3.21	5.04	9.87	8.45	9.30	8.41	6.14	8.51	8.15	9.20	6.12	9.87
	YEAR OF OCCURRENCE		1991	1992	1997	1991	1972	1977	1990	1964	1967	1994	2004	1975	APR 1991
	NORMAL NO. DAYS WITH:														
	PRECIPITATION $\geq$ 0.01	30	8.8	7.3	6.9	6.4	7.4	8.4	7.2	8.8	9.9	7.3	7.5	8.1	94.0
	PRECIPITATION $\geq$ 1.00	30	0.6	0.6	0.7	0.8	1.7	1.7	0.9	0.9	1.5	1.3	0.6	0.6	11.9
SNOWFALL	NORMAL (IN)	30	0.1	0.*	0.*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.*	0.*	0.1
	MAXIMUM MONTHLY (IN)	36	2.1	1.0	T	0.0	T	0.0	0.0	T	0.0	0.0	0.2	T	2.1
	YEAR OF OCCURRENCE		1985	1973	1990		1993			1994			1976	1990	JAN 1985
	MAXIMUM IN 24 HOURS (IN)	36	2.1	1.0	T	0.0	T	0.0	0.0	T	0.0	0.0	0.2	T	2.1
	YEAR OF OCCURRENCE		1985	1973	1990		1993			1994			1976	1990	JAN 1985
	MAXIMUM SNOW DEPTH (IN)	39	2	3	0	0	0	0	0	0	0	0	0	0	3
	YEAR OF OCCURRENCE		1985	1958											FEB 1958
	NORMAL NO. DAYS WITH:														
	SNOWFALL $\geq$ 1.0	30	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2

Source: Reference 2.3S-1

Table 2.3S-3 Climatological Extremes at Selected NWS and Cooperative Observing Stations in the STP 3 & 4 Site Area

Station	Maximum Temperature (°F)	Minimum Temperature (°F)	Max 24-Hr Rainfall (inches)	Max Monthly Rainfall (inches)	Max 24-Hr Snowfall (inches)	Max Monthly Snowfall (inches)
Matagorda 2	104 [a] (09/06/00)	9 [a] (12/23/89)	15.71 [a] (05/01/11)	20.75 [a] (10/86)	5.0 [c] (12/25/04)	5.0 [c] (12/04)
Palacios Muni Airport	107 [a] (09/05/00)	9 [a] (12/23/89)	9.65 [a] (05/07/51)	24.28 (10/49) [1]	4.0 [b, d] (02/12/58)	4.0 [b, d] (02/58)
Bay City Waterworks	109 [a, b] (09/06/00) [g]	7 [a, b] (12/24/89) [h]	20.85 (10/19/83) [1]	24.02 (10/83) [1]	3.8 [b, d] (02/12/58)	3.8 [b, d] (02/58)
Danevang 1W	109 [a, b] (09/06/00) [i]	7 [a] (01/23/40)	12.96 [a] (06/26/60)	24.01 [b, d] (08/45)	10.5 [n] (12/25/04)	10.5 [n] (12/04)
Maurbro	107 [b, d] (07/27/54)	8 [b, d] (01/31/49)	14.80 [b, d] (06/26/60)	22.47 [b, d] (06/60)	4.0 [b, d] (02/13/60)	4.0 [b, d] (02/60)
Pierce 1E	112 [a] (09/05/00)	4 [a] (01/31/49)	8.85 [a] (11/02/43)	23.37 (11/04) [1]	8.0 b, [d] (02/13/60)	8.0 [b, d] (02/60)
Point Comfort	107 [a] (09/06/00)	9 [a] (12/23/89)	14.65 [a] (06/26/60)	25.24 [b, d] (06/60)	Trace [a] (11/28/76)	Trace [a] (11/76)
Port O'Connor	105 [a] (09/06/00)	10 [a] (12/23/89)	12.50 [a] (07/10/76)	24.51 (10/84) [1]	1.3 [a] (02/09/73)	1.3 [a] (02/73)
Wharton	NA [f]	NA [f]	11.58 (10/18/94) [1]	20.06 (11/04) [1]	7.0 [b, d] (02/13/60)	7.0 [b, d] (02/60)
Edna Hwy 59 Bridge	105 [1] 8/12/69	17 [1] 01/12/73	17.58 [b, d] (10/18/94)	20.97 [b, d] (10/94)	NA [f]	NA [f]
Freeport 2NW	105 [a, b] (09/06/00) [g]	13 [a] (12/26/83)	16.72 [a] (07/26/79)	31.61 [a] (09/79)	2.0 b, [d] (02/12/58)	3.0 b, [d] (01/40)
Angleton 2W	107 [a] (09/05/00)	7 [a, b] (12/24/89) [h]	14.36 [a] (07/26/79)	22.13 [a] (07/79)	3.0 [b, d] (01/22/40)	3.0 [b, d] (01/40)
Victoria Regional Airport	111 [a] (09/05/00)	9 [a] (12/23/89)	9.87 [a] (04/05/91)	19.05 [a] (09/78)	3.3 [m] (02/12/58)	3.4 [1] (02/58)
Thompsons 3WSW	106 [c] (07/07/05)	8 [a] (12/23/89)	9.53 [a] (09/19/83)	18.15 [b, d] (06/60)	1.5 [a, b, d] (02/09/73) [j]	1.5 [a, b, d] (02/73) [j]
Aransas Wildlife Refuge	102 [a, b] (09/06/00) [k]	9 [a] (12/23/89)	14.25 [a] (11/01/74)	19.08 [a] (09/79)	5.5 [c] (12/25/04)	5.5 [c] (12/04)

Notes:

[a] Reference 2.3S-2
[b] Reference 2.3S-4
[c] Reference 2.3S-5
[d] Reference 2.3S-3
[e] Reference 2.3S-21
[f] NA = Measurements not made at this station
[g] Occurs on multiple dates: 09/04/00; 09/06/00 (most recent date shown in table)
[h] Occurs on multiple dates: 12/23/89; 12/24/89 (most recent date shown in table)
[i] Occurs on multiple dates: 09/05/00; 09/06/00 (most recent date shown in table)
[j] Occurs on multiple dates: 02/13/60; 02/09/73 (most recent date and/or month shown in table)
[k] Occurs on multiple dates: 05/03/84; 05/04/84; 09/06/00 (most recent date shown in table)
[l] Reference 2.3S-57
[m] Reference 2.3S-58
[n] Reference 2.3S-20

Table 2.3S-4 Morning and Afternoon Mixing Heights and Wind Speeds for the STP Site Area

Period	Statistic [1]	Mixing Height (m, AGL) [2]		Wind Speed – (m/sec)	
		AM	PM	AM	PM
January	Min	267	554	3.2	2.9
	Max	550	1004	4.9	4.2
	Mean	416	843	4.2	3.7
February	Min	294	717	3.1	2.9
	Max	582	1227	5	4.3
	Mean	429	979	4.2	3.7
March	Min	283	872	3.7	3.1
	Max	773	1478	5.1	4.7
	Mean	521	1127	4.5	4.0
April	Min	302	836	4.0	3.4
	Max	892	1577	5.3	4.7
	Mean	615	1147	4.7	4.1
May	Min	378	859	3.6	2.6
	Max	909	1574	5.8	4.7
	Mean	608	1224	4.7	3.9
June	Min	209	1056	3.7	2.7
	Max	1036	1850	5.5	4.1
	Mean	469	1418	4.4	3.6
July	Min	191	1095	3.4	2.9
	Max	602	1904	5.2	4.2
	Mean	351	1518	4.1	3.5
August	Min	193	1181	2.8	2.7
	Max	606	2005	4.8	4.2
	Mean	340	1570	3.9	3.5
September	Min	174	1122	3.1	2.8
	Max	614	1737	5.0	4.4
	Mean	346	1390	3.8	3.5
October	Min	197	972	2.9	2.6
	Max	530	1724	5.0	4.2
	Mean	333	1282	3.9	3.5
November	Min	278	741	3.3	2.9
	Max	582	1342	4.9	4.4
	Mean	399	1051	4.2	3.7
December	Min	267	577	3.5	2.6
	Max	593	1102	5.1	4.2
	Mean	392	853	4.2	3.7

Table 2.3S-4 Morning and Afternoon Mixing Heights and Wind Speeds for the STP Site Area (Continued)

Period	Statistic [1]	Mixing Height (m, AGL) [2]		Wind Speed – (m/sec)	
		AM	PM	AM	PM
Winter	Mean	412	892	4.2	3.7
Spring	Mean	581	1166	4.6	4.0
Summer	Mean	387	1502	4.1	3.5
Autumn	Mean	359	1241	4.0	3.6
Annual	Mean	435	1200	4.2	3.7

Sources: USDA-Forest Service 2007 (Reference 2.3S-26)

Notes:

[1] Monthly minimum, maximum and mean values are based directly on summaries available from USDA - Forest Service Ventilation Climate Information System (VCIS) (Reference 2.3S-26) (USDA 2007). Seasonal and annual mean values represent weighted averages based on the number of days in the appropriate months.

[2] AGL = above ground level

Table 2.3S-5 Climatological Normals at Selected NWS and Cooperative Observing Stations in the STP 3 & 4 Site Area

	Normal Annual Temperatures (OF) [1]				Normal Annual Precipitation	
Station	Daily Maximum	Daily Minimum	Daily Range	Daily Mean	Rainfall [1] (inches)	Snowfall [2] (inches)
Matagorda 2	77.5	61.8	15.7	69.7	43.75	0.1
Palacios Muni Airport	77.2	61.1	16.1	69.2	45.40	0.1
Bay City Waterworks	80.6	61.2	19.4	70.9	48.03	0.0
Danevang 1W	79.0	58.5	20.5	68.8	45.37	0.2
Maurbro [3]	–	–	–	–	–	–
Pierce 1E	79.7	58.0	21.7	68.9	45.92	Trace
Point Comfort	79.7	62.4	17.3	71.1	43.87	Trace
Port O’Connor	76.4	65.0	11.4	70.7	34.78	0.1
Wharton	–	–	–	–	45.62	–
Edna Hwy 59 Bridge	–	–	–	–	42.17	–
Freeport 2NW	77.6	62.1	15.5	69.8	50.66	Trace
Angleton 2W	78.5	59.9	18.6	69.2	57.24	0.1
Victoria Regional Airport	79.6	60.4	19.2	70.0	40.10	0.3
Thompsons 3WSW	79.6	59.3	20.3	69.5	45.81	0.1
Aransas Wildlife Refuge	77.5	62.9	14.6	70.2	40.83	Trace

[1] Reference 2.3S-3
[2] Reference 2.3S-2
[3] Station decommissioned in 1966

Table 2.3S-6 Seasonal and Annual Mean Wind Speeds for the STP 3 & 4 Site (1997, 1999, and 2000) and the Victoria, Texas NWS Station (1971–2000, Normals)

Primary Tower Elevation	Location	Winter	Spring	Summer	Autumn	Annual
Upper Level (60 m) (m/sec)	STP 3 & 4 Site	6.5	6.5	5.4	5.6	6.0
Lower Level (10 m) (m/sec)	STP 3 & 4 Site	4.5	4.7	3.7	3.6	4.1
Single Level (6.1 m) (m/sec)	Victoria Regional Airport [1]	4.6	4.8	3.9	3.9	4.3

Notes:

Winter = December, January, February
Spring = March, April, May
Summer = June, July, August
Autumn = September, October, November

[1] Reference 2.3S-1

Table 2.3S-7 Wind Direction Persistence/Wind Speed Distributions for the STP 3 & 4 Site – 10-Meter Level

Site Name: STP — **Period of Record: 1/1/1997 00:00 to 12/31/1997 23:00 and 1/1/1999 00:00 to 12/31/2000 23:00**
Number of Sectors Included: 1 — **Width in Degrees: 22.5**
Measurement Height, m: 10 — **Speed Sensor: 1** — **Direction Sensor: 1**

Speed Greater than or Equal to:5.00 mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	WSW	SW	WSW	W	WNW	NW	NNW
1	1532	1342	996	835	1123	1607	2951	3368	3182	1195	499	172	170	243	529	1110
2	1007	828	523	412	601	932	1931	2274	2313	709	248	62	66	109	311	723
4	534	354	162	144	261	419	999	1228	1329	282	63	13	15	39	138	362
8	158	85	14	34	76	126	320	405	418	62	5	1	1	6	37	115
12	55	29	0	10	30	48	126	137	142	22	0	0	0	0	6	37
18	3	5	0	3	9	7	33	23	24	9	0	0	0	0	0	10
24	0	0	0	0	1	0	8	5	3	3	0	0	0	0	0	2
30	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Speed Greater than or Equal to:10.00 mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	WSW	SW	WSW	W	WNW	NW	NNW
1	849	455	275	295	475	823	1563	1744	1685	455	188	47	24	59	244	655
2	575	259	137	163	302	534	1075	1188	1200	286	96	10	5	29	157	440
4	303	110	33	68	156	267	578	629	637	122	23	0	1	10	82	221
8	89	33	0	26	57	85	191	199	175	33	0	0	0	1	23	70
12	25	9	0	10	29	27	74	77	45	18	0	0	0	0	4	20
18	0	0	0	3	9	0	25	19	3	8	0	0	0	0	0	1
24	0	0	0	0	1	0	8	5	0	2	0	0	0	0	0	0
30	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Speed Greater than or Equal to:15.00 mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	WSW	SW	WSW	W	WNW	NW	NNW
1	313	93	28	57	170	285	402	396	200	57	33	7	7	12	96	254
2	197	44	8	31	116	193	252	240	127	38	13	1	3	5	62	155
4	84	18	0	15	63	99	119	113	55	21	1	0	1	0	30	68
8	9	3	0	5	22	31	23	20	8	4	0	0	0	0	7	16
12	0	0	0	1	10	6	1	5	1	0	0	0	0	0	0	4
18	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.3S-7 Wind Direction Persistence/Wind Speed Distributions for the STP 3 & 4 Site – 10-Meter Level (Continued)

Site Name: STP | Period of Record: 1/1/1997 00:00 to 12/31/1997 23:00 and 1/1/1999 00:00 to 12/31/2000 23:00

Number of Sectors Included: 1 | Width in Degrees: 22.5

Measurement Height, m: 10 | Speed Sensor: 1 | Direction Sensor: 1

Speed Greater than or Equal to:20.00 mph

Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	WSW	SW	WSW	W	WNW	NW	NNW
1	45	1	1	0	14	43	51	39	13	1	4	1	2	0	14	55
2	22	0	0	0	9	23	26	16	7	0	1	0	1	0	5	31
4	5	0	0	0	5	8	6	2	4	0	0	0	0	0	0	10
8	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	3
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Speed Greater than or Equal to:25.00 mph

Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	WSW	SW	WSW	W	WNW	NW	NNW
1	3	0	0	0	2	4	7	4	0	0	0	0	0	0	0	6
2	1	0	0	0	1	2	5	2	0	0	0	0	0	0	0	2
4	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Speed Greater than or Equal to:30.00 mph

Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	WSW	SW	WSW	W	WNW	NW	NNW
1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.3S-8 Wind Direction Persistence/Wind Speed Distributions for the STP 3 & 4 Site – 60-Meter Level

Site Name: STP
Number of Sectors Included: 1
Measurement Height, m: 60

Period of Record: 1/1/1997 00:00 to 12/31/1997 23:00 and 1/1/1999 00:00 to 12/31/2000 23:00
Width in Degrees: 22.5
Speed Sensor: 2 Direction Sensor: 2

Speed Greater than or Equal to:5.00 mph
Direction

HoursN	NNE	NE	ENE	E	ESE	SE	SSE	S	WSW	SW	WSW	W	WNW	NW	NNW
1 1658	1347	1120	1038	1353	1835	3170	4159	3600	1372	529	222	225	304	568	1173
2 1140	818	620	547	791	1147	2235	3087	2695	855	270	81	86	158	345	784
4 648	356	237	213	346	524	1238	1855	1571	366	88	17	18	52	167	409
8 254	78	39	53	77	150	438	674	539	77	14	1	1	6	46	132
12 113	18	5	28	19	53	187	245	202	13	0	0	0	0	10	34
18 40	0	0	16	7	10	51	55	36	0	0	0	0	0	0	3
24 10	0	0	10	1	0	16	8	6	0	0	0	0	0	0	0
30 3	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
36 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Speed Greater than or Equal to:10.00 mph
Direction

HoursN	NNE	NE	ENE	E	ESE	SE	SSE	S	WSW	SW	WSW	W	WNW	NW	NNW
1 1363	1009	783	714	982	1429	2588	3520	2936	1033	346	118	99	84	354	950
2 971	633	460	419	630919	1814	2611	2207	672	184	47	43	43	217	657	
4 573	276	185	170	296	446	969	1546	1282	308	62	8	13	15	108	349
8 229	64	31	44	70	142	309	553	442	70	10	0	1	1	37	118
12 101	16	3	25	19	53	121	206	164	11	0	0	0	0	7	31
18 37	0	0	16	7	10	43	53	28	0	0	0	0	0	0	1
24 10	0	0	10	1	0	16	8	4	0	0	0	0	0	0	0
30 3	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
36 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Speed Greater than or Equal to:15.00 mph
Direction

HoursN	NNE	NE	ENE	E	ESE	SE	SSE	S	WSW	SW	WSW	W	WNW	NW	NNW
1 768	432	275	233	367	597	986	1471	1387	471	132	26	37	20	165	576
2 517	251	143	132	213	384	676	1045	988	299	65	3	14	6	97	383
4 283	99	48	60	97	208	382	593	534	130	12	0	3	1	46	195
8 97	20	3	35	27	74	128	221	172	16	0	0	0	0	12	67
12 36	3	0	24	4	24	51	97	63	4	0	0	0	0	0	14
18 11	0	0	15	0	3	12	22	12	0	0	0	0	0	0	0
24 3	0	0	9	0	0	5	5	2	0	0	0	0	0	0	0
30 0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
36 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.3S-8 Wind Direction Persistence/Wind Speed Distributions for the STP 3 & 4 Site – 60-Meter Level (Continued)

Site Name: STP
Number of Sectors Included: 1
Measurement Height, m: 60

Period of Record: 1/1/1997 00:00 to 12/31/1997 23:00 and 1/1/1999 00:00 to 12/31/2000 23:00
Width in Degrees: 22.5
Speed Sensor: 2
Direction Sensor: 2

Speed Greater than or Equal to:20.00 mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	WSW	SW	WSW	W	WNW	NW	NNW
1	241	60	20	37	80	191	233	410	335	139	25	3	16	4	60	234
2	148	21	5	19	45	123	147	254	212	75	8	0	7	0	34	149
4	69	6	0	8	19	60	75	115	101	32	1	0	2	0	14	67
8	8	0	0	0	3	14	15	25	23	6	0	0	0	0	1	19
12	0	0	0	0	0	3	0	6	4	0	0	0	0	0	0	2
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Speed Greater than or Equal to:25.00 mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	WSW	SW	WSW	W	WNW	NW	NNW
1	45	3	1	0	1	22	27	75	51	20	8	0	5	0	7	65
2	25	0	0	0	0	9	10	33	29	9	3	0	2	0	3	31
4	8	0	0	0	0	2	0	5	16	1	0	0	0	0	1	13
8	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	3
12	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Speed Greater than or Equal to:30.00 mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	WSW	SW	WSW	W	WNW	NW	NNW
1	5	0	0	0	0	3	5	13	10	1	2	0	2	0	0	11
2	1	0	0	0	0	1	2	5	5	0	1	0	0	0	0	7
4	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	3
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.3S-9 Seasonal and Annual Vertical Stability Class and 10-Meter Level Wind Speed Distributions for the STP 3 & 4 Site (1997, 1999, and 2000)

	Vertical Stability Categories [1]						
Period	***A***	***B***	***C***	***D***	***E***	***F***	***G***
Winter							
Frequency (%)	9.25	3.85	5.07	33.13	28.52	9.65	10.52
Wind Speed (m/sec)	5.9	5.5	5.4	5.4	4.2	2.8	2.0
Spring							
Frequency (%)	11.63	6.43	7.27	39.27	24.12	6.70	4.57
Wind Speed (m/sec)	6.1	5.5	5.6	5.4	3.7	2.3	1.9
Summer							
Frequency (%)	19.74	5.62	6.44	20.02	32.27	13.05	2.87
Wind Speed (m/sec)	4.8	4.3	4.3	4.2	3.4	1.8	1.5
Fall							
Frequency (%)	14.33	5.32	4.57	22.04	23.35	13.28	17.10
Wind Speed (m/sec)	4.5	4.6	4.9	4.8	3.4	2.3	1.9
Annual							
Frequency (%)	13.73	5.31	5.85	28.67	27.07	10.65	8.72
Wind Speed (m/sec)	5.2	5.0	5.1	5.1	3.7	2.3	1.9

[1] Vertical stability based on temperature difference (DT) between 60-meter and 10-meter measurement levels.

Table 2.3S-10 Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the STP 3 & 4 Site (1997, 1999, and 2000)

Hours at Each Wind Speed and Direction

Period of Record: 1997, 1999, 2000 Total Period

Elevation: **Speed**: PT SPD10 **Direction**: PT DIR10 **Lapse**: PT DT60-10

Stability Class: A ΔT Extremely Unstable

Wind Direction (from)	0.23-0.50	0.51-0.75	0.76-1.00	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	> 18.0	Total
						Wind Speed (m/s)							
N	0	0	0	1	6	15	40	29	19	0	0	0	110
NNE	0	0	0	1	4	20	39	27	4	0	0	0	95
NE	0	0	0	2	3	25	58	19	3	0	0	0	110
ENE	0	0	0	1	4	12	38	9	3	0	0	0	67
E	0	0	0	0	2	11	27	14	11	0	0	0	65
ESE	0	0	0	0	5	9	36	38	37	0	0	0	125
SE	0	0	0	0	3	11	114	144	63	2	0	0	337
SSE	0	0	0	0	1	13	119	186	86	1	0	0	406
S	0	0	0	0	4	46	450	588	79	2	0	0	1169
SSW	0	0	0	0	7	39	206	140	37	0	0	0	429
SW	0	0	0	1	2	34	72	43	18	0	0	0	170
WSW	0	0	0	0	6	10	13	6	5	0	0	0	40
W	0	0	0	0	4	11	16	4	3	0	0	0	38
WNW	0	0	0	2	3	31	26	16	3	0	0	0	81
NW	0	0	0	2	5	15	25	32	17	0	0	0	96
NNW	0	0	0	1	1	22	52	45	32	1	0	0	154
Totals	0	0	0	11	60	324	1331	1340	420	6	0	0	3492

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	879
Number of Valid Hours for this Table	3492
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-meter and 10-meter measurement levels.

Table 2.3S-10 Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the STP 3 & 4 Site (1997, 1999, and 2000) (Continued)

Hours at Each Wind Speed and Direction

Period of Record: 1997, 1999, 2000 Total Period

Elevation: **Speed**: PT SPD10 **Direction**: PT DIR10 **Lapse**: PT DT60-10F

Stability Class: B ΔT Moderately Unstable

	Wind Speed (m/s)												
Wind Direction (from)	**0.23-0.50**	**0.51-0.75**	**0.76-1.00**	**1.1-1.5**	**1.6-2.0**	**2.1-3.0**	**3.1-5.0**	**5.1-7.0**	**7.1-10.0**	**10.1-13.0**	**13.1-18.0**	**> 18.0**	**Total**
N	0	0	0	2	4	8	21	9	9	0	0	0	53
NNE	0	0	0	0	2	8	29	10	4	0	0	0	53
NE	0	0	0	0	2	14	26	9	1	0	0	0	52
ENE	0	0	0	2	2	8	24	9	1	0	0	0	46
E	0	0	0	1	2	6	15	7	5	1	0	0	37
ESE	0	0	0	0	4	4	29	45	23	2	0	0	107
SE	0	0	0	0	1	14	73	100	48	0	0	0	236
SSE	0	0	0	1	6	18	86	90	27	0	0	0	228
S	0	0	0	1	3	20	140	80	19	0	0	0	263
SSW	0	0	0	0	0	18	37	11	4	0	0	0	70
SW	0	0	0	0	3	7	12	11	2	0	0	0	35
WSW	0	0	0	0	2	10	9	1	0	0	0	0	22
W	0	0	0	0	2	6	3	2	1	1	0	0	15
WNW	0	0	1	0	2	15	6	1	3	0	0	0	28
NW	0	0	0	2	1	6	11	13	8	0	0	0	41
NNW	0	0	0	2	1	10	17	24	10	1	0	0	65
Totals	0	0	1	11	37	172	538	422	165	5	0	0	1351

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	879
Number of Valid Hours for this Table	1351
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-meter and 10-meter measurement levels.

Table 2.3S-10 Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the STP 3 & 4 Site (1997, 1999, and 2000) (Continued)

Hours at Each Wind Speed and Direction

Period of Record: 1997, 1999, 2000 Total Period

Elevation: **Speed**: PT SPD10 **Direction**: PT DIR10 **Lapse**: PT DT60-10

Stability Class: C ΔT Slightly Unstable

	Wind Speed (m/s)												
Wind Direction (from)	**0.23-0.50**	**0.51-0.75**	**0.76-1.00**	**1.1-1.5**	**1.6-2.0**	**2.1-3.0**	**3.1-5.0**	**5.1-7.0**	**7.1-10.0**	**10.1-13.0**	**13.1-18.0**	**> 18.0**	**Total**
N	0	0	1	1	4	8	23	23	21	0	0	0	81
NNE	0	0	0	1	3	12	43	10	2	0	0	0	71
NE	0	0	0	2	2	11	44	14	1	0	0	0	74
ENE	0	0	0	6	2	12	33	7	6	0	0	0	66
E	0	0	0	0	3	16	23	21	16	3	0	0	82
ESE	0	0	0	1	3	9	17	45	39	5	0	0	119
SE	0	0	0	0	5	8	81	123	52	2	0	0	271
SSE	0	0	0	1	0	11	86	107	24	1	0	0	230
S	0	0	0	0	2	17	94	51	3	0	0	0	167
SSW	0	0	0	0	2	19	44	11	3	0	0	0	79
SW	0	0	0	0	3	11	21	5	0	0	0	0	40
WSW	0	0	0	0	1	4	2	4	0	0	0	0	11
W	0	0	0	1	4	10	4	0	0	0	0	0	19
WNW	0	0	0	2	5	13	8	4	1	0	0	0	33
NW	0	0	2	2	7	7	12	14	7	2	0	0	53
NNW	0	0	0	1	3	12	25	23	25	2	0	0	91
Totals	0	0	3	18	49	180	560	462	200	15	0	0	1487

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	879
Number of Valid Hours for this Table	1487
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-meter and 10-meter measurement levels.

Table 2.3S-10 Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the STP 3 & 4 Site (1997, 1999, and 2000) (Continued)

Hours at Each Wind Speed and Direction

Period of Record: 1997, 1999, 2000 Total Period

Elevation: Speed: PT SPD10 **Direction**: PT DIR10 **Lapse**: PT DT60-10

Stability Class: D ΔT Neutral

	Wind Speed (m/s)												
Wind Direction (from)	0.23-0.50	0.51-0.75	0.76-1.00	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	> 18.0	Total
N	0	0	1	9	18	67	251	307	157	10	0	0	820
NNE	0	0	1	9	17	67	290	159	48	0	0	0	591
NE	0	0	1	10	19	64	180	75	12	0	0	0	361
ENE	0	0	0	10	11	56	167	111	31	0	0	0	386
E	0	0	1	8	14	46	155	183	88	3	0	0	498
ESE	0	0	0	9	13	41	219	223	131	3	0	0	639
SE	0	0	0	10	14	65	371	450	124	6	2	0	1042
SSE	0	0	0	3	11	60	413	391	103	8	0	0	989
S	0	0	0	3	13	60	381	198	21	1	0	0	677
SSW	0	0	0	0	3	36	130	76	3	0	0	0	248
SW	0	0	0	2	3	10	54	23	3	0	0	0	95
WSW	0	0	1	1	3	9	23	6	1	0	0	0	44
W	0	0	0	3	7	16	17	4	2	0	0	0	49
WNW	0	0	0	10	12	22	28	11	1	0	0	0	84
NW	0	0	0	9	17	42	58	49	43	0	0	0	218
NNW	0	0	1	12	16	46	158	182	117	16	0	0	548
Totals	0	0	6	108	191	707	2895	2448	885	47	2	0	7289

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	879
Number of Valid Hours for this Table	7289
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-meter and 10-meter measurement levels.

Table 2.3S-10 Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the STP 3 & 4 Site (1997, 1999, and 2000) (Continued)

Hours at Each Wind Speed and Direction

Period of Record: 1997, 1999, 2000 Total Period

Elevation: **Speed**: PT SPD10 **Direction**: PT DIR10 **Lapse**: PT DT60-10

Stability Class: E ΔT Slightly Stable

Wind Direction (from)	0.23-0.50	0.51-0.75	0.76-1.00	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	> 18.0	Total
	Wind Speed (m/s)												
N	0	0	3	24	30	78	162	68	30	0	0	0	395
NNE	0	1	4	14	37	115	232	30	0	0	0	0	433
NE	0	1	3	27	48	122	128	21	1	0	0	0	351
ENE	0	0	6	24	44	89	105	24	0	0	0	0	292
E	0	1	5	22	37	130	162	25	9	0	0	0	391
ESE	0	0	5	33	59	192	246	47	2	0	0	0	584
SE	0	0	6	21	62	379	409	120	13	0	1	0	1011
SSE	0	0	3	13	34	403	663	228	37	0	0	0	1381
S	0	0	2	6	20	172	567	93	9	0	0	0	869
SSW	0	1	0	4	8	98	249	27	0	0	0	0	387
SW	0	0	2	2	2	24	107	18	1	0	0	0	156
WSW	1	0	1	7	9	16	37	5	1	0	0	0	77
W	0	0	3	8	8	31	15	0	0	0	0	0	65
WNW	0	0	2	9	19	21	12	3	2	0	0	0	68
NW	0	0	1	15	18	39	50	22	4	0	0	0	149
NNW	0	1	3	18	31	48	119	43	9	1	0	0	273
Totals	1	5	49	247	466	1957	3263	774	118	1	1	0	6882

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	879
Number of Valid Hours for this Table	6882
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-meter and 10-meter measurement levels.

Table 2.3S-10 Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the STP 3 & 4 Site (1997, 1999, and 2000) (Continued)

Hours at Each Wind Speed and Direction

Period of Record: 1997, 1999, 2000 Total Period

Elevation: **Speed**: PT SPD10 **Direction**: PT DIR10 **Lapse**: PT DT60-10

Stability Class: F ΔT Moderately Stable

	Wind Speed (m/s)												
Wind Direction (from)	**0.23-0.50**	**0.51-0.75**	**0.76-1.00**	**1.1-1.5**	**1.6-2.0**	**2.1-3.0**	**3.1-5.0**	**5.1-7.0**	**7.1-10.0**	**10.1-13.0**	**13.1-18.0**	**> 18.0**	**Total**
N	0	1	6	28	29	54	41	2	0	0	0	0	161
NNE	0	2	14	43	49	67	52	0	0	0	0	0	227
NE	0	3	16	59	83	80	29	0	0	0	0	0	270
ENE	0	3	9	58	61	83	16	0	1	0	0	0	231
E	0	0	8	71	69	98	28	0	0	0	0	0	274
ESE	0	0	5	91	109	119	20	1	1	0	0	0	346
SE	0	1	3	45	153	205	28	0	0	0	0	0	435
SSE	0	0	0	17	41	167	32	1	3	0	0	0	261
S	0	0	0	5	15	26	36	2	0	0	0	0	84
SSW	0	0	0	4	4	6	12	0	0	0	0	0	26
SW	0	0	0	0	4	6	11	0	0	0	0	0	21
WSW	0	0	0	1	3	5	8	2	0	0	0	0	19
W	0	1	1	4	17	17	4	0	0	0	0	0	44
WNW	0	3	8	22	29	17	4	1	0	0	0	0	84
NW	0	0	7	24	38	32	13	0	0	0	0	0	114
NNW	0	0	2	23	28	40	16	1	0	0	0	0	110
Totals	0	14	79	495	732	1022	350	10	5	0	0	0	2707

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	879
Number of Valid Hours for this Table	2707
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-meter and 10-meter measurement levels.

Table 2.3S-10 Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the STP 3 & 4 Site (1997, 1999, and 2000) (Continued)

Hours at Each Wind Speed and Direction

Period of Record: 1997, 1999, 2000 Total Period

Elevation: **Speed**: PT SPD10 **Direction**: PT DIR10 **Lapse**: PT DT60-10

Stability Class: G ΔT Extremely Stable

Wind Direction (from)	0.23-0.50	0.51-0.75	0.76-1.00	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	> 18.0	Total
	Wind Speed (m/s)												
N	1	3	18	50	41	46	15	0	0	0	0	0	174
NNE	0	2	12	85	125	69	27	0	0	0	0	0	320
NE	1	5	15	108	120	102	18	0	0	0	0	0	369
ENE	1	2	19	100	112	52	3	0	0	0	0	0	289
E	0	6	10	73	89	65	13	0	0	0	0	0	256
ESE	0	4	9	57	81	68	5	1	0	0	0	0	225
SE	1	2	5	26	66	47	0	0	0	0	0	0	147
SSE	0	1	3	6	12	26	2	0	0	0	0	0	50
S	0	1	3	3	1	5	0	0	0	0	0	0	13
SSW	0	0	1	2	0	3	0	0	0	0	0	0	6
SW	0	3	2	0	1	0	0	0	0	0	0	0	6
WSW	1	0	1	1	0	0	3	0	0	0	0	0	6
W	0	4	3	8	6	19	3	0	0	0	0	0	43
WNW	0	6	9	29	29	28	0	0	0	0	0	0	101
NW	0	2	10	22	35	25	4	0	0	0	0	0	98
NNW	0	3	13	33	29	28	8	0	0	0	0	0	114
Totals	5	44	133	603	747	583	101	1	0	0	0	0	2217

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	879
Number of Valid Hours for this Table	2217
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-meter and 10-meter measurement levels.

Table 2.3S-10 Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the STP 3 & 4 Site (1997, 1999, and 2000) (Continued)

Hours at Each Wind Speed and Direction

Period of Record: 1997, 1999, 2000 Total Period

Elevation: **Speed**: PT SPD10 **Direction**: PT DIR10 **Lapse**: PT DT60-10

Summary of All Stability Classes ΔT

Wind Direction (from)	Wind Speed (m/s) 0.23-0.50	0.51-0.75	0.76-1.00	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	> 18.0	Total
N	1	4	29	115	132	276	553	438	236	10	0	0	1794
NNE	0	5	31	153	237	358	712	236	58	0	0	0	1790
NE	1	9	35	208	277	418	483	138	18	0	0	0	1587
ENE	1	5	34	201	236	312	386	160	42	0	0	0	1377
E	0	7	24	175	216	372	423	250	129	7	0	0	1603
ESE	0	4	19	191	274	442	572	400	233	10	0	0	2145
SE	1	3	14	102	304	729	1076	937	300	10	3	0	3479
SSE	0	1	6	41	105	698	1401	1003	280	10	0	0	3545
S	0	1	5	18	58	346	1668	1012	131	3	0	0	3242
SSW	0	1	1	10	24	219	678	265	47	0	0	0	1245
SW	0	3	4	5	18	92	277	100	24	0	0	0	523
WSW	2	0	3	10	24	54	95	24	7	0	0	0	219
W	0	5	7	24	48	110	62	10	6	1	0	0	273
WNW	0	9	20	74	99	147	84	36	10	0	0	0	479
NW	0	2	20	76	121	166	173	130	79	2	0	0	769
NNW	0	4	19	90	109	206	395	318	193	21	0	0	1355
Totals	6	63	271	1493	2282	4945	9038	5457	1793	74	3	0	25425

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	879
Number of Valid Hours for this Table	25425
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-meter and 10-meter measurement levels.

Table 2.3S-11 Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the STP 3 & 4 Site (1997, 1999, and 2000)

Hours at Each Wind Speed and Direction

Period of Record: 1997, 1999, 2000 Total Period

Elevation: **Speed**: PT SPD10 **Direction**: PT DIR10 **Lapse**: PT DT60-10

Stability Class: A ΔT Extremely Unstable

Wind Direction (from)	0.23-0.50	0.51-0.75	0.76-1.00	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	> 18.0	Total
	Wind Speed (m/s)												
N	0	0	0	0	1	10	26	38	24	4	0	0	103
NNE	0	0	0	2	3	8	31	38	19	0	0	0	101
NE	0	0	0	0	3	10	49	32	9	0	0	0	103
ENE	0	0	0	1	1	10	29	15	3	0	0	0	59
E	0	0	0	0	1	8	22	19	12	0	0	0	62
ESE	0	0	0	0	3	3	21	42	48	8	0	0	125
SE	0	0	0	0	1	4	61	173	70	21	0	0	330
SSE	0	0	0	0	0	4	57	146	152	42	0	0	401
S	0	0	0	0	1	15	160	547	363	53	7	0	1146
SSW	0	0	0	0	1	24	115	125	114	37	0	0	416
SW	0	0	0	0	2	15	55	39	22	5	0	0	138
WSW	0	0	0	0	2	3	14	10	2	1	0	0	32
W	0	0	0	0	2	9	17	8	5	2	0	0	43
WNW	0	0	0	0	4	22	23	15	3	0	0	0	67
NW	0	0	0	2	4	8	27	23	19	6	0	0	89
NNW	0	0	0	2	1	16	39	34	42	19	1	0	154
Totals	0	0	0	7	30	169	746	1304	907	198	8	0	3369

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1975
Number of Valid Hours for this Table	3369
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-m and 10-m measurement levels.

Table 2.3S-11 Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the STP 3 & 4 Site (1997, 1999, and 2000) (Continued)

Hours at Each Wind Speed and Direction

Period of Record: 1997, 1999, 2000 Total Period

Elevation: **Speed**: PT SPD10 **Direction**: PT DIR10 **Lapse**: PT DT60-10

Stability Class: B ΔT Moderately Unstable

Wind Direction (from)	Wind Speed (m/s) 0.23-0.50	0.51-0.75	0.76-1.00	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	> 18.0	Total
N	0	1	0	1	2	5	16	7	15	1	0	0	48
NNE	0	0	0	0	0	11	16	20	7	0	0	0	54
NE	0	0	0	0	1	8	22	19	4	0	0	0	54
ENE	0	0	0	2	1	7	13	10	5	0	0	0	38
E	0	0	0	1	1	5	14	14	4	1	0	0	40
ESE	0	0	0	0	1	8	15	41	35	5	1	0	106
SE	0	0	0	0	1	6	42	92	67	11	0	0	219
SSE	0	0	0	0	1	13	43	97	67	9	1	0	231
S	0	0	0	0	1	11	57	94	60	19	1	0	243
SSW	0	0	0	0	0	16	26	16	16	3	0	0	77
SW	0	0	0	0	2	3	15	4	7	0	0	0	31
WSW	0	0	0	0	2	3	9	5	0	0	0	0	19
W	0	0	0	1	0	6	5	0	2	1	1	0	16
WNW	0	0	0	0	2	11	6	1	3	0	0	0	23
NW	0	0	0	2	2	7	10	12	6	3	0	0	42
NNW	0	0	0	0	2	4	10	18	17	11	1	0	63
Totals	0	1	0	7	19	124	319	450	315	64	5	0	1304

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1975
Number of Valid Hours for this Table	1304
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-meter and 10-meter measurement levels.

Table 2.3S-11 Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the STP 3 & 4 Site (1997, 1999, and 2000) (Continued)

Hours at Each Wind Speed and Direction

Period of Record: 1997, 1999, 2000 Total Period

Elevation: **Speed**: PT SPD10 **Direction**: PT DIR10 **Lapse**: PT DT60-10

Stability Class: C ΔT Slightly Unstable

Wind Direction (from)	Wind Speed (m/s) 0.23-0.50	0.51-0.75	0.76-1.00	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	> 18.0	Total
N	0	0	0	1	2	8	16	14	29	6	0	0	76
NNE	0	0	0	2	1	11	37	17	6	0	0	0	74
NE	0	0	0	1	0	6	30	21	6	0	0	0	64
ENE	0	0	0	4	2	11	30	16	9	1	0	0	73
E	0	0	0	1	2	8	18	21	21	4	0	0	75
ESE	0	0	0	0	3	6	13	34	53	14	1	0	124
SE	0	0	0	0	2	3	38	103	75	20	0	0	241
SSE	0	0	0	0	2	7	35	92	87	9	2	0	234
S	0	0	0	0	0	8	36	56	42	6	1	0	149
SSW	0	0	0	0	1	8	25	17	13	4	0	0	68
SW	0	0	0	0	2	6	10	6	6	0	0	0	30
WSW	0	0	1	0	0	3	5	2	1	0	0	0	12
W	0	0	0	0	3	6	6	0	0	0	0	0	15
WNW	0	0	0	0	4	16	5	6	2	0	0	0	33
NW	0	0	0	2	6	3	10	10	5	2	2	0	40
NNW	0	0	0	0	2	5	20	17	25	18	1	0	88
Totals	0	0	1	11	32	115	334	432	380	84	7	0	1396

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1975
Number of Valid Hours for this Table	1396
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-meter and 10-meter measurement levels.

Table 2.3S-11 Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the STP 3 & 4 Site (1997, 1999, and 2000) (Continued)

Hours at Each Wind Speed and Direction

Period of Record: 1997, 1999, 2000 Total Period

Elevation: **Speed**: PT SPD10 **Direction**: PT DIR10 **Lapse**: PT DT60-10

Stability Class: D ΔT Neutral

Wind Direction (from)	Wind Speed (m/s) 0.23-0.50	0.51-0.75	0.76-1.00	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	> 18.0	Total
N	0	0	0	4	8	23	138	224	347	73	7	0	824
NNE	0	0	0	0	12	28	155	176	157	10	0	0	538
NE	0	0	0	4	5	30	117	139	54	5	0	0	354
ENE	0	0	0	9	6	32	77	140	105	7	0	0	376
E	0	0	0	4	5	15	81	151	171	16	0	0	443
ESE	0	0	0	1	6	36	90	234	217	42	2	0	628
SE	0	0	0	3	4	30	153	352	383	40	6	0	971
SSE	0	0	0	2	8	24	139	340	431	78	10	0	1032
S	0	0	0	1	3	14	91	244	233	32	5	0	623
SSW	0	0	0	1	2	11	44	89	79	11	1	0	238
SW	0	0	0	1	1	2	21	35	23	1	1	0	85
WSW	0	0	0	0	4	5	17	13	4	0	0	0	43
W	0	0	0	2	3	8	16	12	7	1	0	0	49
WNW	0	0	1	4	11	16	29	6	4	0	0	0	71
NW	0	0	1	3	7	28	44	48	60	9	1	0	201
NNW	0	0	0	5	9	29	66	154	172	76	12	0	523
Totals	0	0	2	44	94	331	1278	2357	2447	401	45	0	6999

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1975
Number of Valid Hours for this Table	6999
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-meter and 10-meter measurement levels.

Table 2.3S-11 Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the STP 3 & 4 Site (1997, 1999, and 2000) (Continued)

Hours at Each Wind Speed and Direction

Period of Record: 1997, 1999, 2000 Total Period

Elevation: **Speed**: PT SPD10 **Direction**: PT DIR10 **Lapse**: PT DT60-10

Stability Class: E ΔT Slightly Stable

Wind Direction (from)	0.23-0.50	0.51-0.75	0.76-1.00	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	> 18.0	Total
						Wind Speed (m/s)							
N	0	0	0	0	3	15	68	179	108	15	0	0	388
NNE	0	0	0	3	6	15	71	168	89	0	0	0	352
NE	0	0	1	1	7	14	90	130	56	1	0	0	300
ENE	0	0	1	3	2	27	89	132	29	1	0	0	284
E	0	0	0	0	11	24	110	173	34	2	0	0	354
ESE	0	0	0	1	5	19	149	231	53	0	0	0	458
SE	0	0	0	3	4	27	294	381	132	5	0	0	846
SSE	0	0	0	2	9	24	326	764	336	28	2	1	1492
S	0	0	0	0	4	14	212	414	295	17	2	0	958
SSW	0	0	0	2	3	6	116	240	102	5	0	0	474
SW	0	0	0	2	3	6	49	80	32	1	0	0	173
WSW	0	0	0	2	3	3	31	19	6	0	0	0	64
W	0	0	0	2	0	9	13	7	9	0	1	0	41
WNW	0	0	0	2	5	17	28	4	3	0	0	0	59
NW	0	0	0	2	4	12	41	43	15	0	0	0	117
NNW	0	0	0	3	2	13	49	69	74	15	1	0	226
Totals	0	0	2	28	71	245	1736	3034	1373	90	6	1	6586

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1975
Number of Valid Hours for this Table	6586
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-meter and 10-meter measurement levels.

Table 2.3S-11 Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the STP 3 & 4 Site (1997, 1999, and 2000) (Continued)

Hours at Each Wind Speed and Direction

Period of Record: 1997, 1999, 2000 Total Period

Elevation: **Speed**: PT SPD10 **Direction**: PT DIR10 **Lapse**: PT DT60-10

Stability Class: F ΔT Moderately Stable

Wind Direction (from)	Wind Speed (m/s) 0.23-0.50	0.51-0.75	0.76-1.00	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	> 18.0	Total
N	0	0	1	1	2	11	37	60	22	1	0	0	135
NNE	0	0	0	4	4	15	35	52	36	0	0	0	146
NE	0	0	1	2	6	11	37	31	37	0	0	0	125
ENE	0	0	0	2	7	12	61	32	6	1	0	0	121
E	0	0	1	4	9	16	77	108	12	0	0	0	227
ESE	0	0	1	4	8	17	101	70	9	0	0	0	210
SE	0	0	0	3	6	26	158	132	3	0	0	0	328
SSE	0	0	0	2	7	31	271	224	10	2	0	0	547
S	0	0	1	0	4	20	183	63	34	0	0	0	305
SSW	0	0	0	1	4	12	34	14	8	0	0	0	73
SW	0	0	0	4	0	3	30	8	5	0	0	0	50
WSW	0	0	1	4	0	10	13	9	4	0	0	0	41
W	0	0	0	3	2	10	15	10	2	0	0	0	42
WNW	0	0	2	5	3	24	31	3	1	0	0	0	69
NW	0	0	0	3	3	8	36	19	6	0	0	0	75
NNW	0	0	0	2	2	9	18	29	12	1	0	0	73
Totals	0	0	8	44	67	235	1137	864	207	5	0	0	2567

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1975
Number of Valid Hours for this Table	2567
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-meter and 10-meter measurement levels.

Table 2.3S-11 Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the STP 3 & 4 Site (1997, 1999, and 2000) (Continued)

Hours at Each Wind Speed and Direction

Period of Record: 1997, 1999, 2000 Total Period

Elevation: **Speed**: PT SPD10 **Direction**: PT DIR10 **Lapse**: PT DT60-10

Stability Class: G ΔT Extremely Stable

Wind Direction (from)	0.23-0.50	0.51-0.75	0.76-1.00	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	> 18.0	Total
						Wind Speed (m/s)							
N	0	0	2	0	2	17	31	27	16	0	0	0	95
NNE	0	0	1	6	6	16	37	48	23	1	0	0	138
NE	0	1	1	1	3	18	43	47	44	0	0	0	158
ENE	0	1	4	7	7	17	53	51	15	0	0	0	155
E	0	2	1	5	8	21	101	62	12	0	0	0	212
ESE	0	0	0	10	9	27	92	86	14	0	0	0	238
SE	0	0	2	5	13	35	126	104	5	0	0	0	290
SSE	0	0	1	6	9	34	119	90	15	0	0	0	274
S	0	0	1	5	7	21	122	27	5	0	0	0	188
SSW	0	0	0	2	5	7	27	4	0	0	0	0	45
SW	0	0	2	1	4	9	19	3	1	0	0	0	39
WSW	0	0	1	3	3	8	11	13	1	0	0	0	40
W	0	0	1	1	7	9	10	10	2	3	0	0	43
WNW	0	0	0	4	3	10	27	3	3	0	0	0	50
NW	0	0	2	5	2	8	22	10	3	0	0	0	52
NNW	0	0	1	5	4	16	24	29	12	0	0	0	91
Totals	0	4	20	66	92	273	864	614	171	4	0	0	2108

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1975
Number of Valid Hours for this Table	2108
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-meter and 10-meter measurement levels.

Table 2.3S-11 Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the STP 3 & 4 Site (1997, 1999, and 2000) (Continued)

Hours at Each Wind Speed and Direction

Period of Record: 1997, 1999, 2000 Total Period

Elevation: **Speed**: PT SPD10 **Direction**: PT DIR10 **Lapse**: PT DT60-10

Summary of All Stability Classes ΔT

	Wind Speed (m/s)												
Wind Direction (from)	0.23-0.50	0.51-0.75	0.76-1.00	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	> 18.0	Total
N	0	1	3	7	20	89	332	549	561	100	7	0	1669
NNE	0	0	1	17	32	104	382	519	337	11	0	0	1403
NE	0	1	3	9	25	97	388	419	210	6	0	0	1158
ENE	0	1	5	28	26	116	352	396	172	10	0	0	1106
E	0	2	2	15	37	97	423	548	266	23	0	0	1413
ESE	0	0	1	16	35	116	481	738	429	69	4	0	1889
SE	0	0	2	14	31	131	872	1337	735	97	6	0	3225
SSE	0	0	1	12	36	137	990	1753	1098	168	15	1	4211
S	0	0	2	6	20	103	861	1445	1032	127	16	0	3612
SSW	0	0	0	6	16	84	387	505	332	60	1	0	1391
SW	0	0	2	8	14	44	199	175	96	7	1	0	546
WSW	0	0	3	9	14	35	100	71	18	1	0	0	251
W	0	0	1	9	17	57	82	47	27	7	2	0	249
WNW	0	0	3	15	32	116	149	38	19	0	0	0	372
NW	0	0	3	19	28	74	190	165	114	20	3	0	616
NNW	0	0	1	17	22	92	226	350	354	140	16	0	1218
Totals	0	5	33	207	405	1492	6414	9055	5800	846	71	1	24329

Number of Calm Hours for this Table	0
Number of Variable Direction Hours for this Table	0
Number of Invalid Hours	1975
Number of Valid Hours for this Table	24329
Total Hours for the Period	26304

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-meter and 10-meter measurement levels.

Table 2.3S-12 STP 3 & 4 System Meteorological Instrumentation

Parameter	Primary Tower Level (meters)	Backup Tower Level (meters)
Wind Speed	10, 60	10
Wind Direction	10, 60	10
Temperature	10, 60	10
Vertical Temperature Difference	(60–10)	None
Sigma Theta	None	10
Precipitation	0 (ground level)	None
Dew Point R. H./Temperature [1]	3 10, 60	None
Solar Radiometer	2.5	None

[1]Relative humidity/temperature instruments at 10-and 60 meters were added in December 2006 for dew point temperature calculations.

Table 2.3S-13 Meteorological Tower Siting Conformance Status

RG 1.23 Criteria	Conformance Status	Remarks
Tower Siting		
The meteorological tower sites and the proposed STP 3 & 4 location have similar meteorological exposure.	Yes	The site area is generally flat land
The base of the tower is at approximately the same elevation as the finished plant grade of the proposed units.	Yes	Tower elevation: 28' MSL Finished plant grade: 34' MSL
Location of the tower is not directly downwind of the existing and proposed plant cooling systems (i.e., MCR and the mechanical cooling towers) under the prevailing downwind wind direction.	Yes	Prevailing wind: SSE MCR – one mile S to SW of the meteorological towers [Note: It is expected that winds from the south to southwest would have an influence on observed meteorological data; however, the data collected from sensors will be representative of the plant site due to the size and location of the MCR.] Two banks of mechanical draft cooling towers – 1.3 miles west of the meteorological towers
Tower is not located on or near permanent man-made surface.	Yes	There are no large concrete or asphalt parking lot or temporary land disturbance, such as plowed fields or storage areas nearby. Both the primary and backup towers are located on open fields with grassy surface underlying the towers.

Table 2.3S-14 Meteorological Instrument Siting Conformance Status

RG 1.23 Criteria	Conformance Status	Remarks
Sensor Siting		
Wind sensors are located at 10 obstruction heights away from such obstructions (including the existing and proposed unit complex, trees, and nearby terrain) to minimize any airflow modification (i.e., turbulent wake effects).	Yes	Both the primary and backup meteorological towers are located in open fields. The nearby trees and brushes are ranging from 15 feet to 30 feet tall and mostly at 300 feet or more from the towers. During routine maintenance, these trees are to be trimmed periodically to ensure that the 10-obstruction-height requirement is met.
Wind sensors are located at heights that avoid airflow modifications by nearby obstructions with heights exceeding one-half of the wind measurement.	Yes	Existing and STP 3 & 4 structures are less than 250' in height and over a mile from the meteorological towers. Instrument shelter heights are less than 11 ft, which is less than half of the lower level sensor height at 10m (33').
Wind sensors are located to reduce airflow modification and turbulence induced by the supporting structure itself.	Yes	Tower booms (8 feet long) are oriented into the prevailing winds to reduce tower effects on the measurements.
Air temperature and dew point sensors are located in such a way to avoid modification by the existing and proposed heat and moisture sources, such as ventilation systems, water bodies, or the influence of large parking lots or other paved surfaces.	Yes	No ventilation systems or large parking lots within 1000' of the tower. The ground surface at the base of the towers has been kept natural (i.e., grasses). It is expected that winds from the south to southwest would have an influence on observed meteorological data; however, the data collected from sensors will be representative of the plant site due to the size and location of the MCR. Temperature sensors are mounted in downward pointing fan-aspirated radiation shields to minimize the adverse influences of thermal radiation and precipitation.
Precipitation measured at ground level near the base of the tower.	Yes	Precipitation gauge is equipped with wind shields to minimize the wind-caused loss of precipitation.

Table 2.3S-15 Meteorological System – Preoperational Configuration

Sensed Parameter	Sensor Type	Manufacturer/ Model	Range	System Accuracy	System Accuracy (per RG 1.23, Ref. 2.3S-28)	System Accuracy (per ANSI/ANS-3.11-2005, Ref. 2.3S-37)	Starting Threshold	Starting Threshold (RG 1.23, Ref 2.3S-28)	Measure-ment Resolution	Measure-ment Resolution (per RG 1.23, Ref 2.3S-28)	Measure-ment Resolution (per ANSI/ANS-3.11-2005, Ref. 2.3S-37)	Elevation
Primary Tower Instruments												
Wind Speed	Cup Anemometer	Met One Instruments / Model 1564D, Model 170-41 or Model 170-43	0 – 100 mph	±0.1 mph	±0.2 m/s (±0.45 mph) or 5% of observed wind speed	0.2 m/s or 5% of observed wind speed	0.6 mph	< 0.45 m/s (1 mph)	0.085 mph	0.1 m/s or 0.1 mph	0.1 m/s	10 m, 60 m
Wind Direction	Wind Vane	Met One Instruments / Model 1565D, With Quick two Vane, Model 53.2 or 53.4	0°–360°	±0.4°	±5°	5 degrees azimuth	0.3m/sec (0.7mph)	< 0.45 m/s (1 mph)	< 1 degree	1.0 degree	1.0° azimuth	10 m, 60 m
Ambient Temperature	Platinum Resistance Temperature Device	Met One Instruments / Models T-200, T-200UC	-20°C to +120°C (-4°F to +248°F)	±0.56°F	±0.5°C (±0.9°F)	0.5°C	–	–	Infinitesimal	0.1°C or 0.1°F	0.1°C	10 m
Differential Temperature [1]	N/A	N/A	N/A	±0.08°F	±0.1°C (±0.18°F)	0.1°C	–	–	Infinitesimal	0.01°C or 0.01°F	0.01°C	60 m – 10 m
Dew Point	Lithium Chloride Chill Mirror (Optical) Dew Point Hygrometer	Met One Instruments / Model 6354	-30°C to +50°C (-22°F to +122°F)	±0.56°F	±1.5°C (±2.7°F)	1.5°C	–	–	0.1°F	0.1°C or 0.1°F	0.1°C	3 m [2]
Precipitation [3]	Tipping Bucket	Met One Instruments / Model 375B	0 – 6 in/hr	±1%	±10% for a volume equivalent to 2.54 mm (0.1 in) of precipitation at a rate <50 mm/h (<2 in/h)	±10% for a volume equivalent to 2.54 mm of precipitation at a rate < 50 mm/h	–	–	0.01 in	0.25 mm or 0.01 in	0.25 mm	Tower base
Solar Radiometer	Copper constantan thermopile	Met One Instruments / Model 095	0–2 Langley/min	±0.008 Langley/min [4]	–	10 W/m or 5% observed	–	–	0.001 Langley	–	1 W/m	2.5 m
Sigma-Theta [5]	N/A	N/A	N/A	N/A	–	–	N/A	–	1°	–	0.1° azimuth	10 m, 60 m
Relative Humidity / Temperature [6] (for dew point temperature calculation)	Capacitive Polymer Humidity and Temperature Sensors	Vaisala / HMT337 with Vaisala HUMICAP 180L2	0% to 100% RH	At -10°C to +40°C (14°F to 104°F): ±(1.0+0.01 x reading)%RH At -40°C to +180°C (-40°F to 356°F): ±(1.5+0.02 x reading)%RH	±4%/±1.5°C (±2.7°F)	1.5°C	–	–	0.1°F [5]	0.1%	0.1°C	10 m, 60 m

Table 2.3S-15 Meteorological System – Preoperational Configuration (Continued)

Sensed Parameter	Sensor Type	Manufacturer/ Model	Range	System Accuracy	System Accuracy (per RG 1.23, Ref. 2.3S-28)	System Accuracy (per ANSI/ANS-3.11-2005, Ref. 2.3S-37)	Starting Threshold	Starting Threshold (RG 1.23, Ref 2.3S-28)	Measure-ment Resolution	Measure-ment Resolution (per RG 1.23, Ref 2.3S-28)	Measure-ment Resolution (per ANSI/ANS-3.11-2005, Ref. 2.3S-37)	Elevation
Backup Tower Instruments												
Wind Speed	Cup Anemometer	Met One Instruments / Model 1564D, Model 170-41 or Model 170-43	0–100 mph	±0.1 mph	±0.2 m/s (±0.45 mph) or 5% of observed wind speed	0.2 m/s or 5% of observed wind speed	0.6 mph	< 0.45 m/s (1 mph)	0.085 mph	0.1 m/s or 0.1 mph	0.1 m/s	
Wind Direction	Wind Vane	Met One Instruments / Model 1565D, With Quick two Vane, Model 53.2 or 53.4	0°– 360°	±0.4°	±5°	5°azimuth	0.3 m/sec (0.7mph)	< 0.45 m/s (1 mph)	< 1 degree	1.0 degree	1.0 degree azimuth	
Ambient Temperature	Platinum Resistance	Met One Instruments / Models T-200, T-200UC	-20°C to +120°C (-4°F to +248°F)	±0.56°F	±0.5°C (±0.9°F)	0.5°C	-----	-----	Infinitesimal	0.1°C or 0.1°F	0.1°C	
Sigma-Theta [5]	N/A	N/A	N/A	N/A	-----	-----	N/A	-----	1°	-----	0.1 degrees azimuth	

[1] The Differential Temperature value is a calculated value based on arithmetic differences in the Ambient Temperature measurements at 60-meter and 10-meter locations.

[2] The attachment arm for the Dew Point instrument is 2.77 meters above grade and the bottom of the instrument is 2.56 meters above grade.

[3] Water is collected and drained each time an internal bucket fills with 0.01 inches of water.

[4] As measured at the output of N0EM-XY-8134 (Primary equipment rack).

[5] The Sigma-Theta value is a calculated value based on the Wind Direction variation measurements, and therefore has the same resolution as the Wind Direction measurements.

[6] The Relative Humidity / Temperature instrument was installed and placed in operation in December of 2006.

Table 2.3S-16 STP 3 & 4 Data Collection and Recording Equipment Accuracy

Equipment	System	Accuracy
Microprocessor	**Primary and Backup**	**Better than +0.10% of full scale**
Digital Data Recorder Temperature Delta temperature Dew Point Solar radiation Precipitation Wind speed Wind direction	Primary	Current: +0.10% of full scale
Digital Data Recorder Temperature Wind speed Wind direction Sigma theta	Backup	Current: +0.10% of full scale
Disk Drives Various digital devices	Primary and Backup	

Source: Reference 2.3S-40, STPEGS Updated Safety Analysis Report, Revision 13

Table 2.3S-17 Meteorological System – Operational Configuration

Sensed Parameter	Sensor Type	Manufacturer/ Model	Range	System Accuracy	System Accuracy (per RG 1.23, Ref. 2.3S-28)	System Accuracy (per ANSI/ANS-3.11-2005, Ref. 2.3S-37)	Starting Threshold	Starting Threshold (RG 1.23, Ref. 2.3S-28)	Measure-ment Resolution	Measure-ment Resolution (per RG 1.23, Ref. 2.3S-28)	Measure-ment Resolution (per ANSI/ANS-3.11-2005, Ref. 2.3S-37)	Elevation
PRIMARY TOWER INSTRUMENTS												
Wind Speed	Ultrasonic	Met One Instruments / Model 50.5 [1]	0 to 50 m/sec (0 to 112 mph)	±0.15 m/sec 5 m/sec or ±2% 5 m/sec (±0.33 mph 11.2 mph or ±2% 11.2 mph)	±0.2 m/s (±0.45 mph) or 5% of observed wind speed	0.2 m/s or 5% of observed wind speed	Virtually zero	< 0.45 m/s (1 mph)	0.1 m/sec (0.1 mph)	0.1 m/s or 0.1 mph	0.1 m/s	10 m, 60 m
Wind Direction	Ultrasonic	Met One Instruments / Model 50.5 [1]	0° to 360°	±3°	±5 degree	5 degrees azimuth	Virtually zero	< 0.45 m/s (1 mph)	1°	1.0°	1.0 ° azimuth	10 m, 60 m
Ambient Temperature	Platinum Resistance Temperature Device	Met One Instruments / Models T-200, T-200UC	-20°C to +120°C (-4°F to +248°F)	±0.5°C (±0.9°F)	±0.5°C (±0.9°F)	0.5°C	–	–	0.1°F	0.1°C or 0.1°F	0.1°C	10 m, 60 m
Differential Temperature [2]	N/A	N/A	N/A	±0.18°F	±0.1°C (±0.18°F)	0.1°C	N/A	–	0.01°F	0.01°C or 0.01°F	0.01°C	60 m – 10 m
Relative Humidity / Temperature [2 (for dew point temperature calculation)]	Capacitive Polymer Humidity and Temperature Sensors	Vaisala / HMT337 with Vaisala HUMICAP 180L2	0% to 100% RH	At -10°C to +40°C (14°F to 104°F): ±(1.0+0.01 x reading)%RH At -40°C to +180°C (-40°F to 356°F): ±(1.5+0.02 x reading)%RH	±4% / ±1.5°C (±2.7°F)	1.5°C	–	–	0.1°F [3]	0.1%	0.1°C	10 m, 60 m
Precipitation [4]	Tipping Bucket	Met One Instruments / Model 375B	0–6 in/hr	±1%	±10% for a volume equivalent to 2.54 mm (0.1 in) of precipitation at a rate < 50 mm/h (< 2 in/h)	±10% for a volume equivalent to 2.54 mm of precipitation at a rate < 50 mm/h	–	–	0.01 in	0.25 mm or 0.01 in	0.25 mm	Tower base
Solar Radiometer	Copper constantan thermopile	Met One Instruments / Model 095	0–2 Langley/min	+0.008 Langley/min [5]	–	10 W/m or 5% observed	–	–	0.001 Langley	–	–	2.5 m
Sigma-Theta [6]	N/A	N/A	N/A	N/A	–	–	N/A	–	1°	–	0.1° azimuth	10 m, 60 m

Table 2.3S-17 Meteorological System – Operational Configuration (Continued)

Sensed Parameter	Sensor Type	Manufacturer/ Model	Range	System Accuracy	System Accuracy (per RG 1.23, Ref. 2.3S-28)	System Accuracy (per ANSI/ANS-3.11-2005, Ref. 2.3S-37)	Starting Threshold	Starting Threshold (RG 1.23, Ref. 2.3S-28)	Measure-ment Resolution	Measure-ment Resolution (per RG 1.23, Ref. 2.3S-28)	Measure-ment Resolution (per ANSI/ANS-3.11-2005, Ref. 2.3S-37)	Elevation
BACKUP TOWER INSTRUMENTS												
Wind Speed	Ultrasonic	Met One Instruments / Model 50.5 [1]	0 to 50 m/sec (0 to 112 mph)	±0.15 m/sec 5 m/sec or ±2% 5 m/sec (±0.33 mph 11.2 mph or ±2% 11.2 mph)	±0.2 m/s (±0.45 mph) or 5% of observed wind speed	0.2 m/s or 5% of observed wind speed	Virtually zero	< 0.45 m/s (1 mph)	0.1 m/sec (0.1 mph)	0.1 m/s or 0.1 mph	0.1 m/s	10 m
Wind Direction	Ultrasonic	Met One Instruments / Model 50.5 [1]	0° to 360°	±3°	±5°	5° azimuth	Virtually zero]	< 0.45 m/s (1 mph)	1°	1.0°	1.0° azimuth	10 m
Ambient Temperature	Platinum Resistance Temperature Device	Met One Instruments / Models T-200, T-200UC	-20°C to +120°C (-4°F to +248°F)	±0.5°C (±0.9°F)	±0.5°C (±0.9°F)	0.5°C	–	–	1°F	0.1°C or 0.1°F	0.1°C	10 m
Sigma-Theta [6]	N/A	N/A	N/A	N/A	–	–	N/A	–	1°	–	0.1° azimuth	10 m

[1] The sonic Wind Speed / Direction instrument has an external electrical heater circuit

[2] The Differential Temperature value is a calculated value based on arithmetic differences in the Ambient Temperature measurements at 60-meter and 10-meter locations.

[3] The Dew Point Temperature value is a calculated value based on Relative Humidity and Ambient Temperature

[4] Water is collected and drained each time an internal bucket fills with 0.01 inches of water.

[5] As measured at the output of N0EM-XY-8134 (Primary equipment rack).

[6] The Sigma-Theta value is a calculated value based on the Wind Direction variation measurements, and therefore has the same resolution as the Wind Direction measurements.

Table 2.3S-18 Annual Data Recovery Rate (in percent) for STP 3 & 4 Meteorological Monitoring System (1997, 1999, and 2000)

Parameter	1997	1999	2000	3-Year Composite
Wind Speed (10 m)	100.0	99.6	99.5	99.7
Wind Speed (60 m)	96.2	93.6	90.9	93.6
Wind Direction (10 m)	99.9	99.6	99.5	99.7
Wind Direction (60 m)	96.4	94.6	91.1	94.0
-Temperature (60 m–10 m) [1]	96.6	96.1	97.3	96.7
Ambient Temperature (10 m)	93.0	95.0	92.2	93.4
Ambient Temperature (60 m)	93.0	91.3	90.0	91.4
Composite Parameters				
WS/WD (10m), T (60m-10m) [1]	96.6	96.1	97.3	96.7
WS/WD (60m), T (60m-10m) [1]	95.3	91.6	90.6	92.5

[1] Temperature difference (ΔT) between 60-meter and 10-meter levels.

Table 2.3S-19 Comparison of Onsite Data – Wind Direction Frequency Distribution by Stability Class (frequency in percent)

	Stability Class A		Stability Class B		Stability Class C		Stability Class D		Stability Class E		Stability Class F		Stability Class G		All Stability Classes	
	ORIGINAL [1]	CURRENT [2]	ORIGINAL [1]	CURRENT [2]	ORIGINAL [1]	CURRENT [2]	ORIGINAL [1]	CURRENT [2]	ORIGINAL [1]	CURRENT [2]	ORIGINAL [1]	CURRENT [2]	ORIGINAL [1]	CURRENT [2]	ORIGINAL [1]	CURRENT [2]
N	0.4	0.43	0.4	0.21	0.51	0.32	3.83	3.23	1.37	1.55	0.66	0.63	0.52	0.68	7.69	7.05
NNE	0.29	0.37	0.25	0.21	0.34	0.28	2.8	2.32	1.35	1.7	1.03	0.89	0.98	1.26	7.04	7.03
NE	0.26	0.43	0.27	0.2	0.37	0.29	2.16	1.42	1.38	1.38	1.24	1.06	1.69	1.45	7.37	6.23
ENE	0.18	0.26	0.21	0.18	0.27	0.26	1.46	1.52	1.04	1.15	0.98	0.91	1.29	1.14	5.43	5.42
E	0.15	0.26	0.15	0.15	0.27	0.32	1.61	1.96	1.23	1.54	1.2	1.08	1.12	1.01	5.73	6.32
ESE	0.26	0.49	0.28	0.42	0.38	0.47	2.06	2.51	1.53	2.3	1.28	1.36	0.66	0.88	6.45	8.43
SE	0.97	1.33	0.71	0.93	1.08	1.07	4.78	4.1	3.59	3.98	1.81	1.71	0.58	0.58	13.52	13.70
SSE	1.36	1.6	1.11	0.9	1.03	0.9	4.54	3.89	4.81	5.43	1.87	1.03	0.48	0.2	15.20	13.95
S	1.79	4.6	1.25	1.03	1.22	0.66	3.2	2.66	3.14	3.42	1.38	0.33	0.56	0.05	12.54	12.75
SSW	0.83	1.69	0.45	0.28	0.51	0.31	1.1	0.98	0.94	1.52	0.61	0.1	0.32	0.02	4.76	4.90
SW	0.3	0.67	0.23	0.14	0.18	0.16	0.47	0.37	0.42	0.61	0.33	0.08	0.36	0.02	2.29	2.05
WSW	0.11	0.16	0.09	0.09	0.08	0.04	0.3	0.17	0.21	0.3	0.14	0.07	0.18	0.02	1.11	0.85
W	0.08	0.15	0.06	0.06	0.1	0.07	0.36	0.19	0.24	0.26	0.22	0.17	0.26	0.17	1.32	1.07
WNW	0.11	0.32	0.09	0.11	0.11	0.13	0.34	0.33	0.26	0.27	0.19	0.33	0.23	0.4	1.33	1.89
NW	0.21	0.38	0.14	0.16	0.15	0.21	0.74	0.86	0.39	0.59	0.3	0.45	0.35	0.39	2.28	3.04
NNW	0.29	0.61	0.3	0.26	0.32	0.36	2.46	2.16	1.13	1.07	0.64	0.43	0.46	0.45	5.60	5.34

[1] The “ORIGINAL” data was compiled from July 21, 1973 to July 20, 1976 and October 1, 1976 to September 30, 1977 (STP 1 & 2 UFSAR Units 1 & 2 Tables 2.3-29 to 2.3-36, Reference 2.3S-40).

[2] The “CURRENT” data was compiled from 1997, 1999, and 2000 (Tables 2.3S-10 to 2.3S-11).

Table 2.3S-20 Comparison of Onsite Data – Stability Class Distribution (in percent)

	STABILITY CLASSES						
	A	B	C	D	E	F	G
ORIGINAL [1]	7.59	6.00	6.93	32.22	23.08	14.06	10.13
CURRENT [2]	13.73	5.31	5.85	28.67	27.07	10.65	8.72

[1] The "ORIGINAL" data was compiled from July 21, 1973 to July 20, 1976 and October 1, 1976 to September 30, 1977 (STP 1 & 2 UFSAR Tables 2.3-29 to 2.3-36, Reference 2.3S-40).

[2] See Table 2.3S-9.

Table 2.3S-21 EAB and LPZ Distances

Distance from Envelope Surrounding STP 3 & 4				
Directional Sector	**To EAB (feet)**	**To EAB (meters)**	**To LPZ (feet)**	**To LPZ (meters)**
N	2503	763	13304	4055
NNE	2572	784	13684	4171
NE	2815	858	14183	4323
ENE	3691	1125	14941	4554
E	5098	1554	15912	4850
ESE	6335	1931	16765	5110
SE	6611	2015	17287	5269
SSE	6106	1861	17241	5255
S	5650	1722	16486	5025
SSW	4911	1497	15545	4738
SW	3825	1166	14350	4374
WSW	3084	940	13701	4176
W	2746	837	13182	4018
WNW	2343	714	12874	3924
NW	2251	686	12831	3911
NNW	2464	751	13156	4010

Table 2.3S-22 [Not Used]

Table 2.3S-23 PAVAN Results - 0.5% χ/Q Values at the Dose Calculation EAB Site Exclusion Area Boundary Calculations - Building Wake Credit Is Not Included. Relative Concentration (χ/Q) Values (Sec/Cubic Meter) Versus Averaging Time (Note: Site Limit = 5% χ/Q Values)

Downwind Sector	Distance (Meters)	0-2 Hours	0-8 Hours	8-24 Hours	1-4 Days	4-30 Days	Annual Average	HRS PER YR MAX 0-2 HR χ/Q Exceed in Sector
S	1722	9.63E-05	5.37E-05	4.01E-05	2.12E-05	8.54E-06	2.80E-06	0.8
SSW	1497	1.21E-04	7.26E-05	5.62E-05	3.23E-05	1.46E-05	5.49E-06	0.3
SW	1166	1.71E-04	1.09E-04	8.72E-05	5.36E-05	2.66E-05	1.13E-05	5.4
WSW	940	2.03E-04	1.31E-04	1.05E-04	6.54E-05	3.31E-05	1.43E-05	13
W	837	2.25E-04	1.47E-04	1.19E-04	7.50E-05	3.87E-05	1.72E-05	18.6
WNW	714	2.74E-04	1.85E-04	1.52E-04	9.95E-05	5.40E-05	2.56E-05	43.7
NW	686	2.49E-04	1.76E-04	1.49E-04	1.02E-04	5.96E-05	3.09E-05	32.3
NNW	751	1.74E-04	1.22E-04	1.02E-04	6.93E-05	3.97E-05	2.01E-05	7.5
N	763	1.22E-04	8.24E-05	6.77E-05	4.42E-05	2.39E-05	1.13E-05	3.6
NNE	784	9.92E-05	5.97E-05	4.63E-05	2.67E-05	1.21E-05	4.58E-06	0.9
NE	858	6.87E-05	3.81E-05	2.84E-05	1.50E-05	5.98E-06	1.95E-06	2.4
ENE	1125	2.42E-05	1.38E-05	1.04E-05	5.68E-06	2.37E-06	8.14E-07	1
E	1554	3.28E-05	1.78E-05	1.32E-05	6.81E-06	2.64E-06	8.29E-07	0.9
ESE	1931	6.52E-05	3.29E-05	2.33E-05	1.11E-05	3.80E-06	1.03E-06	0.7
SE	2015	6.17E-05	3.14E-05	2.24E-05	1.08E-05	3.78E-06	1.05E-06	0.1
SSE	1861	7.12E-05	3.81E-05	2.79E-05	1.42E-05	5.35E-06	1.63E-06	0.2
Max 0-2 hr χ/Q		2.74E-04	Total Hours Entire Site Max 0-2 hr χ/Q Exceeded					131.4

Site Limit		1.62E-04	1.23E-04	1.07E-04	7.97E-05	5.20E-05	3.09E-05	

Table 2.3S-24 PAVAN Results - 0.5% χ/Q Values at the Dose Calculation LPZ Low Population Zone Calculations - Building Wake Credit Is Not Included. Relative Concentration (χ/Q) Values (Sec/Cubic Meter) Versus Averaging Time (Note: Site Limit = 5% χ/Q Values)

Downwind Sector	Distance (Meters)	0-2 Hours	0-8 Hours	8-24 Hours	1-4 Days	4-30 Days	Annual Average	HRS PER YR MAX 0-2 HR χ/Q Exceed in Sector
S	5025	3.58E-05	1.59E-05	1.06E-05	4.40E-06	1.24E-06	2.65E-07	16.5
SSW	4738	4.47E-05	2.06E-05	1.40E-05	6.06E-06	1.82E-06	4.17E-07	22.2
SW	4374	5.16E-05	2.44E-05	1.67E-05	7.40E-06	2.30E-06	5.49E-07	40.4
WSW	4176	5.27E-05	2.45E-05	1.67E-05	7.30E-06	2.22E-06	5.15E-07	43.7
W	4018	4.93E-05	2.34E-05	1.61E-05	7.18E-06	2.25E-06	5.43E-07	34.8
WNW	3924	4.81E-05	2.35E-05	1.65E-05	7.57E-06	2.48E-06	6.34E-07	31.5
NW	3911	4.34E-05	2.20E-05	1.56E-05	7.48E-06	2.59E-06	7.09E-07	24.3
NNW	4010	2.72E-05	1.41E-05	1.01E-05	4.97E-06	1.78E-06	5.08E-07	6.7
N	4055	1.34E-05	7.06E-06	5.13E-06	2.56E-06	9.47E-07	2.80E-07	3.4
NNE	4171	9.22E-06	4.45E-06	3.09E-06	1.40E-06	4.51E-07	1.12E-07	1.1
NE	4323	6.35E-06	2.87E-06	1.93E-06	8.18E-07	2.38E-07	5.26E-08	2.7
ENE	4554	3.08E-06	1.45E-06	9.95E-07	4.40E-07	1.36E-07	3.25E-08	1.5
E	4850	8.14E-06	3.67E-06	2.46E-06	1.04E-06	3.00E-07	6.58E-08	5.3
ESE	5110	2.59E-05	1.08E-05	6.94E-06	2.67E-06	6.80E-07	1.27E-07	10.4
SE	5269	2.36E-05	1.00E-05	6.54E-06	2.58E-06	6.81E-07	1.33E-07	7.9
SSE	5255	2.55E-05	1.11E-05	7.36E-06	3.00E-06	8.24E-07	1.70E-07	10.3
Max 0-2 hr χ/Q		5.27E-05	Total Hours Entire Site Max 0-2 hr χ/Q Exceeded					262.6

Site Limit		3.99E-05	2.05E-05	1.47E-05	7.12E-06	2.52E-06	7.09E-07	

Table 2.3S-25 ARCON96 χ/Q Values (sec/m^3)

ARCON96 χ/Q Values at the Control Room Air Intake "C"					
Release Point	**0 – 2 hours**	**2 – 8 hours**	**8 – 24 hours**	**1 – 4 days**	**4 – 30 days**
Reactor Building Plant Stack	9.14E-04	4.98E-04	2.22E-04	1.68E-04	1.16E-04
DCD Control Room Limit	3.10E-03[1]	NA	1.83 E-03	1.16 E-03	5.12 E-04
Turbine Building Truck Doors	3.38E-04	2.43E-04	1.16E-04	6.28E-05	5.43E-05
DCD Turbine Building Limit [2]	5.17E-04	NA	3.05E-04	1.93E-04	8.53E-05
ARCON96 χ/Q Values at the Control Room Air Intake "B"					
Release Point	**0 – 2 hours**	**2 – 8 hours**	**8 – 24 hours**	**1 – 4 days**	**4 – 30 days**
Reactor Building Plant Stack	2.03E-03	1.68E-03	5.88E-04	6.29E-04	5.59E-04
DCD Control Room Limit	3.10E-03 [1]	NA	1.83 E-03	1.16 E-03	5.12 E-04
Turbine Building Truck Doors	5.20E-04	4.18E-04	1.84E-04	1.18E-04	9.15E-05
DCD Turbine Building Limit [2]	5.17E-04 [3]	NA	3.05E-04	1.93E-04	8.53E-05
ARCON96 χ/Q Values at the Technical Support Center Air Intake					
Release Point	**0 – 2 hours**	**2 – 8 hours**	**8 – 24 hours**	**1 – 4 days**	**4 – 30 days**
Reactor Building Plant Stack	5.89E-04	4.50E-04	1.91E-04	1.27E-04	9.39E-05
DCD Control Room Limit	3.10E-03[1]	NA	1.83 E-03	1.16 E-03	5.12 E-04
Turbine Building Truck Doors	3.28E-04	2.26E-04	1.06E-04	5.67E-05	4.99E-05
DCD Turbine Building Limit [2]	5.17E-04	NA	3.05E-04	1.93E-04	8.53E-05

NA -Not available

[1] reference ABWR DCD specifies that this value is for 0-8 hour.

[2] reference ABWR DCD specifies that the χ/Q values for Turbine Building release are a factor 6 less than those from the Reactor Building release.

[3] The value provided in the 0-2 hour column for the DCD Turbine Building Limit is the 0-8 hour DCD Turbine Building Limit. The equivalent calculated ARCON96 0-8 hr value is estimated to be 4.44E-04 sec/m^3 based on the method provided in Section 3.7 of NUREG/CR-6331, which does not exceed the 0-8 hour DCD Turbine Building Limit (5.17E-04 sec/m^3).

Table 2.3S-26 Distances from the Release Points to Sensitive Receptors

	Distance to Nearest Residence, Vegetable Garden, and Meat Animal (meters) from	Distance to Nearest Residence, Vegetable Garden, and Meat Animal (meters) from		Closest of two (meters)
Direction	Center of STP 1 & 2	STP 3	STP 4	STP 3 or 4
N	5600	5157	5193	5157
NNE	8000	7802	7932	7802
NE	8000	8083	8295	8083
ENE	7200	7549	7811	7549
E	8000	8557	8831	8557
ESE	5600	6287	6538	6287
SE	5600	6319	6517	6319
SSE	8000	8650	8768	8650
S	0	0	0	0
SSW	8000	8256	8177	8177
SW	7200	7185	7015	7015
WSW	4000	3734	3506	3506
W	7200	6673	6399	6399
WNW	7200	6521	6264	6264
NW	7200	6482	6292	6292
NNW	5600	4966	4884	4884

Note: For STP 1 & 2, if the distance is greater than 8,000 meters, then the distance is taken as 8,000 meters. If a pathway is not applicable, the receptor distance is 0 meters

Table 2.3S-26a Distances from Release Points to the EAB		
Direction	**From**	**Distance (m)**
S	Unit 4	1756
SSW	Unit 4	1519
SW	Unit 4	1271
WSW	Unit 4	1006
W	Unit 4	934
WNW	Unit 4	859
NW	Unit 4	838
NNW	Unit 4	839
N	Unit 4	874
NNE	Unit 4	970
NE	Unit 4	1155
ENE	Unit 3	1497
E	Unit 3	1838
ESE	Unit 3	2110
SE	Unit 3	2151
SSE	Unit 4	1944

Table 2.3S-26b Distances from Release Points to the Site Boundary		
Direction	**From**	**Distance (m)**
S	Unit 3	6380
SSW	Unit 4	4117
SW	Unit 4	2248
WSW	Unit 4	1916
W	Unit 4	1917
WNW	Unit 4	1917
NW	Unit 4	1295
NNW	Unit 4	1115
N	Unit 4	1098
NNE	Unit 3	1123
NE	Unit 3	1311
ENE	Unit 3	1649
E	Unit 3	2242
ESE	Unit 3	2309
SE	Unit 3	6180
SSE	Unit 3	6652

Table 2.3S-27 XOQDOQ-Predicted Maximum χ/Q and (D/Q) Values at Receptors of Interest

	Type of Location	Direction from Site	Distance (miles)	χ/Q (sec/m^3)
No Decay	EAB	NW	0.52	1.50E-05
	Site Boundary	NNW	0.69	8.10E-06
	Resident	WSW	2.18	6.30E-07
	Meat Animal	WSW	2.18	6.30E-07
	Vegetable Garden	WSW	2.18	6.30E-07
	Unit 4 Reactor	WNW	0.17	8.30E-05
2.26 Day Decay	EAB	NW	0.52	1.50E-05
	Site Boundary	NNW	0.69	8.10E-06
	Resident	WSW	2.18	6.20E-07
	Meat Animal	WSW	2.18	6.20E-07
	Vegetable Garden	WSW	2.18	6.20E-07
	Unit 4 Reactor	WNW	0.17	8.30E-05
8 Day Decay	EAB	NW	0.52	1.40E-05
	Site Boundary	NNW	0.69	7.30E-06
	Resident	WSW	2.18	5.10E-07
	Meat Animal	WSW	2.18	5.10E-07
	Vegetable Garden	WSW	2.18	5.10E-07
	Unit 4 Reactor	WNW	0.17	8.00E-05
	Type of Location	**Direction from Site**	**Distance (miles)**	**D/Q (1/m^2)**
	EAB	NW/NNW	0.52	1.00E-07
	Site Boundary	NNW	0.69	6.40E-08
	Resident	NNW	3.03	1.80E-09
	Meat Animal	NNW	3.03	1.80E-09
	Vegetable Garden	NNW	3.03	1.80E-09
	Unit 4 Reactor	WNW	0.17	3.40E-07

Table 2.3S-28 XOQDOQ-Predicted Annual Averate χ/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

No Decay χ/Q at Various Distances											
RELEASE POINT - GROUND LEVEL - NO INTERMITTENT RELEASES NO DECAY, UNDEPLETED CORRECTED USING STANDARD OPEN TERRAIN FACTORS											
ANNUAL AVERAGE CHI/Q (SEC/METER CUBED)											
DISTANCE IN MILES FROM THE SITE											
Sector	**.250**	**.500**	**.750**	**1.000**	**1.500**	**2.000**	**2.500**	**3.000**	**3.500**	**4.000**	**4.500**
S	3.024E-05	9.780E-06	5.079E-06	2.601E-06	1.052E-06	5.737E-07	3.658E-07	2.567E-07	1.921E-07	1.504E-07	1.220E-07
SSW	4.092E-05	1.295E-05	6.688E-06	3.461E-06	1.420E-06	7.811E-07	5.015E-07	3.538E-07	2.659E-07	2.091E-07	1.701E-07
SW	4.526E-05	1.411E-05	7.274E-06	3.787E-06	1.565E-06	8.655E-07	5.577E-07	3.947E-07	2.974E-07	2.343E-07	1.909E-07
WSW	3.885E-05	1.214E-05	6.260E-06	3.256E-06	1.344E-06	7.423E-07	4.780E-07	3.380E-07	2.546E-07	2.005E-07	1.633E-07
W	3.799E-05	1.208E-05	6.311E-06	3.266E-06	1.338E-06	7.359E-07	4.722E-07	3.331E-07	2.502E-07	1.967E-07	1.600E-07
WNW	4.265E-05	1.383E-05	7.329E-06	3.766E-06	1.530E-06	8.360E-07	5.341E-07	3.754E-07	2.812E-07	2.205E-07	1.789E-07
NW	4.916E-05	1.643E-05	8.801E-06	4.462E-06	1.781E-06	9.619E-07	6.091E-07	4.251E-07	3.167E-07	2.471E-07	1.996E-07
NNW	3.826E-05	1.337E-05	7.195E-06	3.600E-06	1.413E-06	7.542E-07	4.735E-07	3.281E-07	2.430E-07	1.887E-07	1.517E-07
N	2.412E-05	8.121E-06	4.263E-06	2.104E-06	8.172E-07	4.335E-07	2.709E-07	1.871E-07	1.382E-07	1.070E-07	8.590E-08
NNE	1.015E-05	3.457E-06	1.819E-06	8.977E-07	3.486E-07	1.849E-07	1.156E-07	7.981E-08	5.893E-08	4.564E-08	3.664E-08
NE	5.005E-06	1.648E-06	8.572E-07	4.271E-07	1.679E-07	8.989E-08	5.656E-08	3.928E-08	2.915E-08	2.267E-08	1.827E-08
ENE	3.215E-06	1.088E-06	5.747E-07	2.885E-07	1.140E-07	6.122E-08	3.861E-08	2.686E-08	1.995E-08	1.554E-08	1.253E-08
E	6.872E-06	2.178E-06	1.131E-06	5.827E-07	2.379E-07	1.305E-07	8.360E-08	5.889E-08	4.421E-08	3.473E-08	2.823E-08
ESE	1.450E-05	4.452E-06	2.290E-06	1.191E-06	4.921E-07	2.720E-07	1.753E-07	1.240E-07	9.346E-08	7.365E-08	6.001E-08
SE	1.645E-05	5.201E-06	2.712E-06	1.396E-06	5.690E-07	3.117E-07	1.995E-07	1.405E-07	1.054E-07	8.273E-08	6.719E-08
SSE	2.145E-05	6.929E-06	3.598E-06	1.838E-06	7.415E-07	4.035E-07	2.570E-07	1.802E-07	1.347E-07	1.055E-07	8.545E-08

Table 2.3S-28 XOQDOQ-Predicted Annual Averate χ/Q Values at the Standard Radial Distances and Distance-Segment Boundaries (Continued)

No Decay χ/Q at Various Distances

ANNUAL AVERAGE CHI/Q (SEC/METER CUBED)

	DISTANCE IN MILES FROM THE SITE										
Sector	**5.000**	**7.500**	**10.000**	**15.000**	**20.000**	**25.000**	**30.000**	**35.000**	**40.000**	**45.000**	**50.000**
S	1.015E-07	5.336E-08	3.517E-08	2.067E-08	1.424E-08	1.070E-08	8.477E-09	6.970E-09	5.887E-09	5.075E-09	4.446E-09
SSW	1.420E-07	7.544E-08	5.008E-08	2.973E-08	2.062E-08	1.556E-08	1.238E-08	1.021E-08	8.650E-09	7.475E-09	6.562E-09
SW	1.596E-07	8.530E-08	5.684E-08	3.391E-08	2.361E-08	1.786E-08	1.424E-08	1.176E-08	9.976E-09	8.631E-09	7.585E-09
WSW	1.365E-07	7.287E-08	4.852E-08	2.892E-08	2.012E-08	1.522E-08	1.213E-08	1.002E-08	8.494E-09	7.348E-09	6.456E-09
W	1.335E-07	7.085E-08	4.700E-08	2.786E-08	1.931E-08	1.456E-08	1.157E-08	9.541E-09	8.076E-09	6.976E-09	6.121E-09
WNW	1.490E-07	7.856E-08	5.186E-08	3.054E-08	2.107E-08	1.583E-08	1.255E-08	1.032E-08	8.716E-09	7.514E-09	6.583E-09
NW	1.657E-07	8.616E-08	5.634E-08	3.276E-08	2.241E-08	1.673E-08	1.319E-08	1.080E-08	9.088E-09	7.808E-09	6.820E-09
NNW	1.254E-07	6.427E-08	4.159E-08	2.382E-08	1.613E-08	1.194E-08	9.353E-09	7.615E-09	6.376E-09	5.455E-09	4.746E-09
N	7.092E-08	3.620E-08	2.338E-08	1.337E-08	9.046E-09	6.700E-09	5.250E-09	4.277E-09	3.583E-09	3.067E-09	2.670E-09
NNE	3.024E-08	1.542E-08	9.945E-09	5.680E-09	3.843E-09	2.845E-09	2.229E-09	1.815E-09	1.521E-09	1.301E-09	1.133E-09
NE	1.513E-08	7.817E-09	5.092E-09	2.949E-09	2.016E-09	1.505E-09	1.187E-09	9.720E-10	8.182E-10	7.033E-10	6.145E-10
ENE	1.039E-08	5.380E-09	3.509E-09	2.034E-09	1.388E-09	1.035E-09	8.149E-10	6.666E-10	5.605E-10	4.813E-10	4.202E-10
E	2.355E-08	1.249E-08	8.280E-09	4.908E-09	3.403E-09	2.567E-09	2.042E-09	1.684E-09	1.426E-09	1.232E-09	1.081E-09
ESE	5.018E-08	2.684E-08	1.790E-08	1.069E-08	7.454E-09	5.644E-09	4.503E-09	3.723E-09	3.160E-09	2.735E-09	2.405E-09
SE	5.603E-08	2.965E-08	1.963E-08	1.161E-08	8.042E-09	6.060E-09	4.816E-09	3.969E-09	3.359E-09	2.900E-09	2.545E-09
SSE	7.110E-08	3.733E-08	2.458E-08	1.444E-08	9.947E-09	7.468E-09	5.917E-09	4.865E-09	4.109E-09	3.542E-09	3.103E-09

VENT AND BUILDING PARAMETERS:

RELEASE HEIGHT (METERS)	.00	REP. WIND HEIGHT (METERS)	10.0
DIAMETER (METERS)	.00	BUILDING HEIGHT (METERS)	37.7
EXIT VELOCITY (METERS)	.00	BLDG.MINCHESCRS.SEC.AREA (SQ.METERS)	2134.0
		HEAT EMISSION RATE (CAL/SEC)	.0

Table 2.3S-28 XOQDOQ-Predicted Annual Averate χ/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

No Decay χ/Q at Various Segments											
RELEASE POINT - GROUND LEVEL - NO INTERMITTENT RELEASES NO DECAY, UNDEPLETED											
CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT											
SEGMENT BOUNDARIES IN MILES FROM THE SITE											
Direction from Site	**.5-1**	**1-2**	**2-3**	**3-4**	**4-5**	**5-10**	**10-20**	**20-30**	**30-40**	**40-50**	
S	5.022E-06	1.184E-06	3.776E-07	1.947E-07	1.228E-07	5.597E-08	2.104E-08	1.075E-08	6.988E-09	5.083E-09	
SSW	6.646E-06	1.590E-06	5.170E-07	2.694E-07	1.712E-07	7.896E-08	3.020E-08	1.564E-08	1.024E-08	7.485E-09	
SW	7.243E-06	1.748E-06	5.746E-07	3.011E-07	1.922E-07	8.917E-08	3.443E-08	1.794E-08	1.179E-08	8.642E-09	
WSW	6.231E-06	1.501E-06	4.925E-07	2.578E-07	1.644E-07	7.619E-08	2.937E-08	1.529E-08	1.004E-08	7.357E-09	
W	6.239E-06	1.499E-06	4.869E-07	2.535E-07	1.611E-07	7.417E-08	2.831E-08	1.463E-08	9.564E-09	6.985E-09	
WNW	7.191E-06	1.718E-06	5.511E-07	2.850E-07	1.802E-07	8.236E-08	3.107E-08	1.591E-08	1.034E-08	7.525E-09	
NW	8.567E-06	2.013E-06	6.296E-07	3.212E-07	2.011E-07	9.059E-08	3.340E-08	1.683E-08	1.083E-08	7.821E-09	
NNW	6.970E-06	1.606E-06	4.902E-07	2.466E-07	1.529E-07	6.778E-08	2.435E-08	1.202E-08	7.640E-09	5.465E-09	
N	4.161E-06	9.326E-07	2.808E-07	1.403E-07	8.661E-08	3.822E-08	1.367E-08	6.746E-09	4.291E-09	3.073E-09	
NNE	1.773E-06	3.979E-07	1.198E-07	5.983E-08	3.694E-08	1.628E-08	5.812E-09	2.865E-09	1.821E-09	1.304E-09	
NE	8.418E-07	1.908E-07	5.853E-08	2.957E-08	1.841E-08	8.231E-09	3.011E-09	1.514E-09	9.748E-10	7.044E-10	
ENE	5.616E-07	1.293E-07	3.994E-08	2.024E-08	1.263E-08	5.661E-09	2.075E-09	1.041E-09	6.686E-10	4.821E-10	
E	1.120E-06	2.668E-07	8.622E-08	4.480E-08	2.842E-08	1.308E-08	4.988E-09	2.580E-09	1.688E-09	1.234E-09	
ESE	2.282E-06	5.495E-07	1.806E-07	9.465E-08	6.041E-08	2.806E-08	1.086E-08	5.670E-09	3.731E-09	2.738E-09	
SE	2.680E-06	6.384E-07	2.058E-07	1.068E-07	6.766E-08	3.106E-08	1.181E-08	6.091E-09	3.978E-09	2.904E-09	
SSE	3.556E-06	8.349E-07	2.653E-07	1.366E-07	8.606E-08	3.917E-08	1.470E-08	7.509E-09	4.878E-09	3.547E-09	
XOQDOQ - STP (1997, 1999, 2000 Met Data)											

Table 2.3S-29 XOQDOQ-Predicted Annual Average D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

D/Qs at Various Distances

RELEASE POINT - GROUND LEVEL - NO INTERMITTENT RELEASES
CORRECTED USING STANDARD OPEN TERRAIN FACTORS

RELATIVE DEPOSITION PER UNIT AREA (M-2) AT FIXED POINTS BY DOWNWIND SECTORS**
DISTANCES IN MILES

Direction from Site	.25	.50	.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50
S	1.634E-07	5.526E-08	2.837E-08	1.349E-08	4.845E-09	2.403E-09	1.415E-09	9.265E-10	6.519E-10	4.831E-10	3.723E-10
SSW	1.631E-07	5.514E-08	2.831E-08	1.346E-08	4.835E-09	2.398E-09	1.412E-09	9.244E-10	6.505E-10	4.820E-10	3.715E-10
SW	1.446E-07	4.889E-08	2.510E-08	1.193E-08	4.286E-09	2.126E-09	1.252E-09	8.196E-10	5.767E-10	4.274E-10	3.293E-10
WSW	1.254E-07	4.242E-08	2.178E-08	1.035E-08	3.719E-09	1.844E-09	1.086E-09	7.111E-10	5.004E-10	3.708E-10	2.858E-10
W	1.460E-07	4.938E-08	2.535E-08	1.205E-08	4.330E-09	2.147E-09	1.264E-09	8.278E-10	5.825E-10	4.317E-10	3.327E-10
WNW	1.954E-07	6.607E-08	3.393E-08	1.613E-08	5.793E-09	2.873E-09	1.692E-09	1.108E-09	7.795E-10	5.776E-10	4.451E-10
NW	3.169E-07	1.072E-07	5.502E-08	2.616E-08	9.396E-09	4.660E-09	2.744E-09	1.797E-09	1.264E-09	9.369E-10	7.220E-10
NNW	3.229E-07	1.092E-07	5.607E-08	2.666E-08	9.575E-09	4.748E-09	2.796E-09	1.831E-09	1.288E-09	9.547E-10	7.357E-10
N	2.953E-07	9.987E-08	5.128E-08	2.438E-08	8.756E-09	4.342E-09	2.557E-09	1.674E-09	1.178E-09	8.731E-10	6.728E-10
NNE	1.134E-07	3.835E-08	1.969E-08	9.361E-09	3.363E-09	1.668E-09	9.819E-10	6.429E-10	4.524E-10	3.353E-10	2.584E-10
NE	4.764E-08	1.611E-08	8.272E-09	3.933E-09	1.413E-09	7.005E-10	4.125E-10	2.701E-10	1.900E-10	1.408E-10	1.085E-10
ENE	1.995E-08	6.746E-09	3.464E-09	1.647E-09	5.915E-10	2.933E-10	1.727E-10	1.131E-10	7.958E-11	5.898E-11	4.545E-11
E	2.487E-08	8.409E-09	4.318E-09	2.053E-09	7.373E-10	3.657E-10	2.153E-10	1.410E-10	9.920E-11	7.352E-11	5.666E-11
ESE	4.363E-08	1.475E-08	7.576E-09	3.602E-09	1.294E-09	6.416E-10	3.778E-10	2.474E-10	1.741E-10	1.290E-10	9.941E-11
SE	7.005E-08	2.369E-08	1.216E-08	5.782E-09	2.077E-09	1.030E-09	6.065E-10	3.971E-10	2.794E-10	2.071E-10	1.596E-10
SSE	1.234E-07	4.174E-08	2.143E-08	1.019E-08	3.660E-09	1.815E-09	1.069E-09	6.998E-10	4.924E-10	3.649E-10	2.812E-10

Table 2.3S-29 XOQDOQ-Predicted Annual Average D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries (Continued)

D/Qs at Various Distances											
	DISTANCES IN MILES										
Direction from Site	5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
S	2.958E-10	1.314E-10	7.959E-11	4.023E-11	2.435E-11	1.633E-11	1.170E-11	8.784E-12	6.830E-12	5.456E-12	4.453E-12
SSW	2.951E-10	1.311E-10	7.941E-11	4.014E-11	2.429E-11	1.629E-11	1.167E-11	8.764E-12	6.815E-12	5.443E-12	4.443E-12
SW	2.616E-10	1.162E-10	7.041E-11	3.559E-11	2.154E-11	1.444E-11	1.035E-11	7.770E-12	6.042E-12	4.826E-12	3.939E-12
WSW	2.270E-10	1.009E-10	6.109E-11	3.088E-11	1.869E-11	1.253E-11	8.979E-12	6.742E-12	5.242E-12	4.188E-12	3.418E-12
W	2.643E-10	1.174E-10	7.112E-11	3.595E-11	2.176E-11	1.459E-11	1.045E-11	7.849E-12	6.103E-12	4.875E-12	3.979E-12
WNW	3.536E-10	1.571E-10	9.516E-11	4.810E-11	2.911E-11	1.952E-11	1.399E-11	1.050E-11	8.166E-12	6.523E-12	5.324E-12
NW	5.736E-10	2.548E-10	1.543E-10	7.802E-11	4.722E-11	3.166E-11	2.269E-11	1.703E-11	1.324E-11	1.058E-11	8.636E-12
NNW	5.845E-10	2.596E-10	1.573E-10	7.950E-11	4.811E-11	3.226E-11	2.312E-11	1.736E-11	1.350E-11	1.078E-11	8.799E-12
N	5.345E-10	2.374E-10	1.438E-10	7.270E-11	4.400E-11	2.950E-11	2.114E-11	1.587E-11	1.234E-11	9.859E-12	8.047E-12
NNE	2.053E-10	9.118E-11	5.524E-11	2.792E-11	1.690E-11	1.133E-11	8.118E-12	6.096E-12	4.740E-12	3.786E-12	3.090E-12
NE	8.623E-11	3.830E-11	2.320E-11	1.173E-11	7.098E-12	4.759E-12	3.410E-12	2.561E-12	1.991E-12	1.590E-12	1.298E-12
ENE	3.611E-11	1.604E-11	9.716E-12	4.911E-12	2.972E-12	1.993E-12	1.428E-12	1.072E-12	8.337E-13	6.660E-13	5.436E-13
E	4.501E-11	1.999E-11	1.211E-11	6.122E-12	3.705E-12	2.484E-12	1.780E-12	1.337E-12	1.039E-12	8.302E-13	6.776E-13
ESE	7.897E-11	3.508E-11	2.125E-11	1.074E-11	6.501E-12	4.359E-12	3.123E-12	2.345E-12	1.824E-12	1.457E-12	1.189E-12
SE	1.268E-10	5.632E-11	3.412E-11	1.724E-11	1.044E-11	6.998E-12	5.014E-12	3.765E-12	2.928E-12	2.339E-12	1.909E-12
SSE	2.234E-10	9.924E-11	6.012E-11	3.039E-11	1.839E-11	1.233E-11	8.835E-12	6.634E-12	5.158E-12	4.121E-12	3.363E-12

Table 2.3S-29 XOQDOQ-Predicted Annual Average D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

D/Qs at Various Segments

RELEASE POINT - GROUND LEVEL - NO INTERMITTENT RELEASES

RELATIVE DEPOSITION PER UNIT AREA (M-2) BY DOWNWIND SECTORS**
SEGMENT BOUNDARIES IN MILES

Direction from Site	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50	
S	2.773E-08	5.681E-09	1.483E-09	6.661E-10	3.768E-10	1.449E-10	4.192E-11	1.661E-11	8.872E-12	5.491E-12	
SSW	2.767E-08	5.668E-09	1.480E-09	6.646E-10	3.760E-10	1.446E-10	4.183E-11	1.658E-11	8.852E-12	5.479E-12	
SW	2.453E-08	5.025E-09	1.312E-09	5.892E-10	3.333E-10	1.282E-10	3.708E-11	1.470E-11	7.848E-12	4.858E-12	
WSW	2.129E-08	4.360E-09	1.138E-09	5.112E-10	2.892E-10	1.112E-10	3.218E-11	1.275E-11	6.810E-12	4.215E-12	
W	2.478E-08	5.076E-09	1.325E-09	5.951E-10	3.367E-10	1.295E-10	3.746E-11	1.485E-11	7.928E-12	4.907E-12	
WNW	3.316E-08	6.792E-09	1.773E-09	7.964E-10	4.505E-10	1.732E-10	5.012E-11	1.986E-11	1.061E-11	6.566E-12	
NW	5.378E-08	1.102E-08	2.876E-09	1.292E-09	7.307E-10	2.810E-10	8.129E-11	3.222E-11	1.721E-11	1.065E-11	
NNW	5.480E-08	1.123E-08	2.930E-09	1.316E-09	7.446E-10	2.863E-10	8.283E-11	3.283E-11	1.753E-11	1.085E-11	
N	5.012E-08	1.027E-08	2.680E-09	1.204E-09	6.809E-10	2.619E-10	7.575E-11	3.002E-11	1.603E-11	9.924E-12	
NNE	1.925E-08	3.942E-09	1.029E-09	4.622E-10	2.615E-10	1.006E-10	2.909E-11	1.153E-11	6.157E-12	3.811E-12	
NE	8.085E-09	1.656E-09	4.323E-10	1.942E-10	1.098E-10	4.224E-11	1.222E-11	4.843E-12	2.586E-12	1.601E-12	
ENE	3.386E-09	6.935E-10	1.810E-10	8.131E-11	4.600E-11	1.769E-11	5.117E-12	2.028E-12	1.083E-12	6.704E-13	
E	4.220E-09	8.645E-10	2.257E-10	1.014E-10	5.734E-11	2.205E-11	6.379E-12	2.528E-12	1.350E-12	8.357E-13	
ESE	7.405E-09	1.517E-09	3.960E-10	1.778E-10	1.006E-10	3.869E-11	1.119E-11	4.436E-12	2.369E-12	1.466E-12	
SE	1.189E-08	2.435E-09	6.357E-10	2.855E-10	1.615E-10	6.211E-11	1.797E-11	7.122E-12	3.803E-12	2.354E-12	
SSE	2.095E-08	4.291E-09	1.120E-09	5.031E-10	2.846E-10	1.094E-10	3.166E-11	1.255E-11	6.701E-12	4.148E-12	

VENT AND BUILDING PARAMETERS:

RELEASE HEIGHT (METERS)	.00	REP. WIND HEIGHT (METERS)	10.0
DIAMETER (METERS)	.00	BUILDING HEIGHT (METERS)	37.7
EXIT VELOCITY (METERS)	.00	BLDG.MINCHESCRS.SEC.AREA (SQ.METERS)	2134.0
		HEAT EMISSION RATE (CAL/SEC)	.0

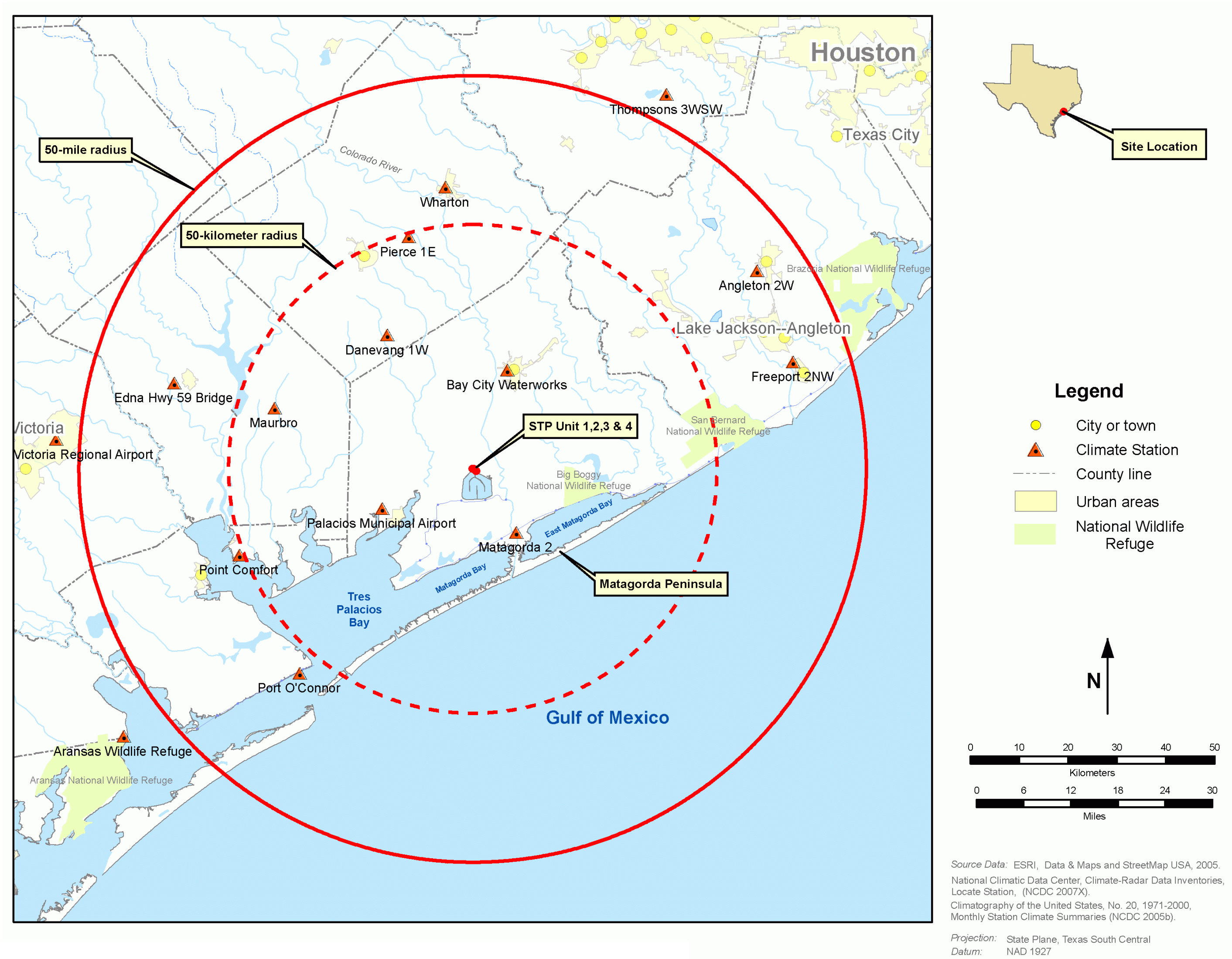


Figure 2.3S-1 Climatological Observing Stations Near the STP Site

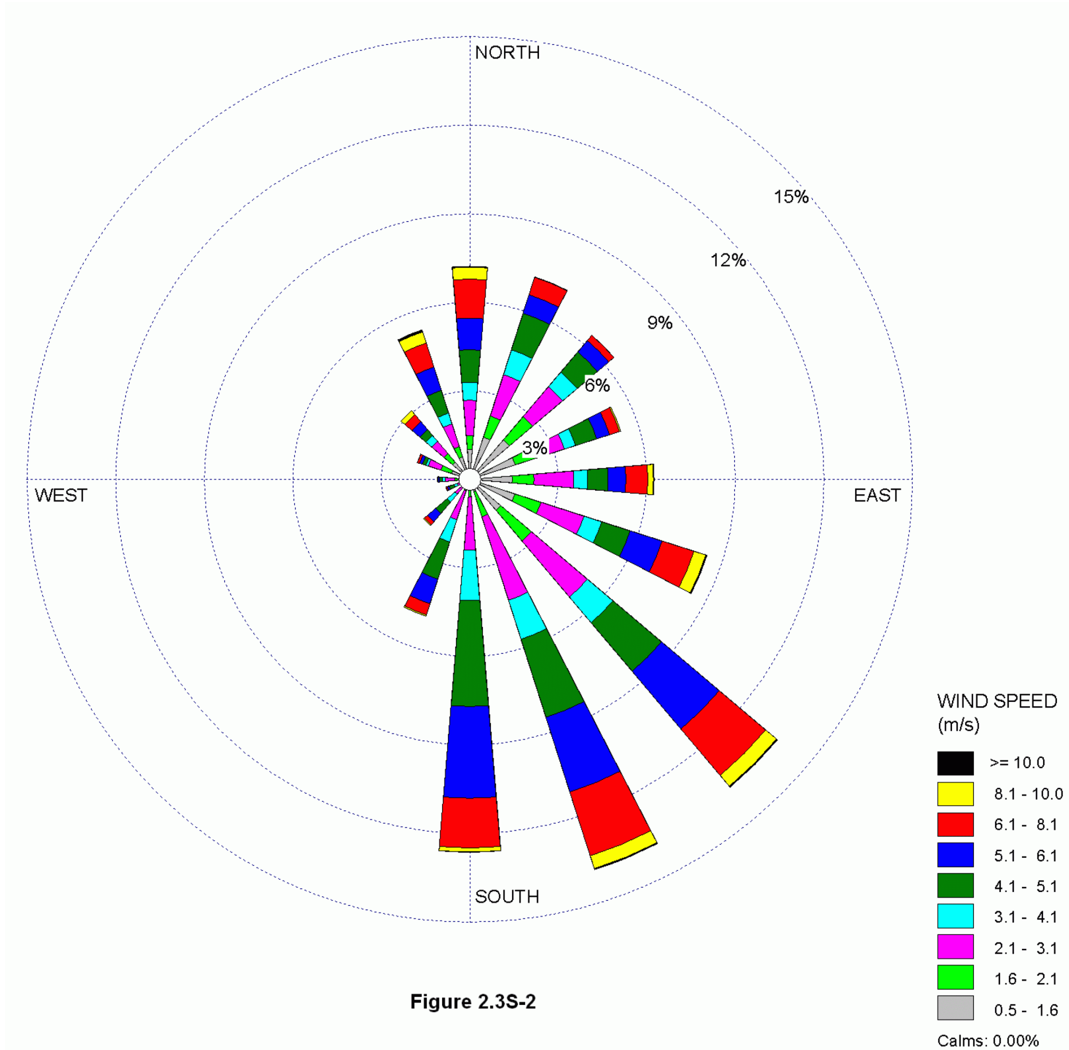


Figure 2.3S-2

Figure 2.3S-2 STP 3 & 4 10-Meter Level 3-year Composite Wind Rose - Annual (1997, 1999, and 2000)

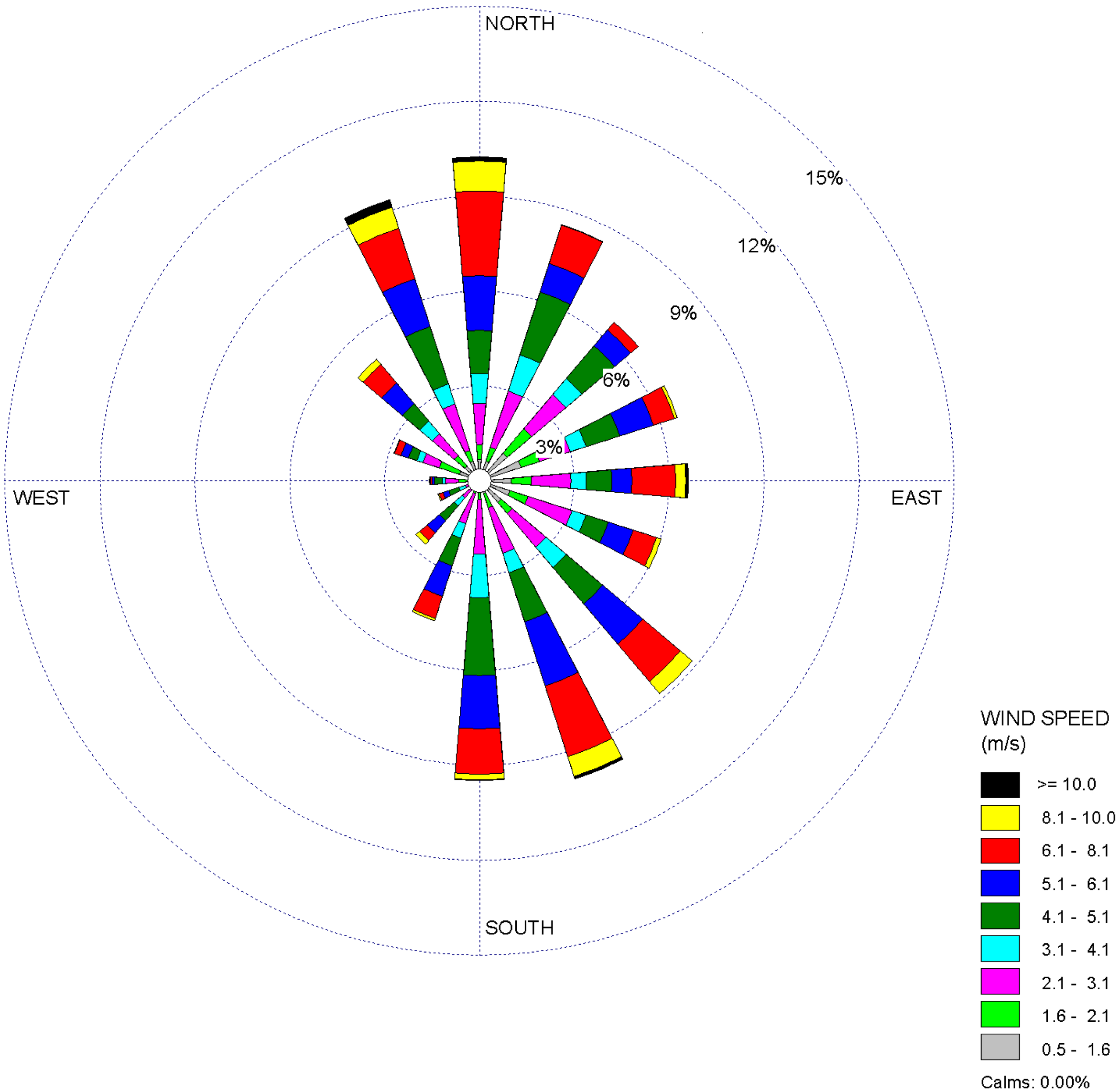


Figure 2.3S-3 STP 3 & 4 10-Meter Level 3-Year Composite Wind Rose - Winter (1997, 1999, and 2000)

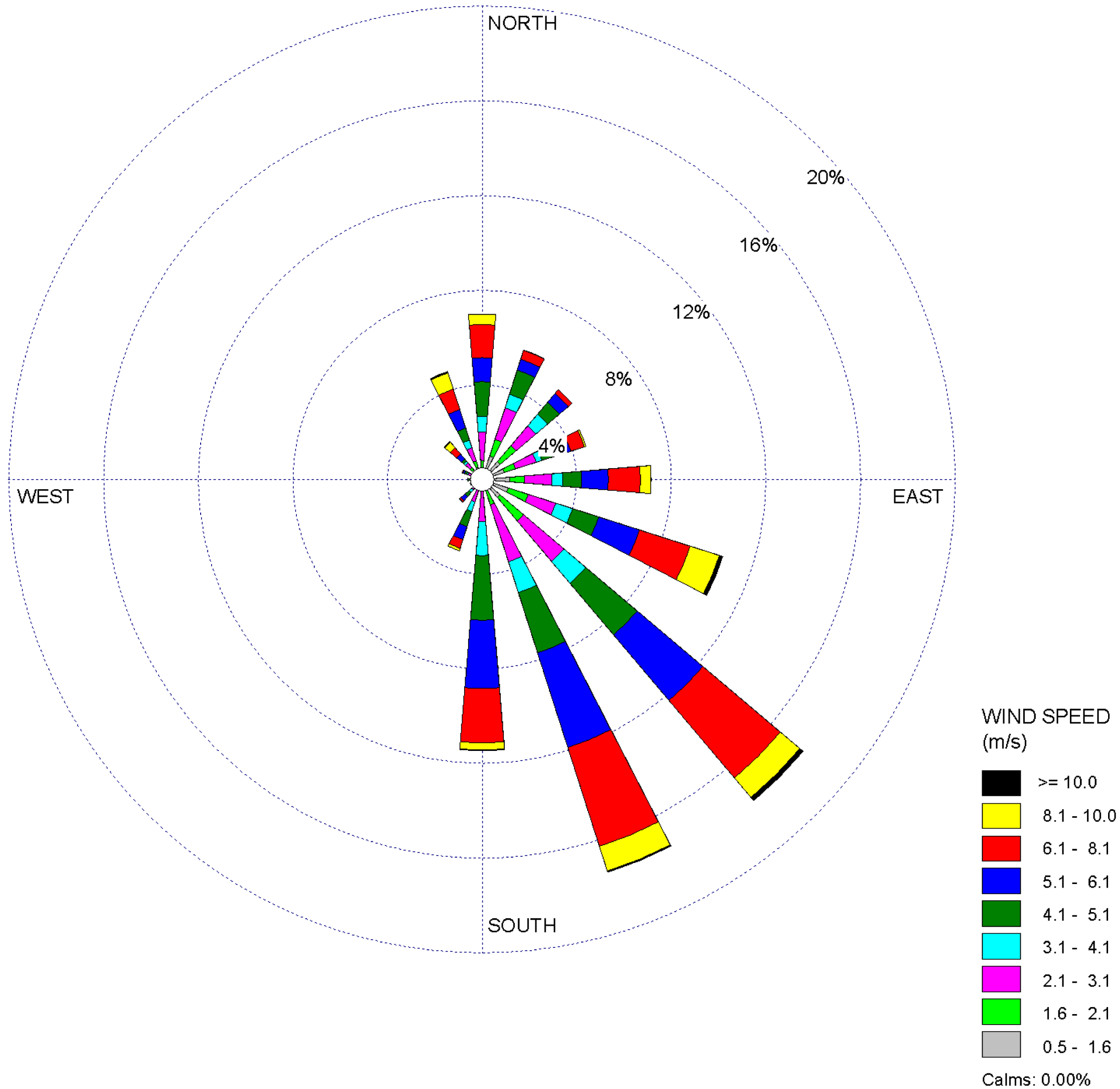


Figure 2.3S-4 STP 3 & 4 10-Meter Level 3-Year Composite Wind Rose - Spring (1997, 1999, and 2000)

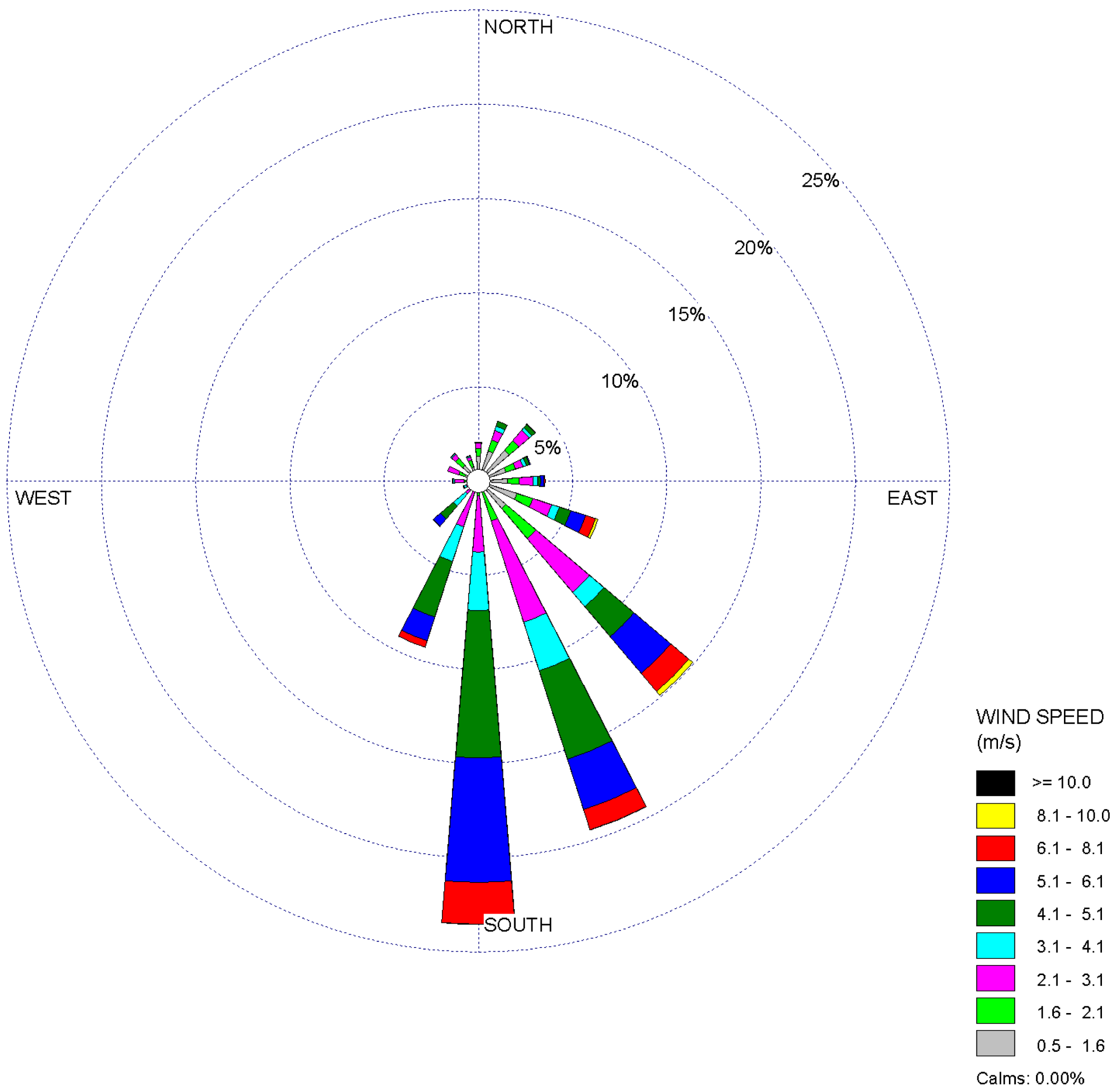


Figure 2.3S-5 STP 3 & 4 10-Meter Level 3-Year Composite Wind Rose - Summer (1997, 1999, and 2000)

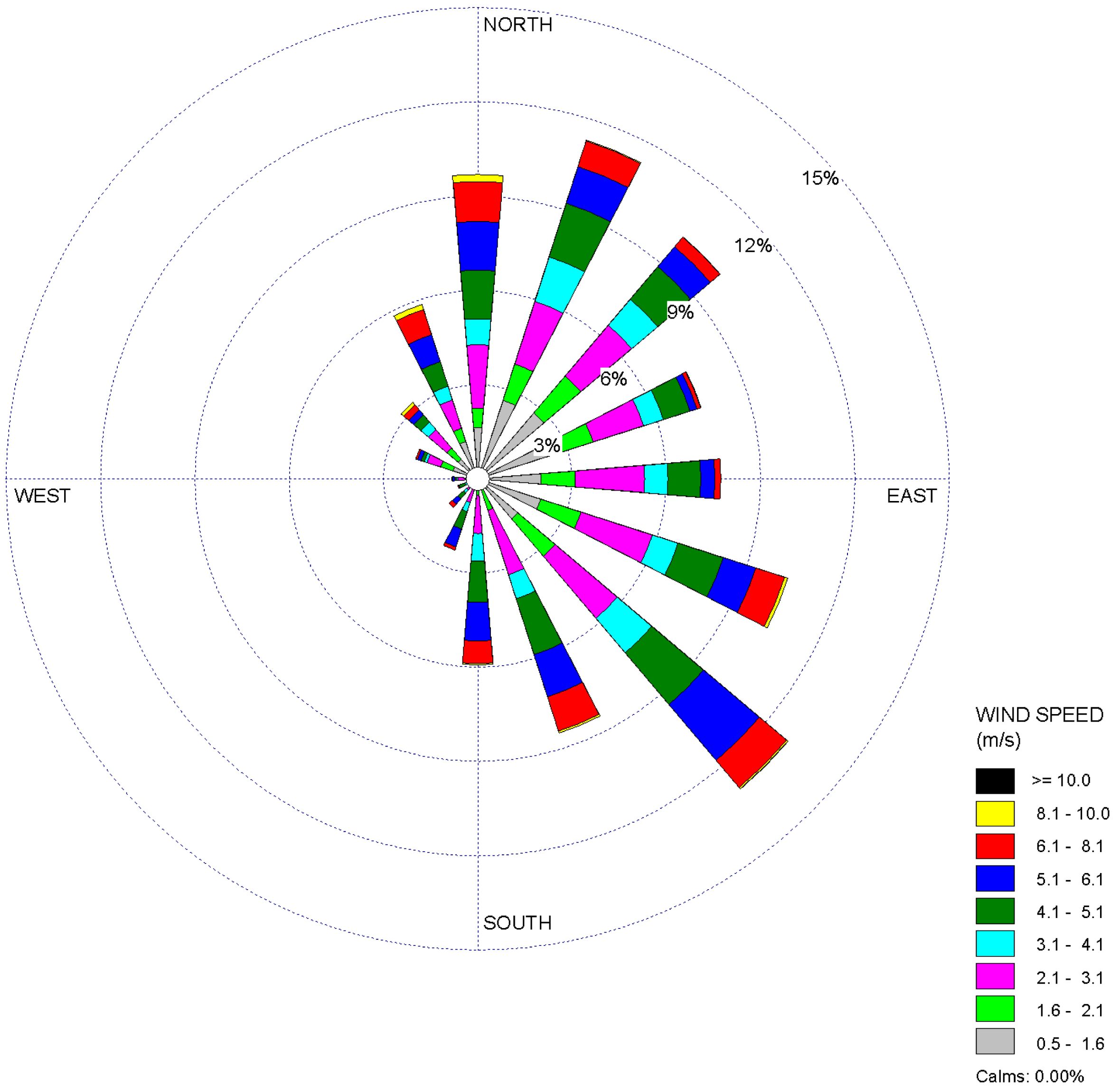


Figure 2.3S-6 STP 3 & 4 10-Meter Level 3-Year Composite Wind Rose - Autumn (1997, 1999, and 2000)

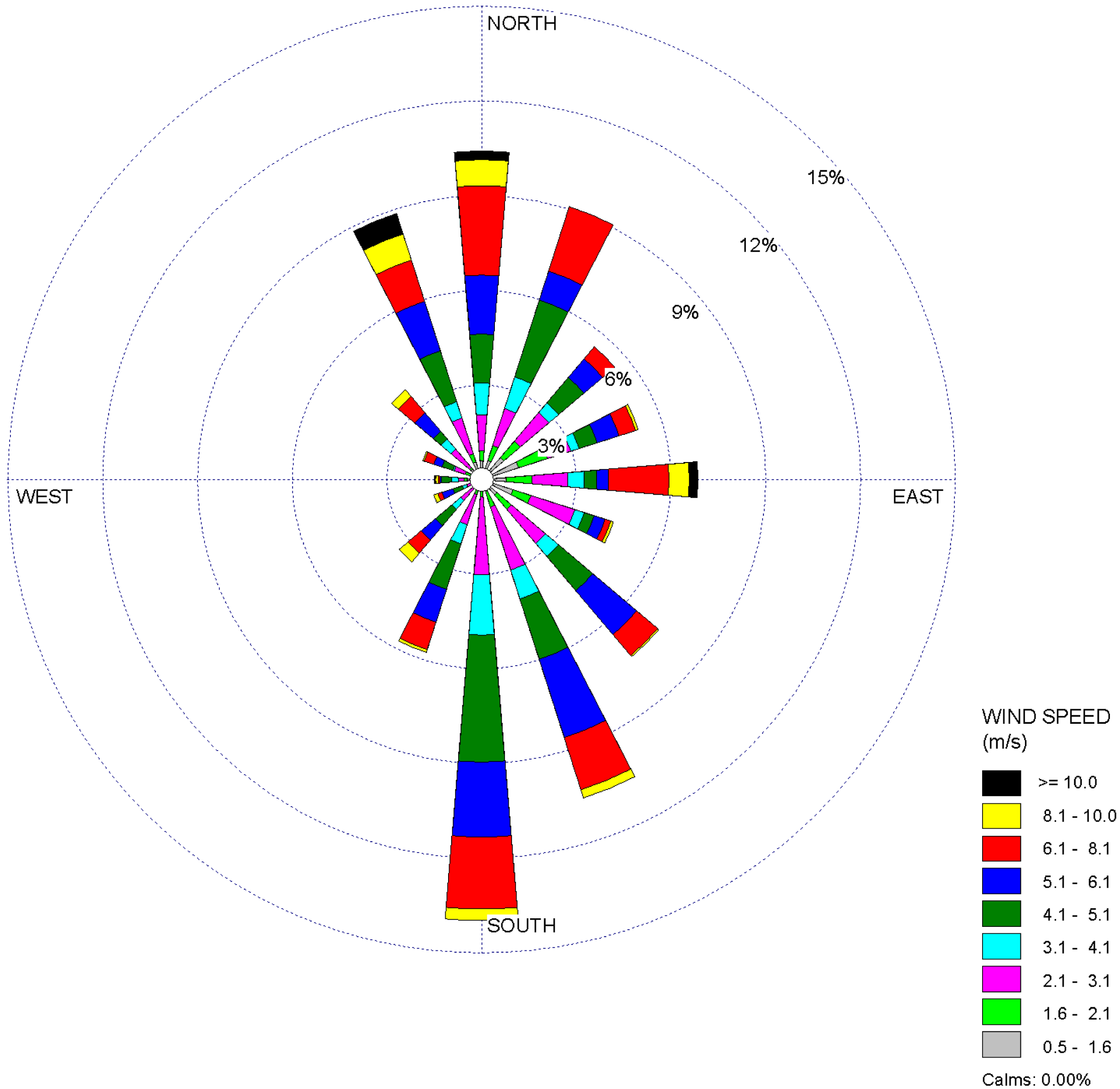


Figure 2.3S-7 STP 3 & 4 10-Meter Level 3-Year Composite Wind Rose - January (1997, 1999, and 2000) - Sheet 1 of 12

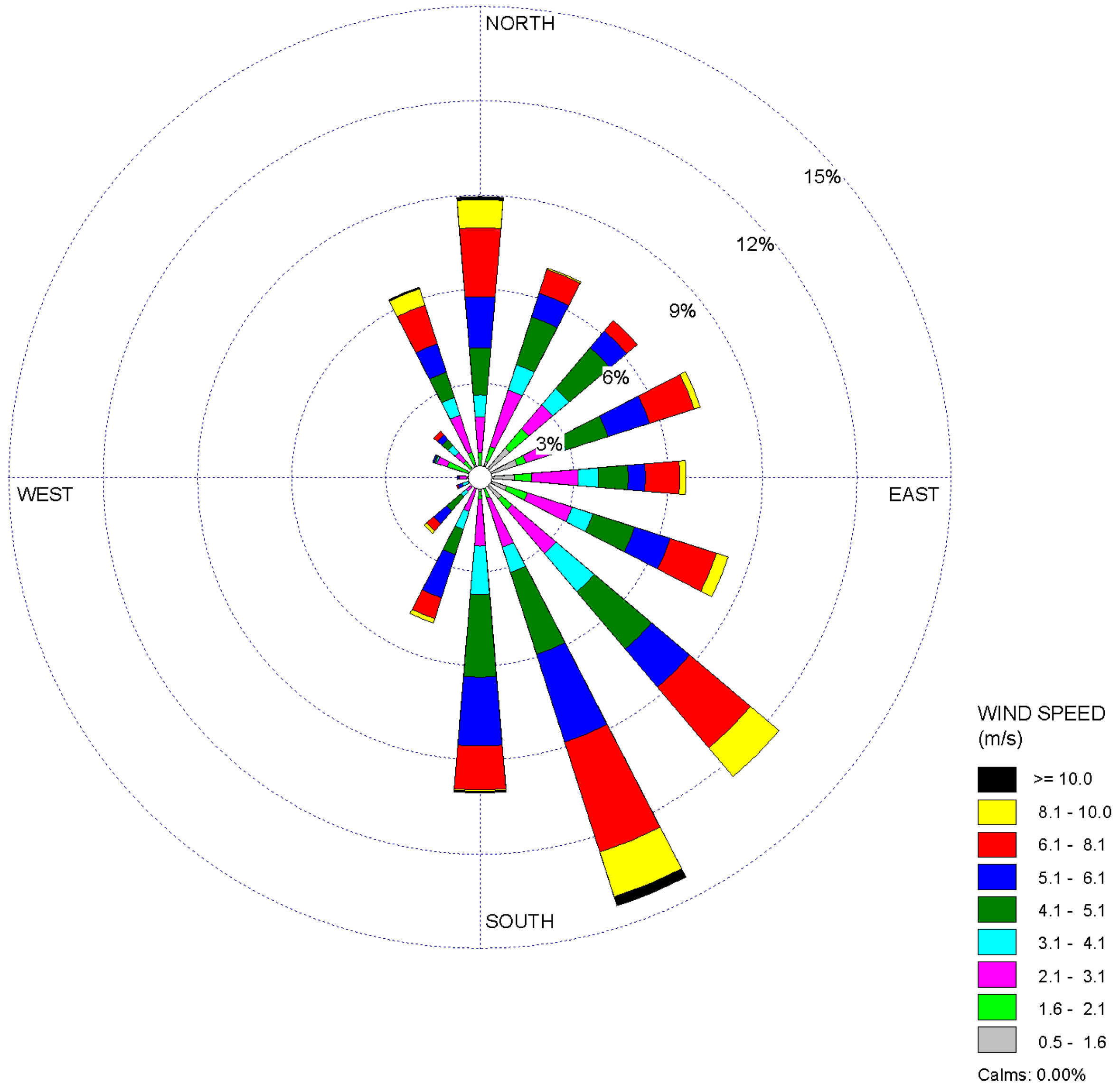


Figure 2.3S-7 STP 3 & 4 10-Meter Level 3-Year Composite Wind Rose - February (1997, 1999, and 2000) - Sheet 2 of 12

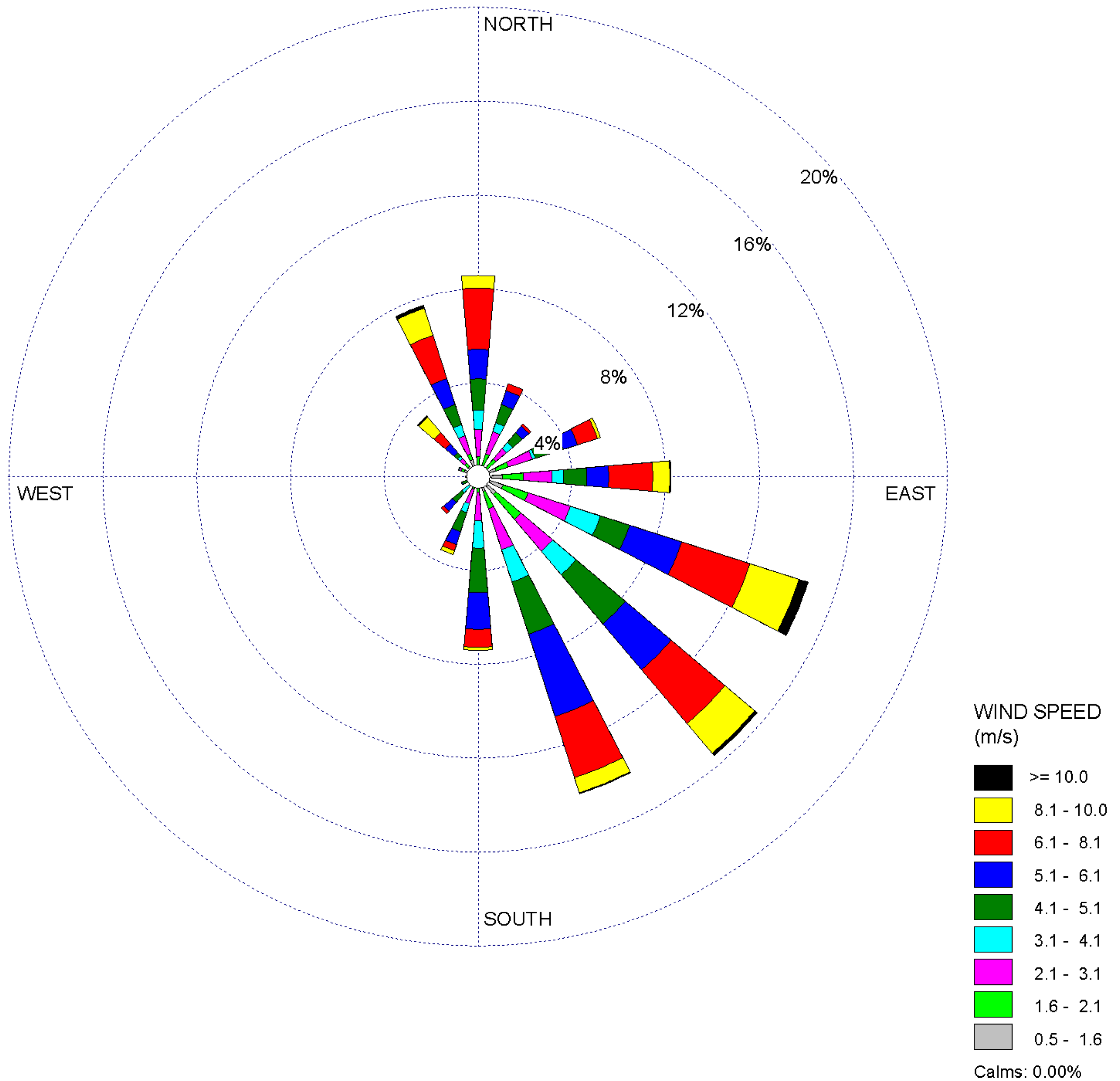


Figure 2.3S-7 STP 3 & 4 10-Meter Level 3-Year Composite Wind Rose - March (1997, 1999, and 2000) - Sheet 3 of 12

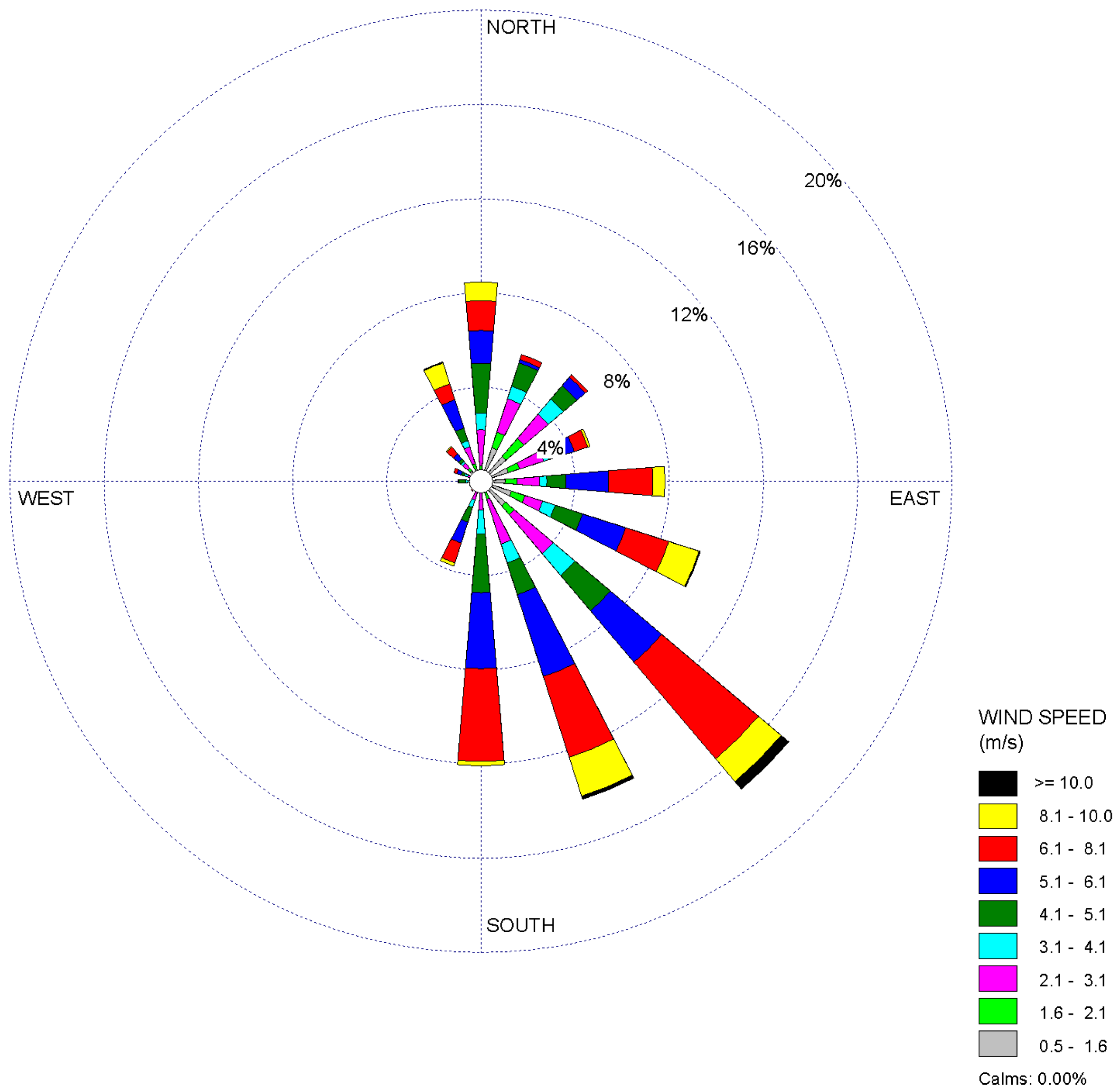


Figure 2.3S-7 STP 3 & 4 10-Meter Level 3-Year Composite Wind Rose - April (1997, 1999, and 2000) - Sheet 4 of 12

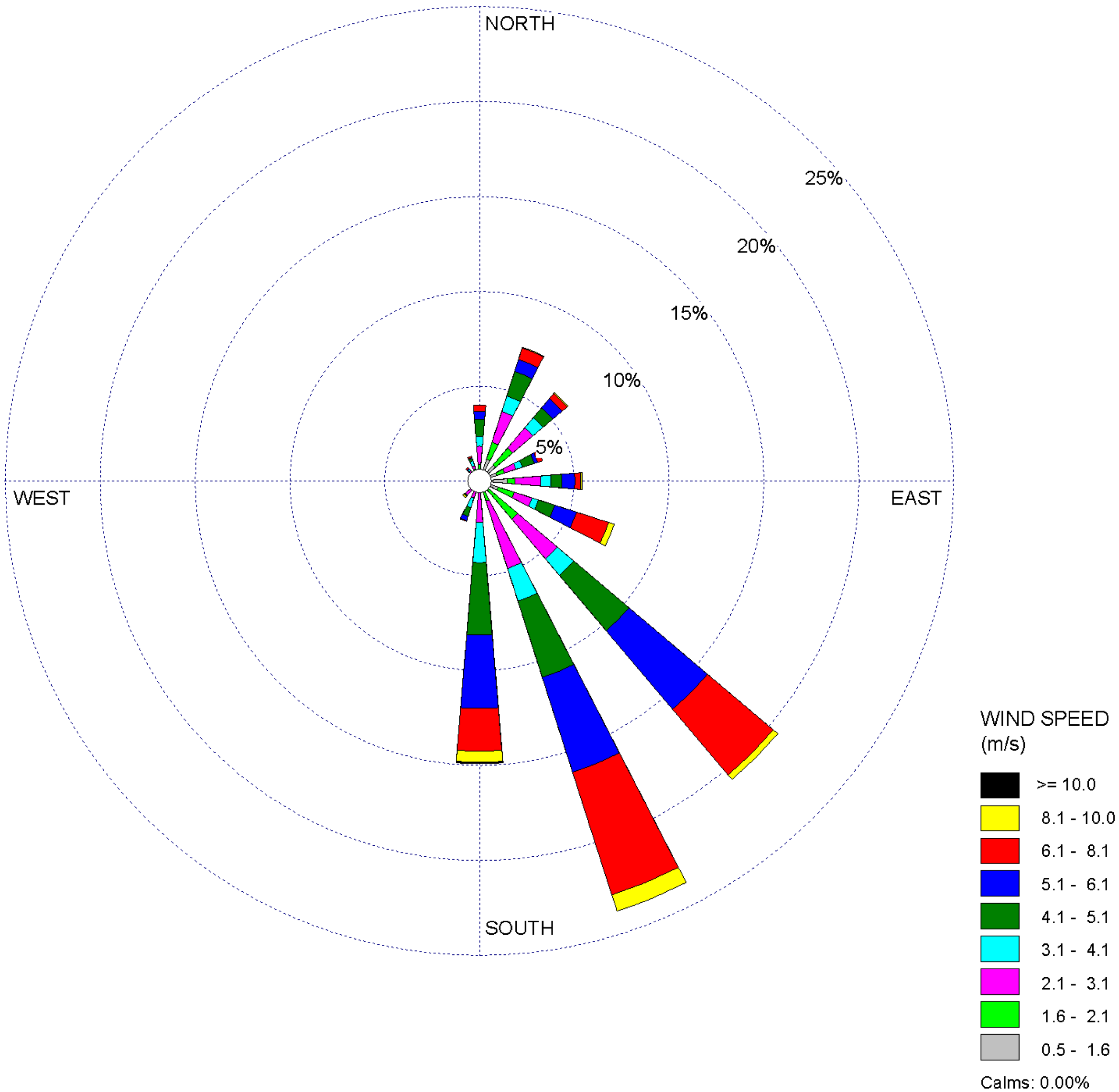


Figure 2.3S-7 STP 3 & 4 10-Meter Level 3-Year Composite Wind Rose - May (1997, 1999, and 2000) - Sheet 5 of 12

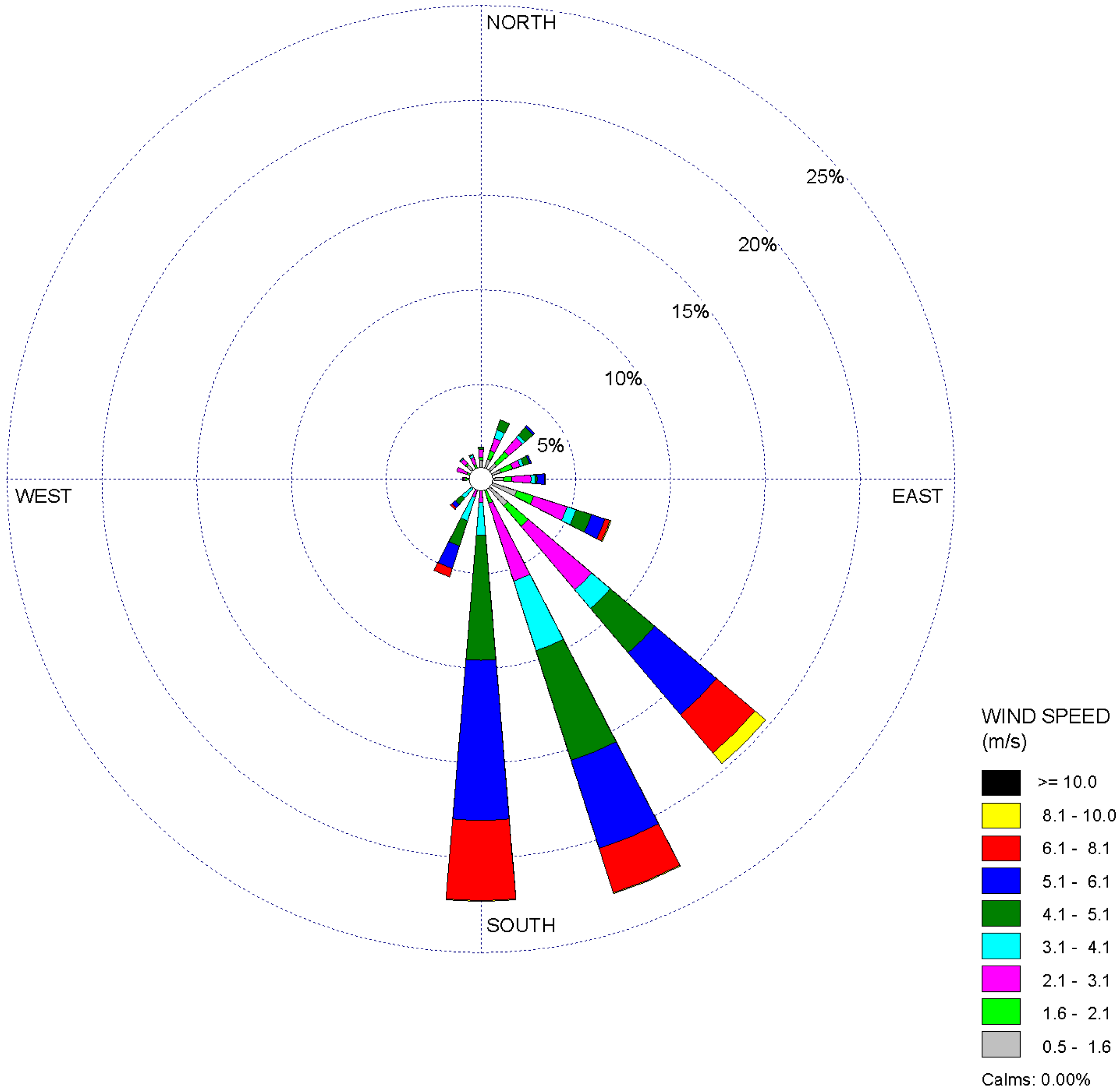


Figure 2.3S-7 STP 3 & 4 10-Meter Level 3-Year Composite Wind Rose - June (1997, 1999, and 2000) - Sheet 6 of 12

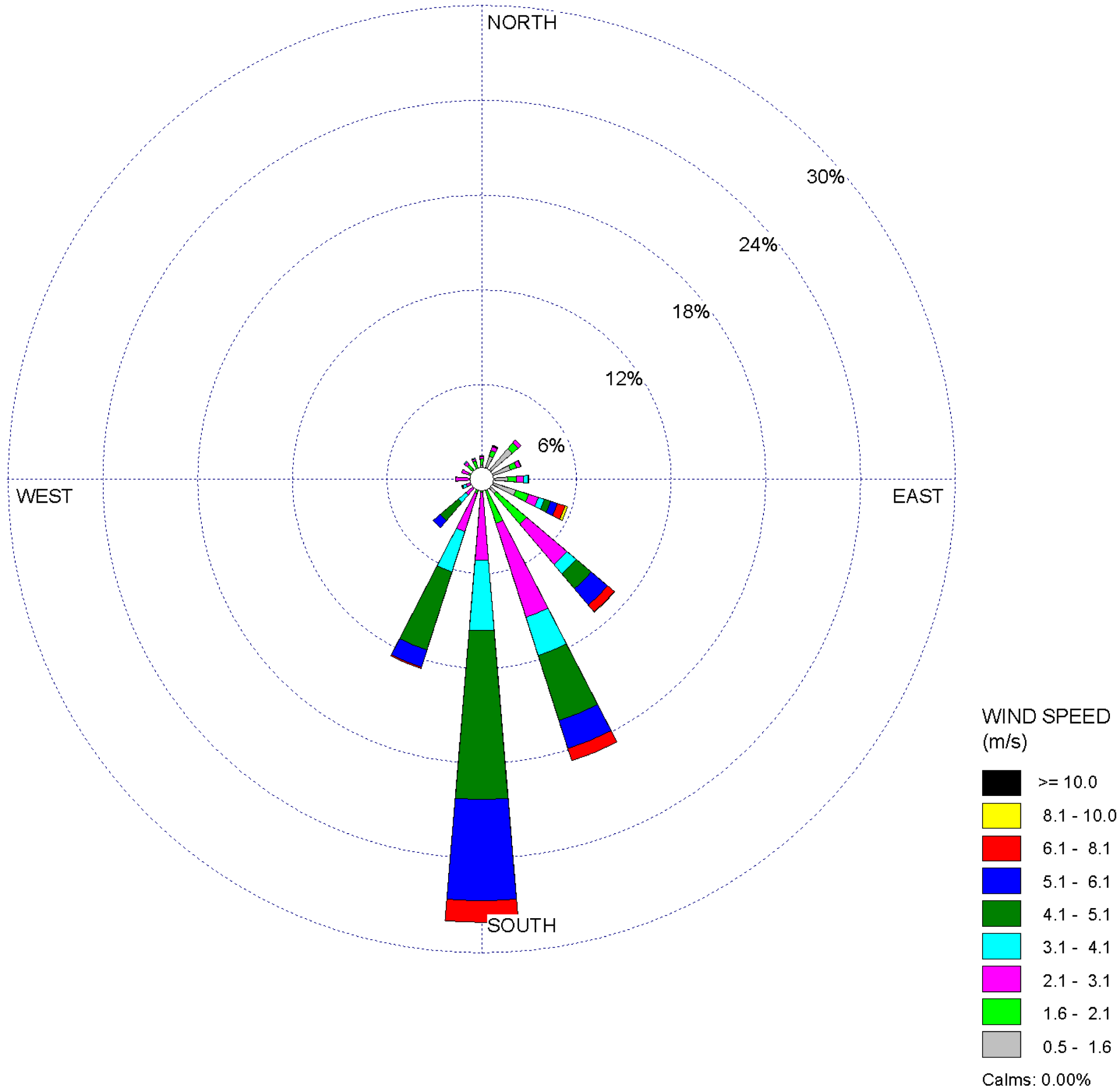


Figure 2.3S-7 STP 3 & 4 10-Meter Level 3-Year Composite Wind Rose - July (1997, 1999, and 2000) - Sheet 7 of 12

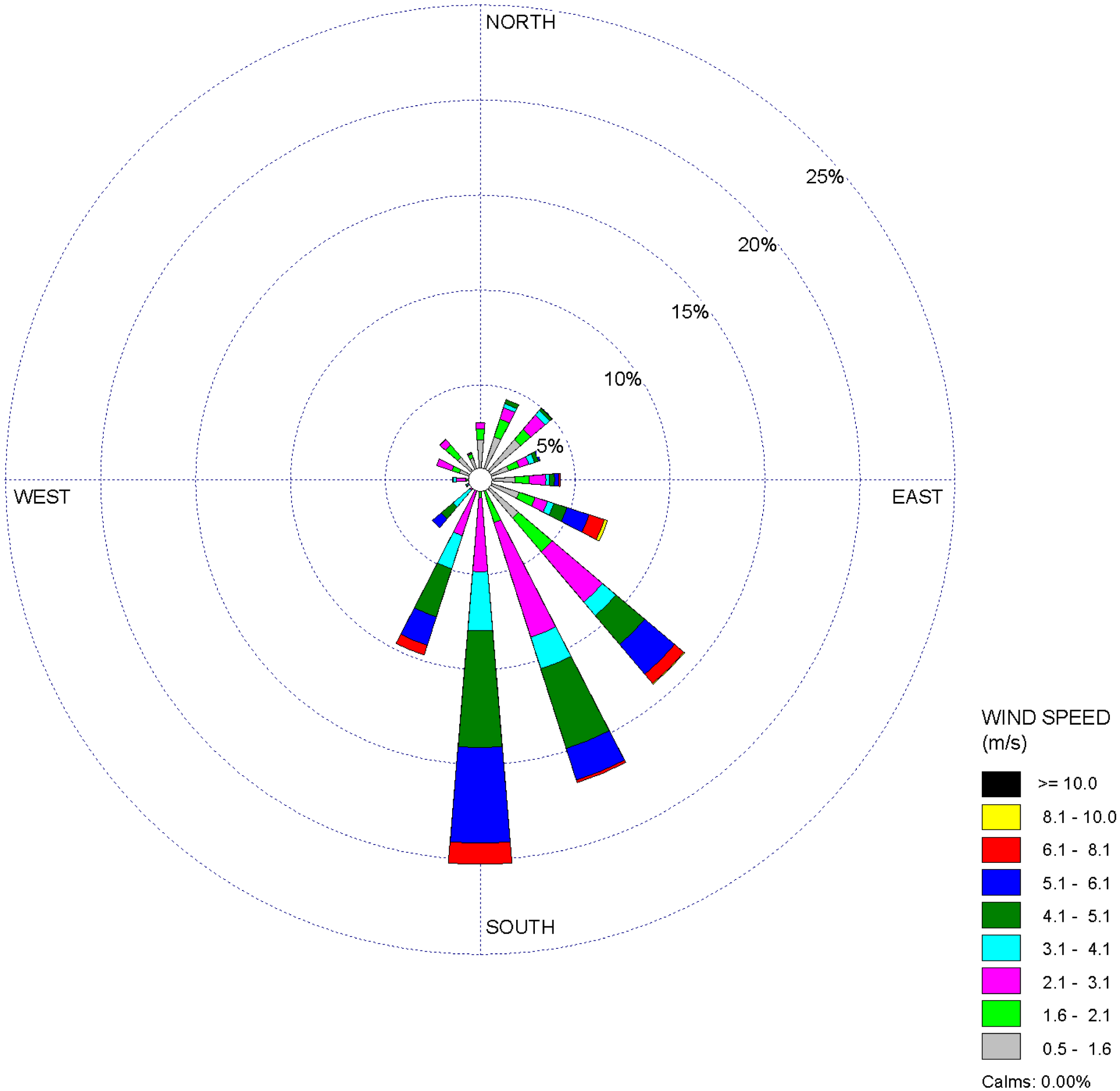


Figure 2.3S-7 STP 3 & 4 10-Meter Level 3-Year Composite Wind Rose - August (1997, 1999, and 2000) - Sheet 8 of 12

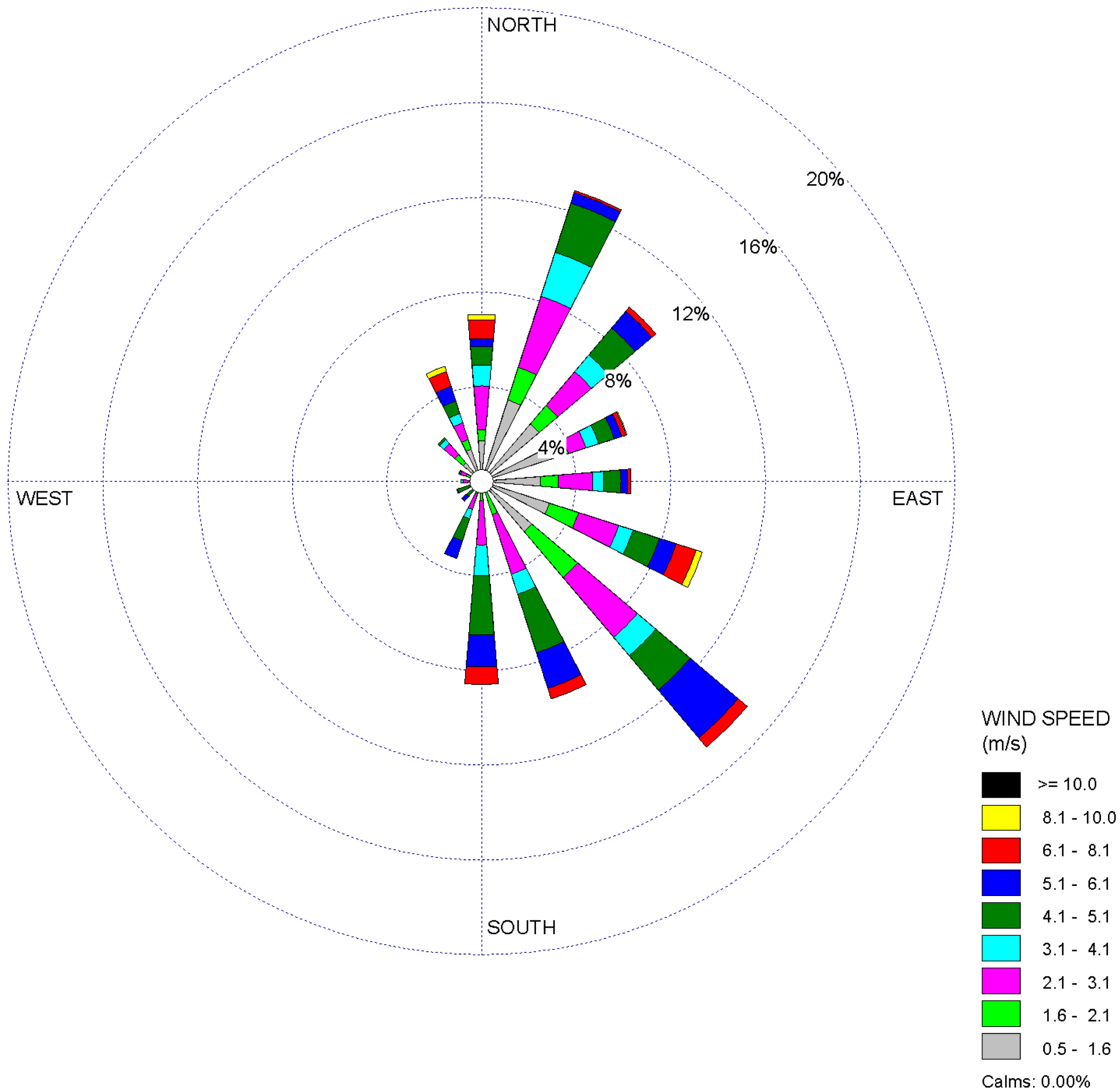


Figure 2.3S-7 STP 3 & 4 10-Meter Level 3-Year Composite Wind Rose - September (1997, 1999, and 2000) - Sheet 9 of 12

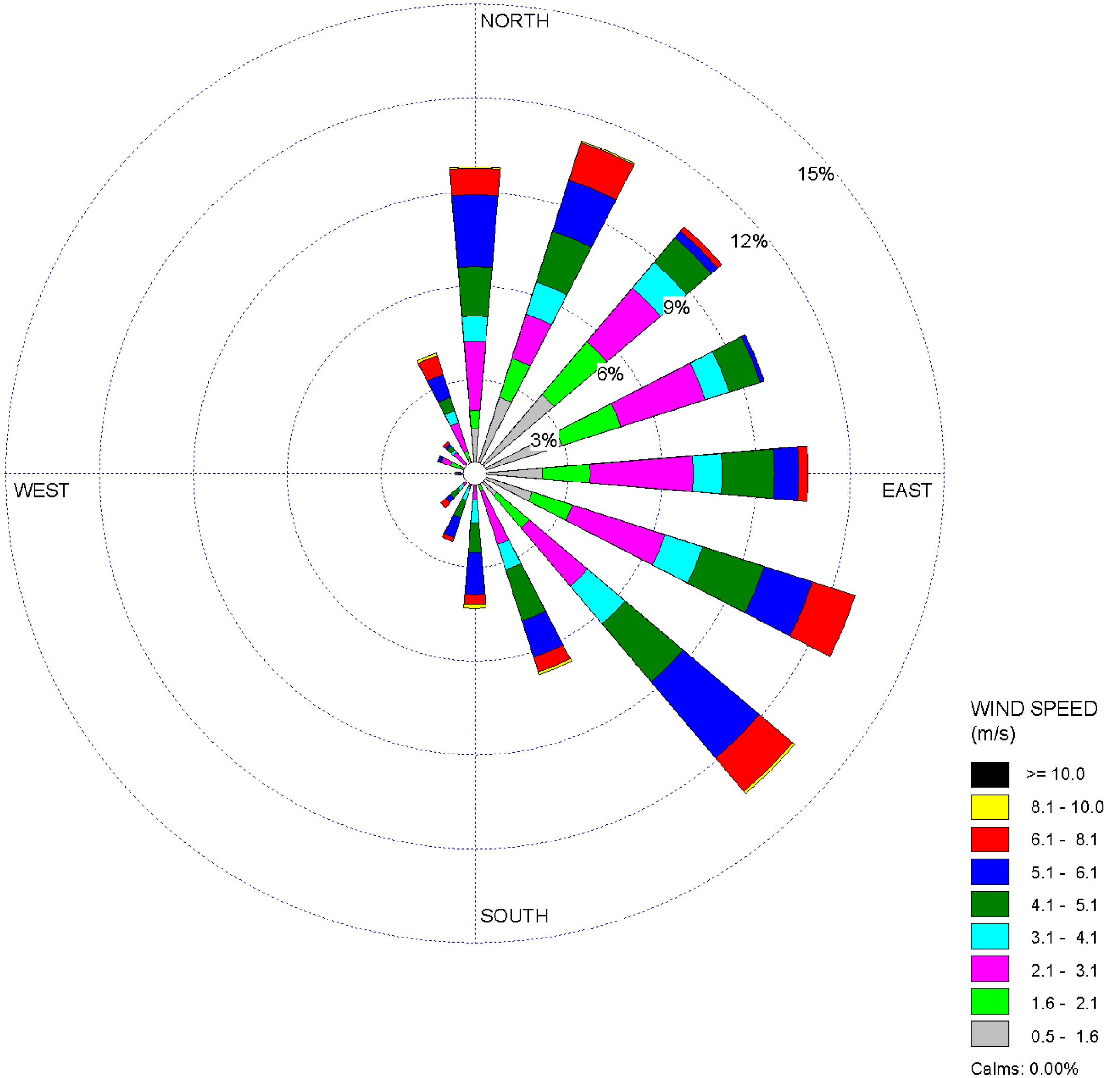


Figure 2.3S-7 STP 3 & 4 10-Meter Level 3-Year Composite Wind Rose - October (1997, 1999, and 2000) - Sheet 10 of 12

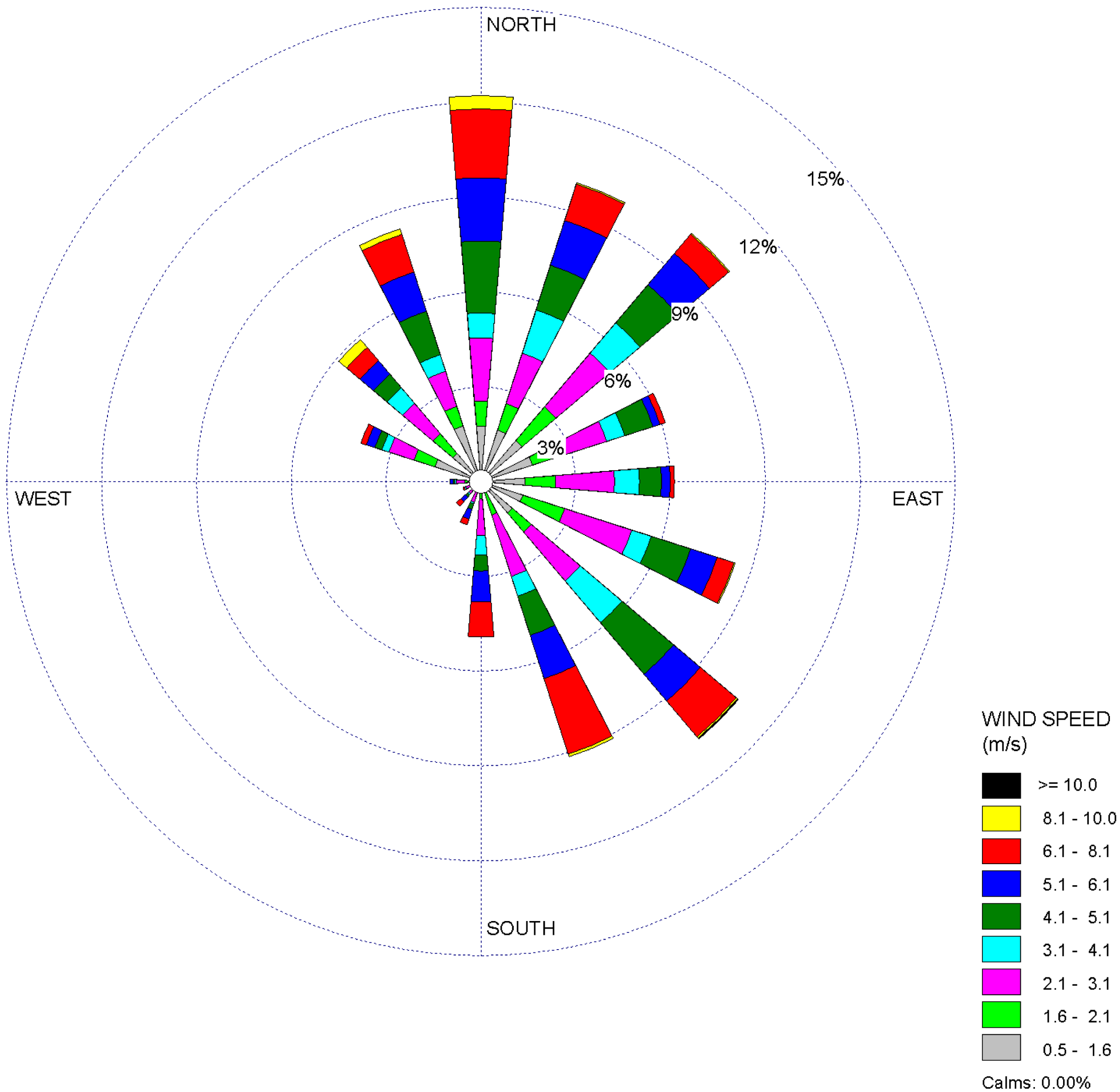


Figure 2.3S-7 STP 3 & 4 10-Meter Level 3-Year Composite Wind Rose - November (1997, 1999, and 2000) - Sheet 11 of 12

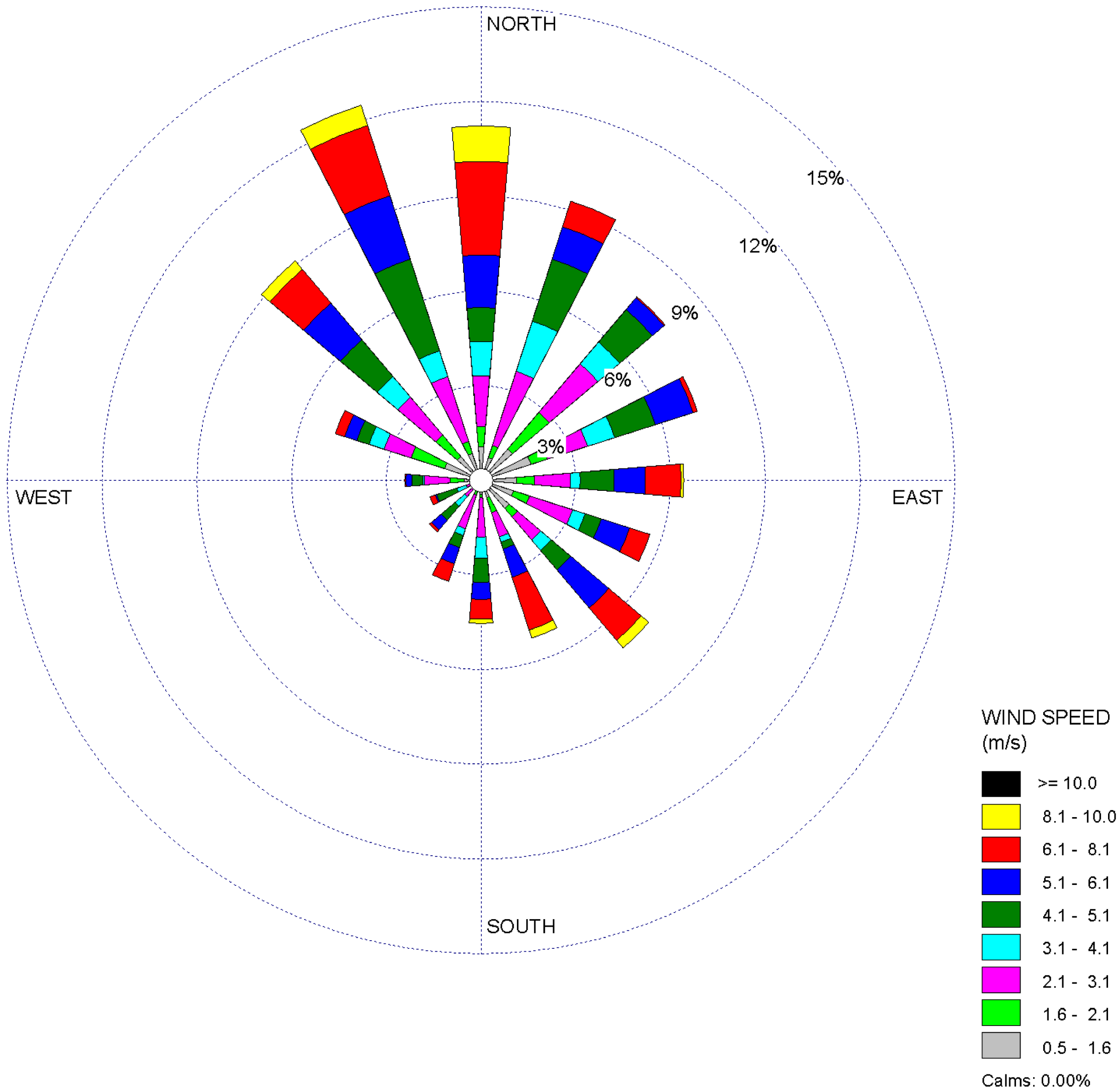


Figure 2.3S-7 STP 3 & 4 10-Meter Level 3-Year Composite Wind Rose - December (1997, 1999, and 2000) - Sheet 12 of 12

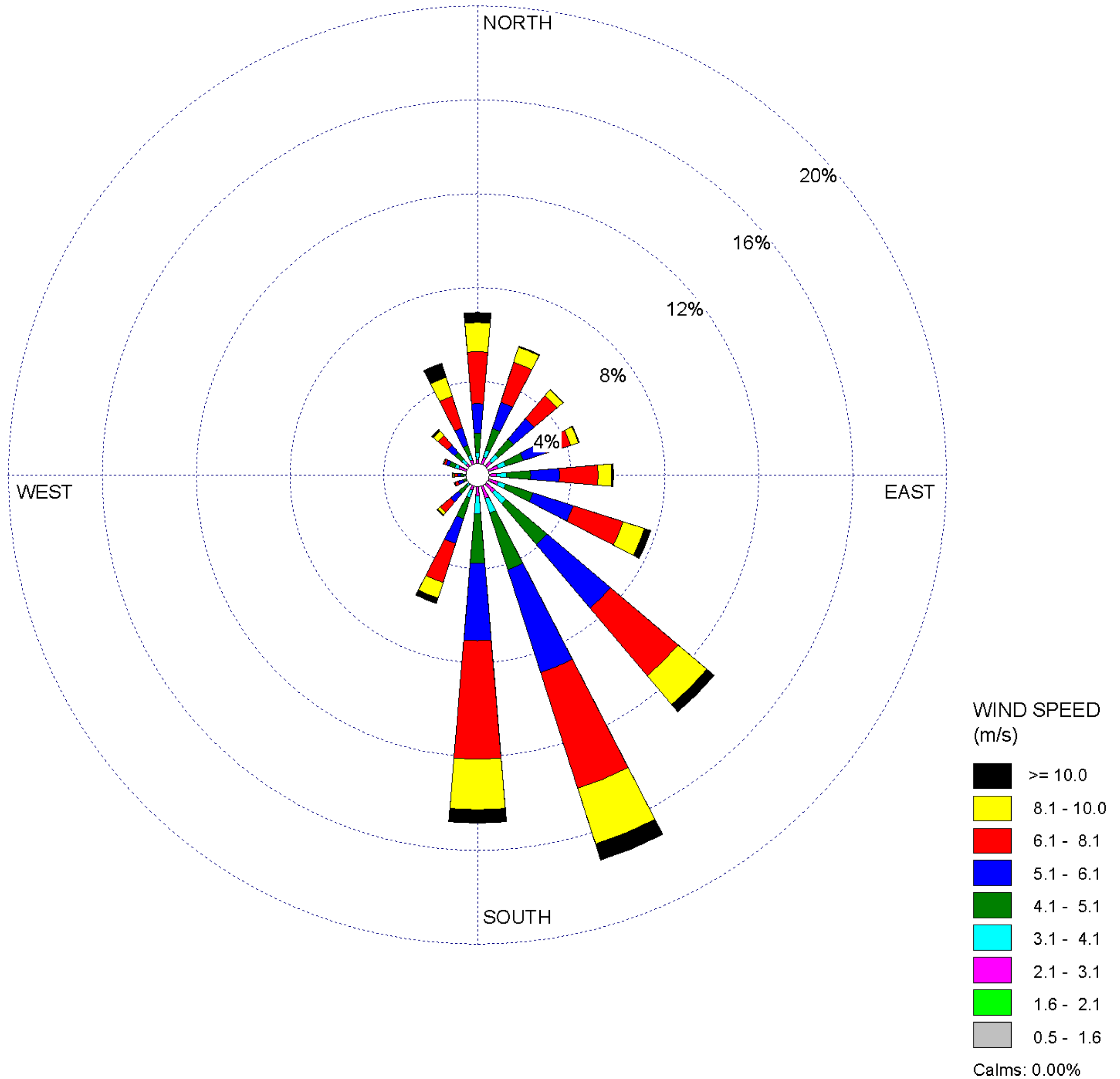


Figure 2.3S-8 STP 3 & 4 60-Meter Level 3-Year Composite Wind Rose - Annual (1997, 1999, and 2000)

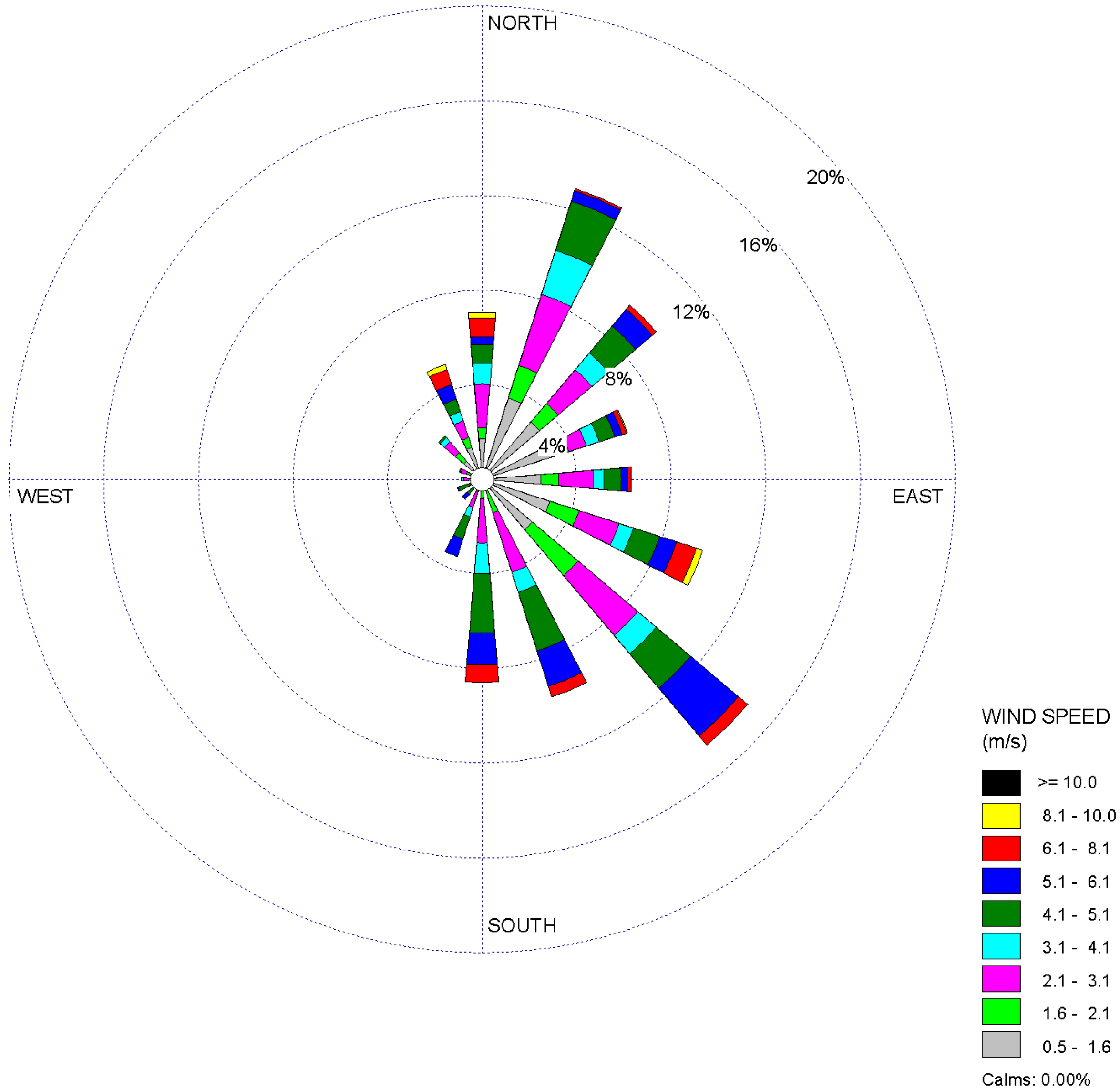


Figure 2.3S-9 STP 3 & 4 60-Meter Level 3-Year Composite Wind Rose - Winter (1997, 1999, and 2000)

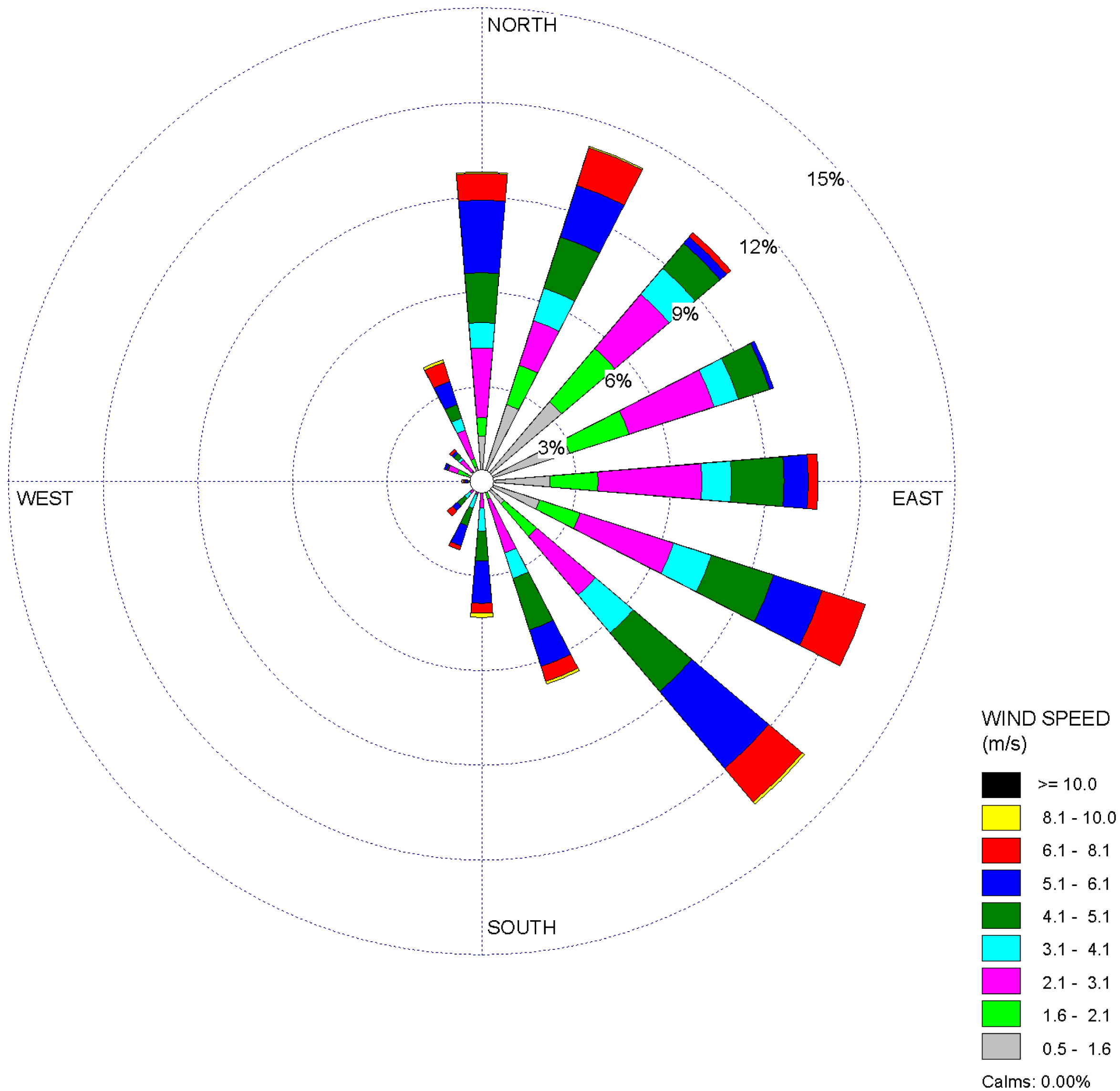


Figure 2.3S-10 STP 3 & 4 60-Meter Level 3-Year Composite Wind Rose - Spring (1997, 1999, and 2000)

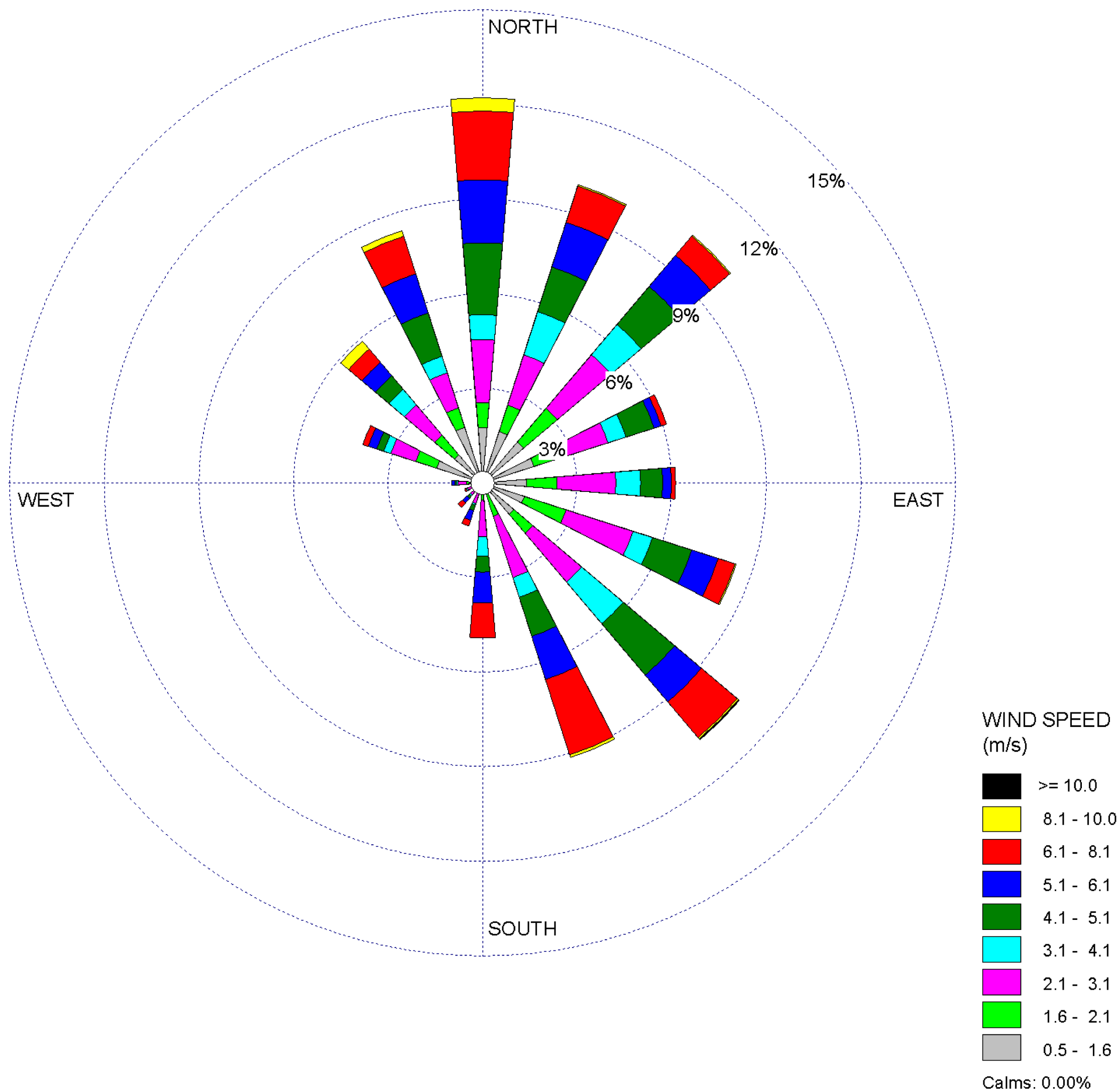


Figure 2.3S-11 STP 3 & 4 60-Meter Level 3-Year Composite Wind Rose - Summer (1997, 1999, and 2000)

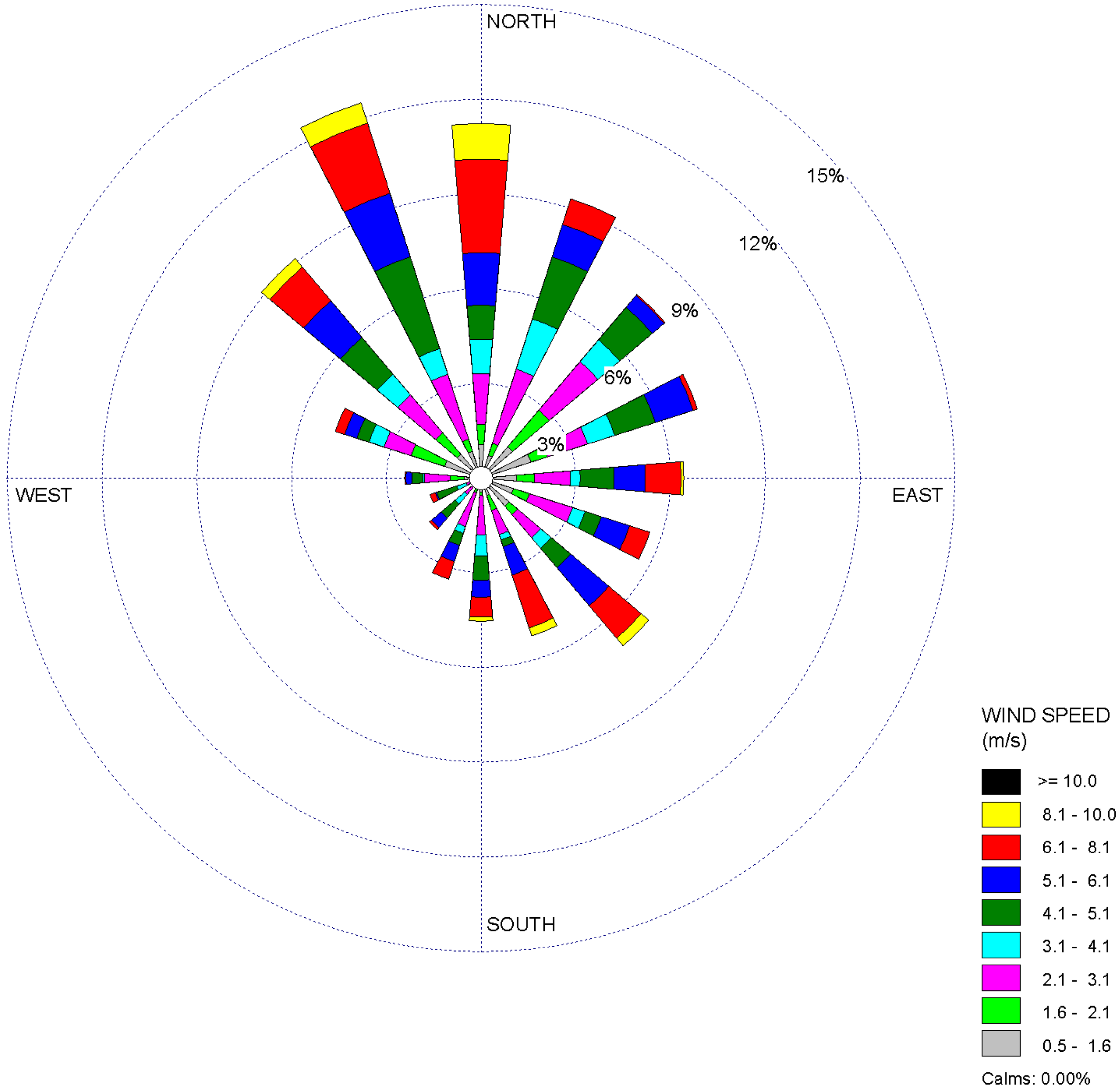


Figure 2.3S-12 STP 3 & 4 60-Meter Level 3-Year Composite Wind Rose - Autumn (1997, 1999, and 2000)

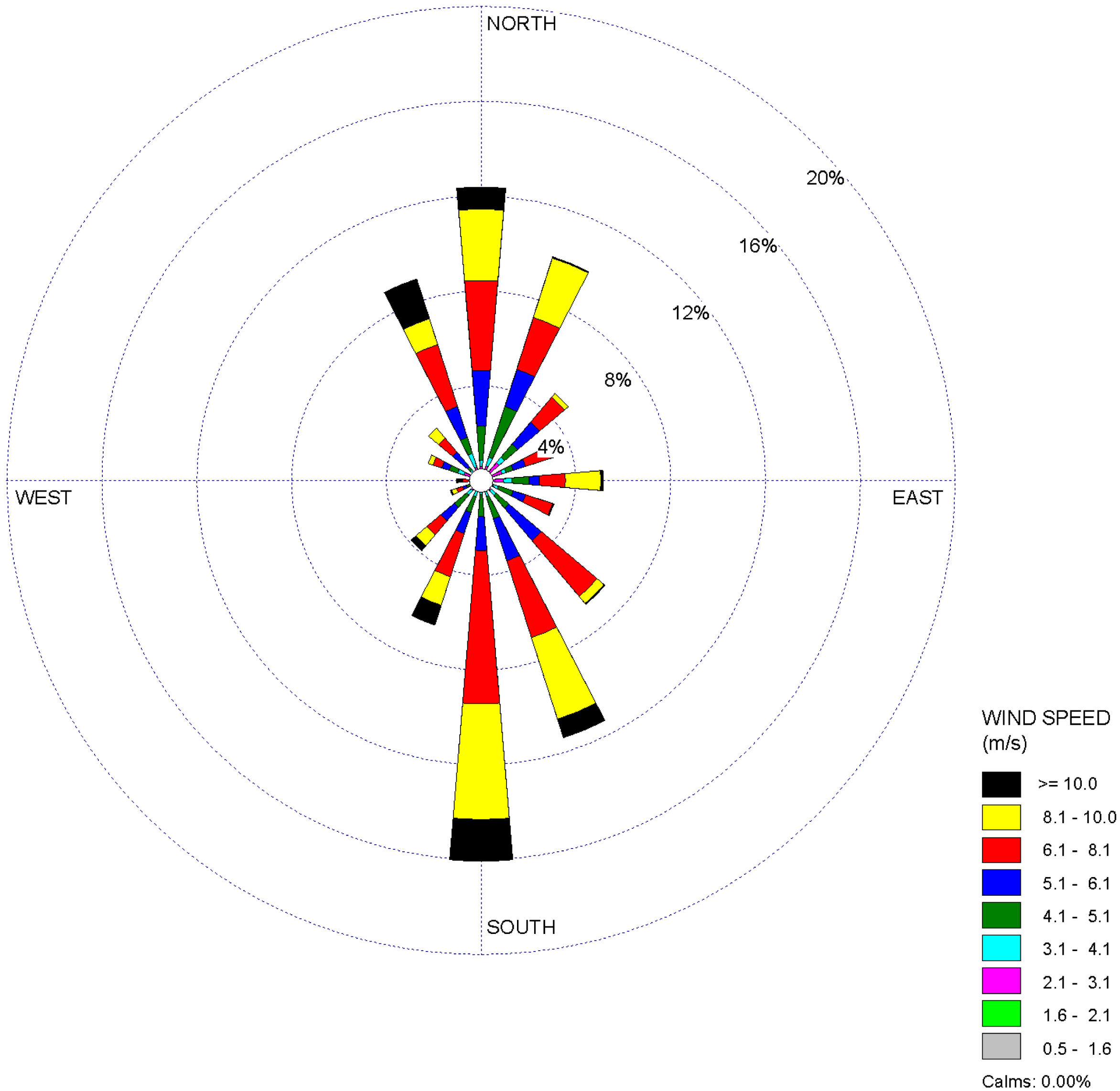


Figure 2.3S-13 STP 3 & 4 60-Meter Level 3-Year Composite Wind Rose - January (1997, 1999, and 2000) - Sheet 1 of 12

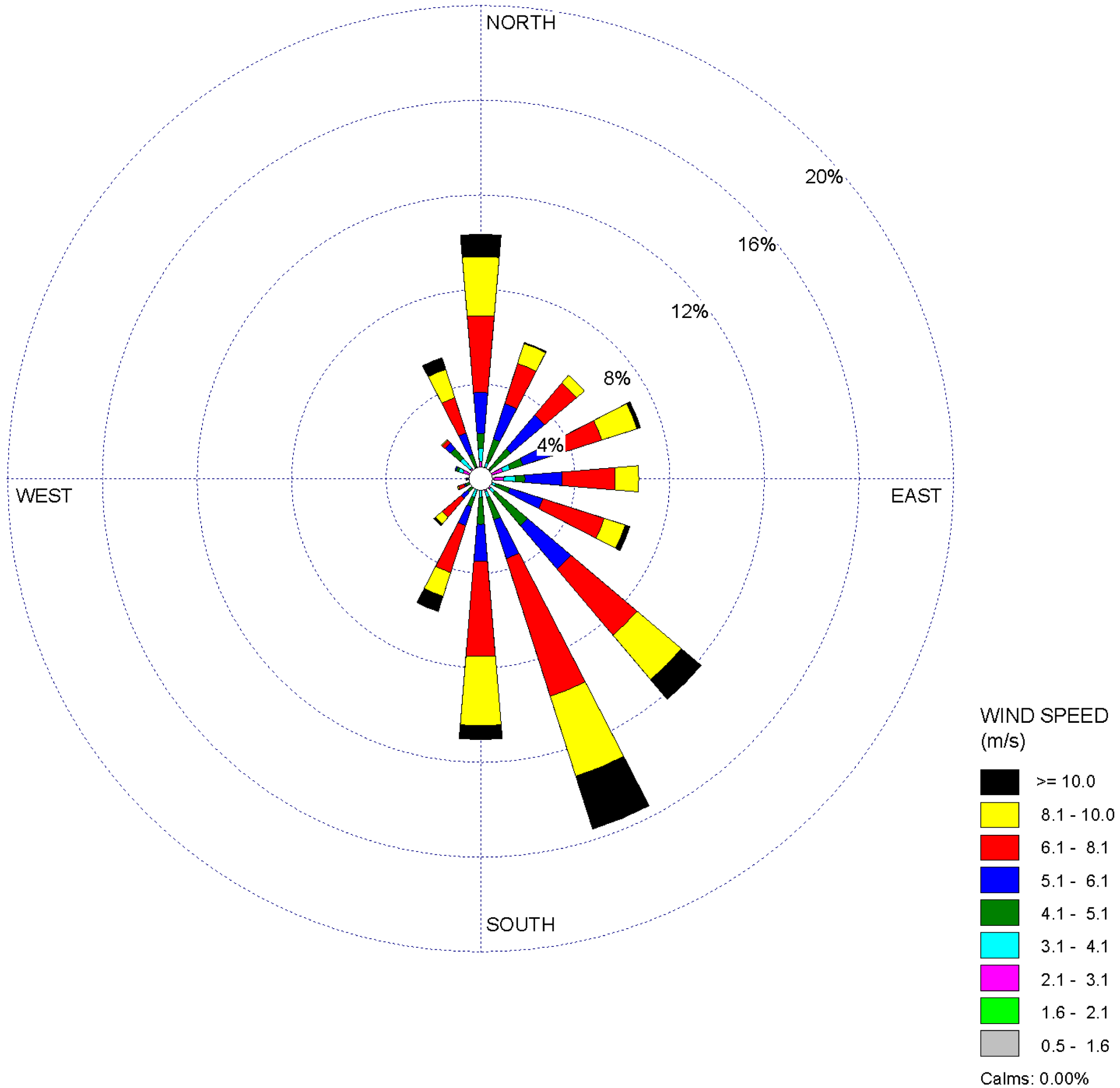


Figure 2.3S-13 STP 3 & 4 60-Meter Level 3-Year Composite Wind Rose - February (1997, 1999, and 2000) - Sheet 2 of 12

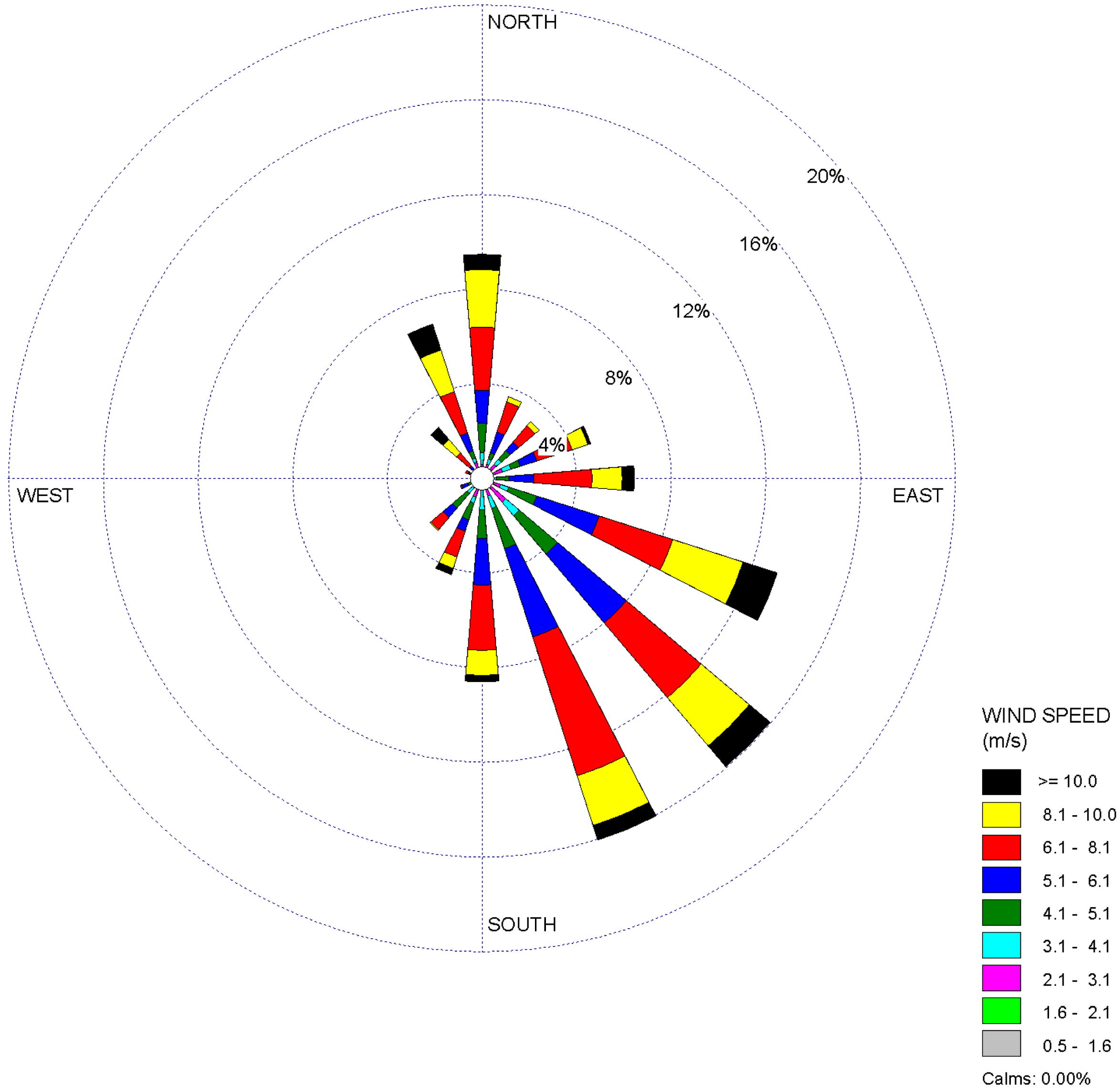


Figure 2.3S-13 STP 3 & 4 60-Meter Level 3-Year Composite Wind Rose - March (1997, 1999, and 2000) - Sheet 3 of 12

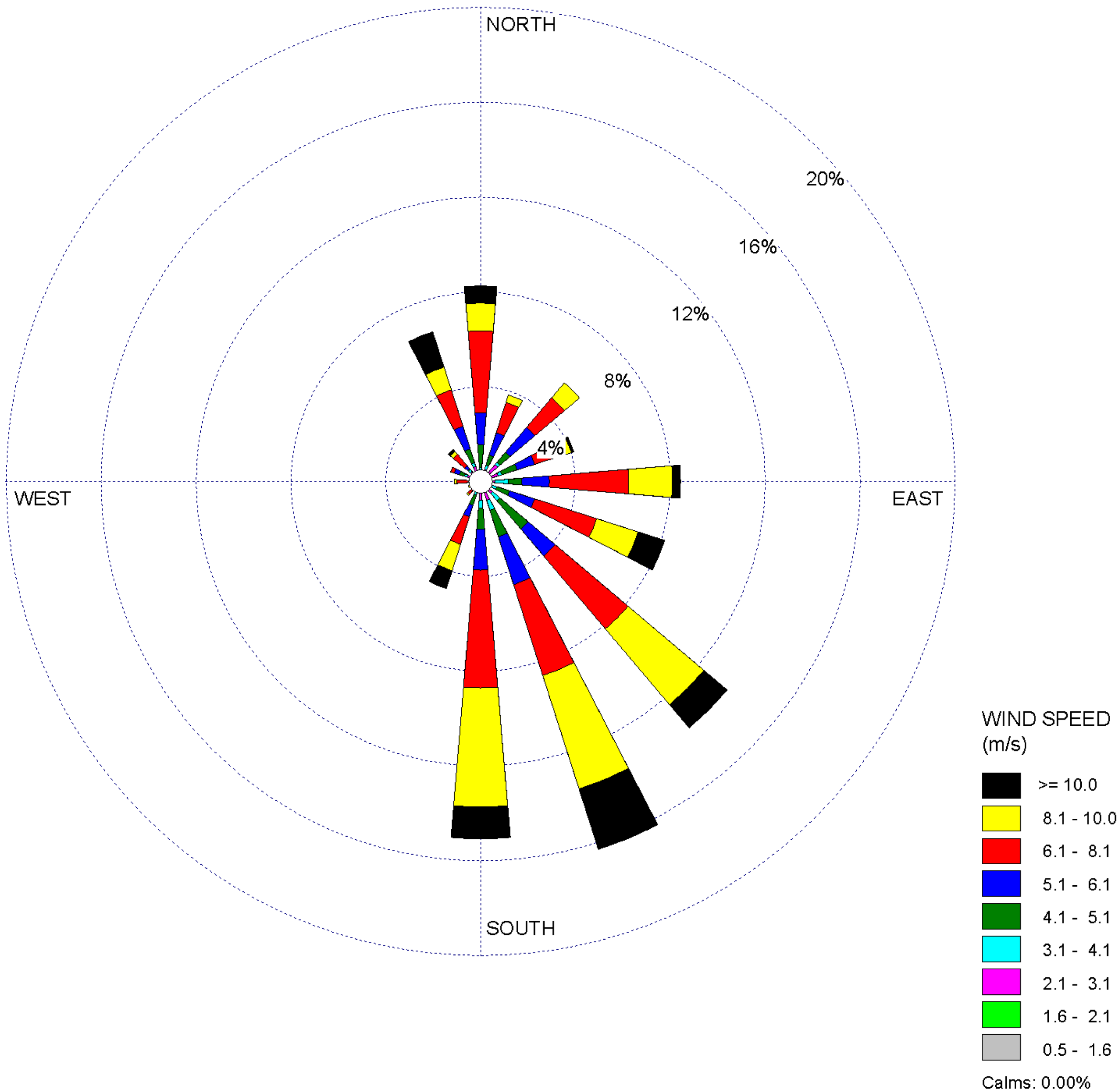


Figure 2.3S-13 STP 3 & 4 60-Meter Level 3-Year Composite Wind Rose - April (1997, 1999, and 2000) - Sheet 4 of 12

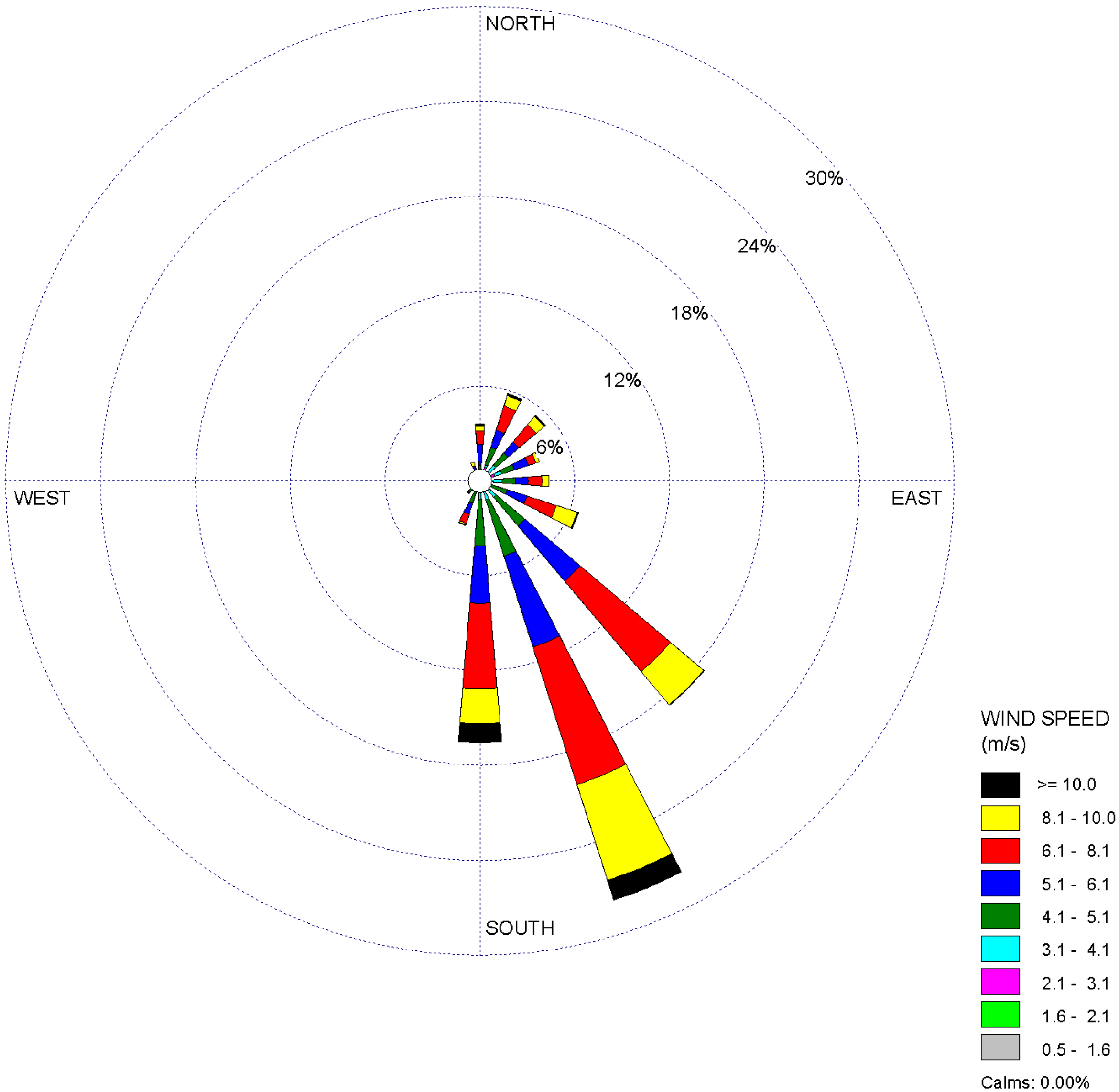


Figure 2.3S-13 STP 3 & 4 60-Meter Level 3-Year Composite Wind Rose - May (1997, 1999, and 2000) - Sheet 5 of 12

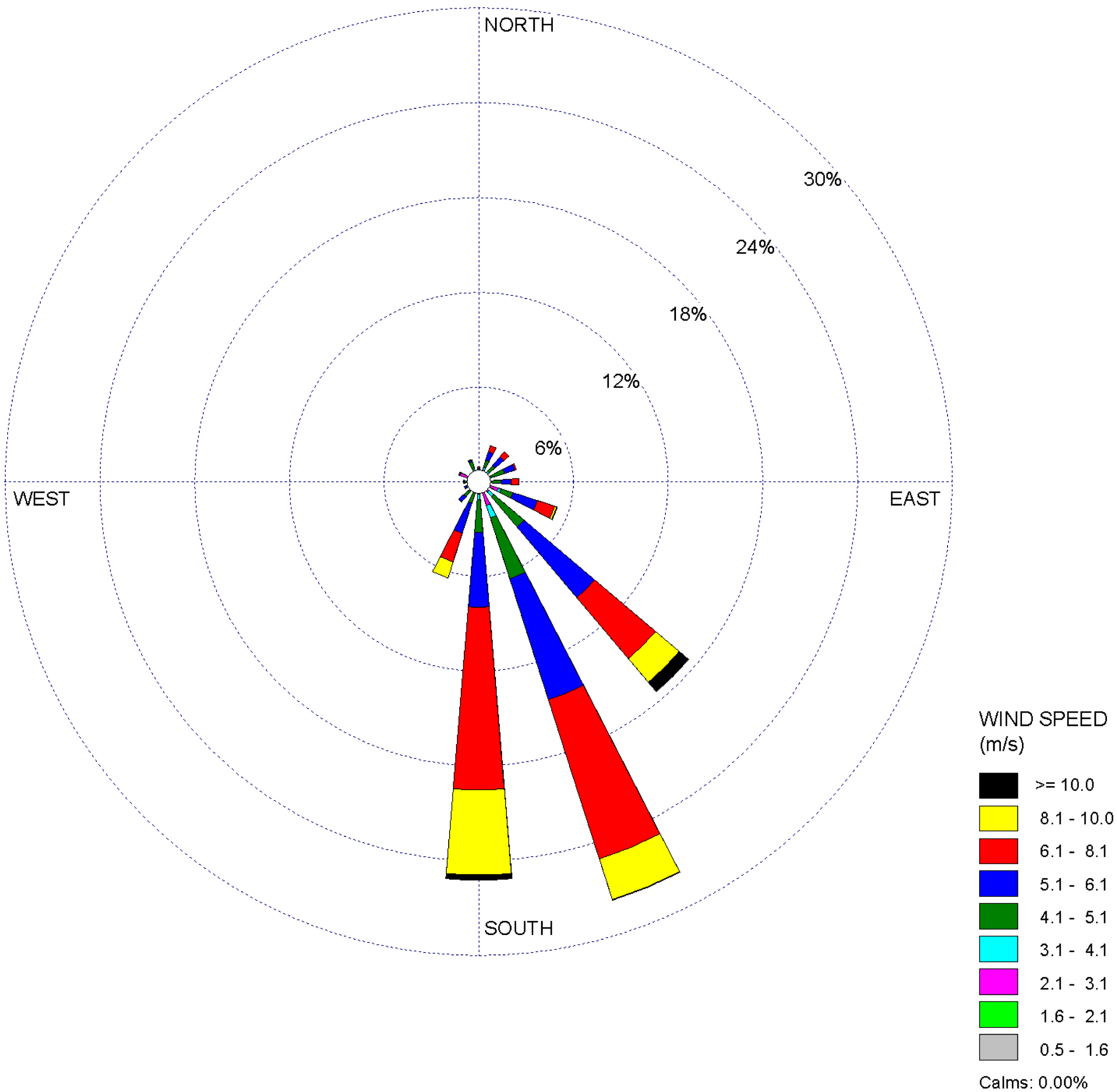


Figure 2.3S-13 STP 3 & 4 60-Meter Level 3-Year Composite Wind Rose - June (1997, 1999, and 2000) - Sheet 6 of 12

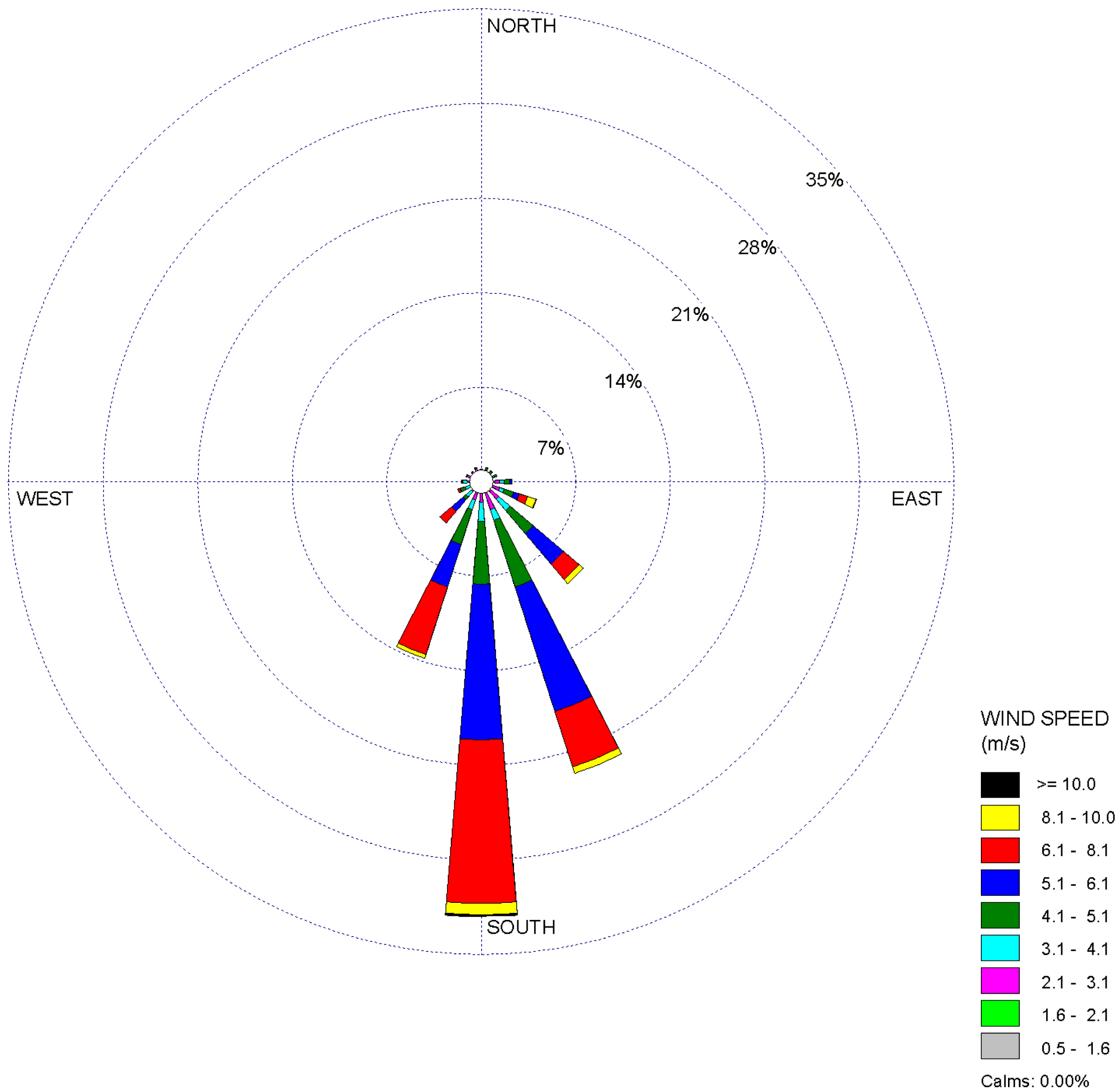


Figure 2.3S-13 STP 3 & 4 60-Meter Level 3-Year Composite Wind Rose - July (1997, 1999, and 2000) - Sheet 7 of 12

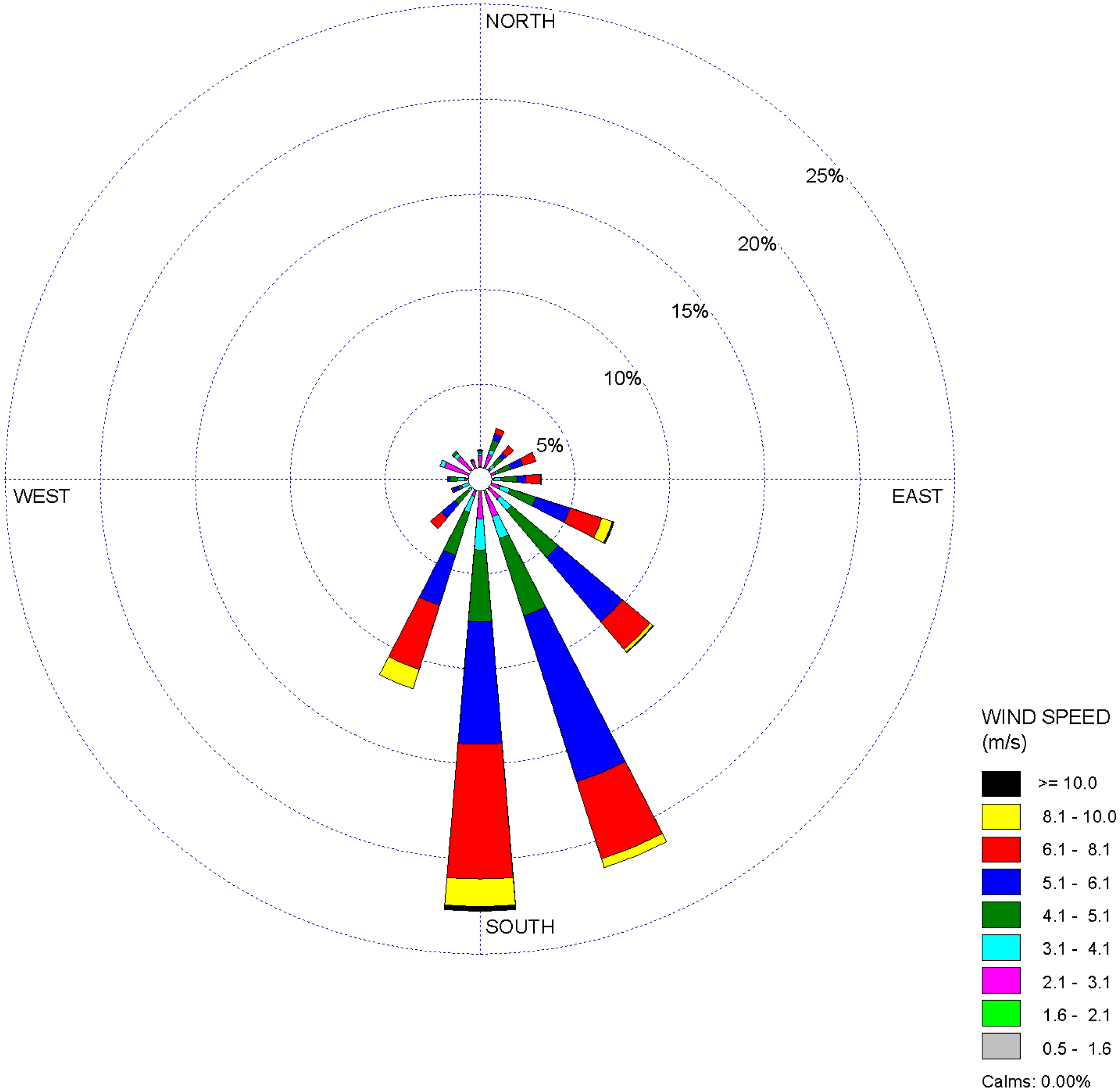


Figure 2.3S-13 STP 3 & 4 60-Meter Level 3-Year Composite Wind Rose - August (1997, 1999, and 2000) - Sheet 8 of 12

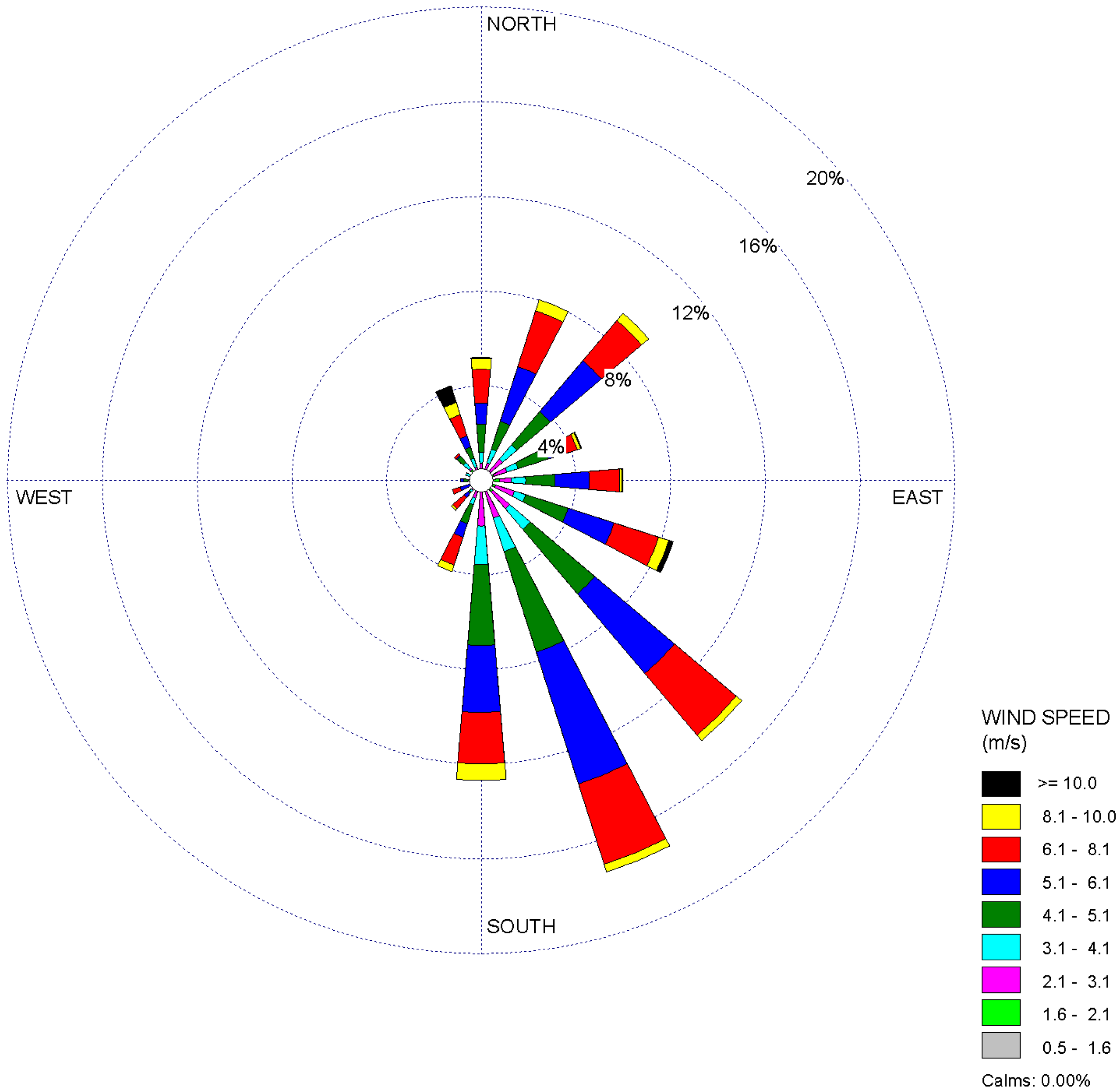


Figure 2.3S-13 STP 3 & 4 60-Meter Level 3-Year Composite Wind Rose - September (1997, 1999, and 2000) - Sheet 9 of 12

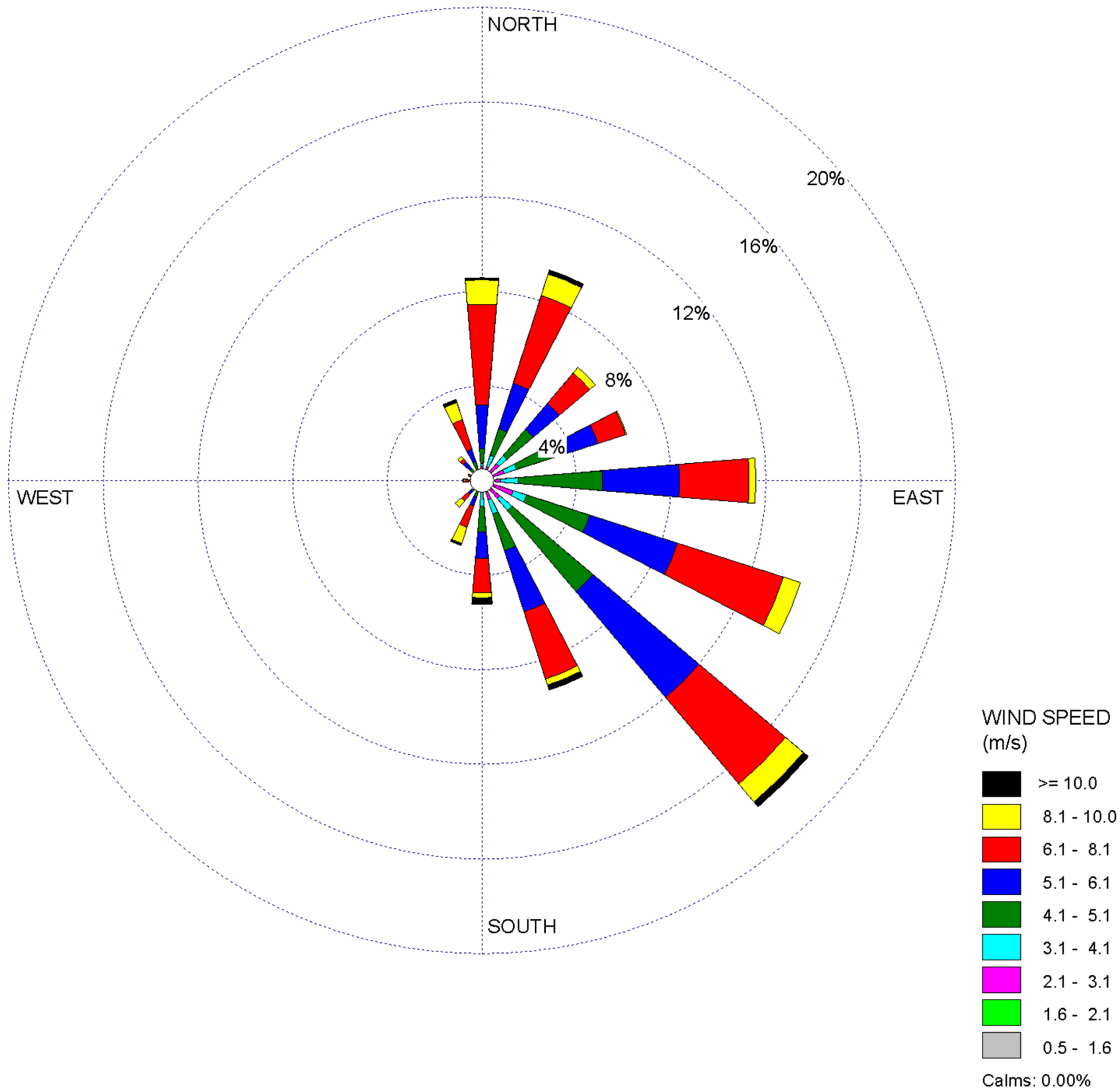


Figure 2.3S-13 STP 3 & 4 60-Meter Level 3-Year Composite Wind Rose - October (1997, 1999, and 2000) - Sheet 10 of 12

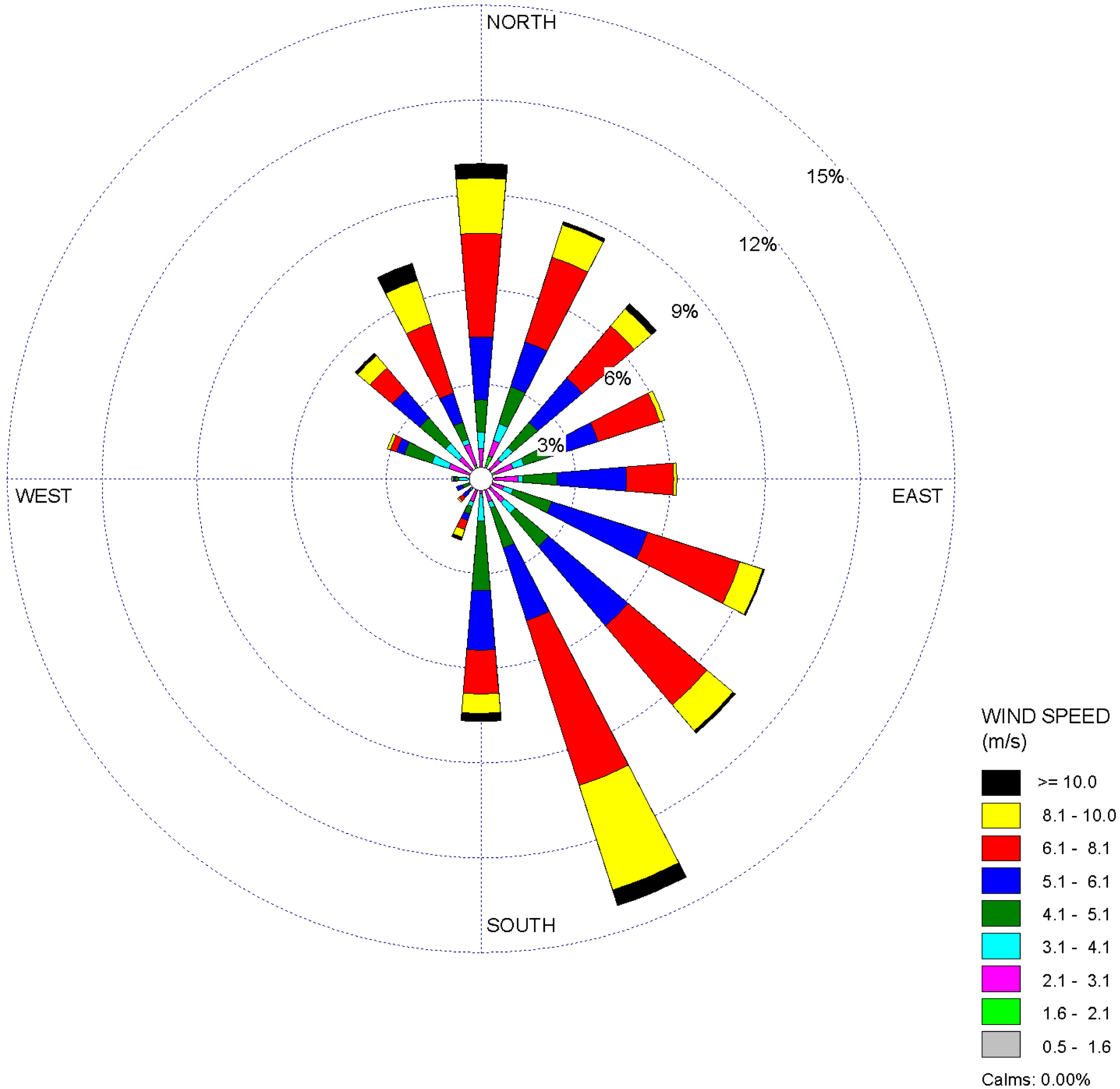


Figure 2.3S-13 STP 3 & 4 60-Meter Level 3-Year Composite Wind Rose - November (1997, 1999, and 2000) - Sheet 11 of 12

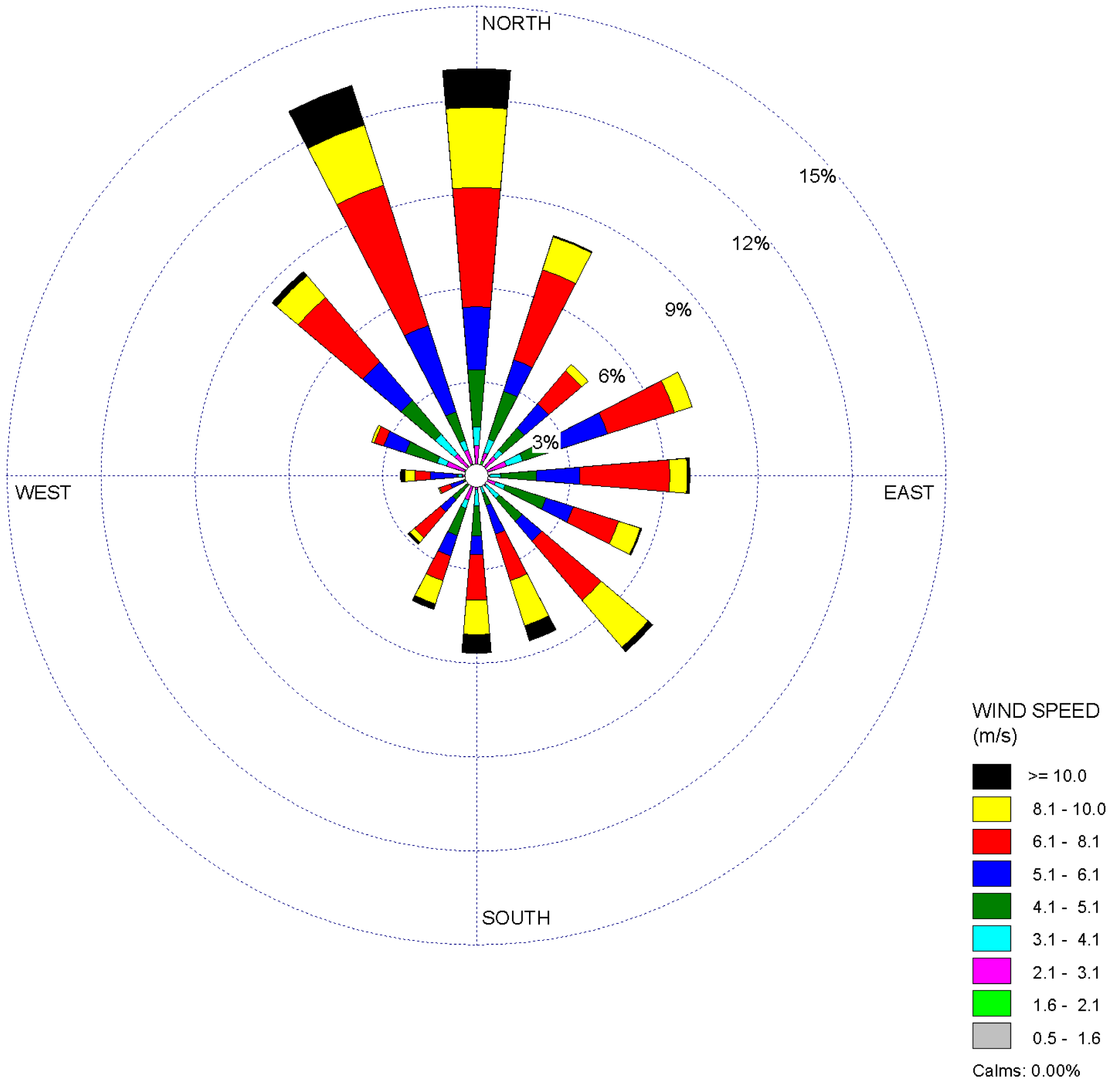
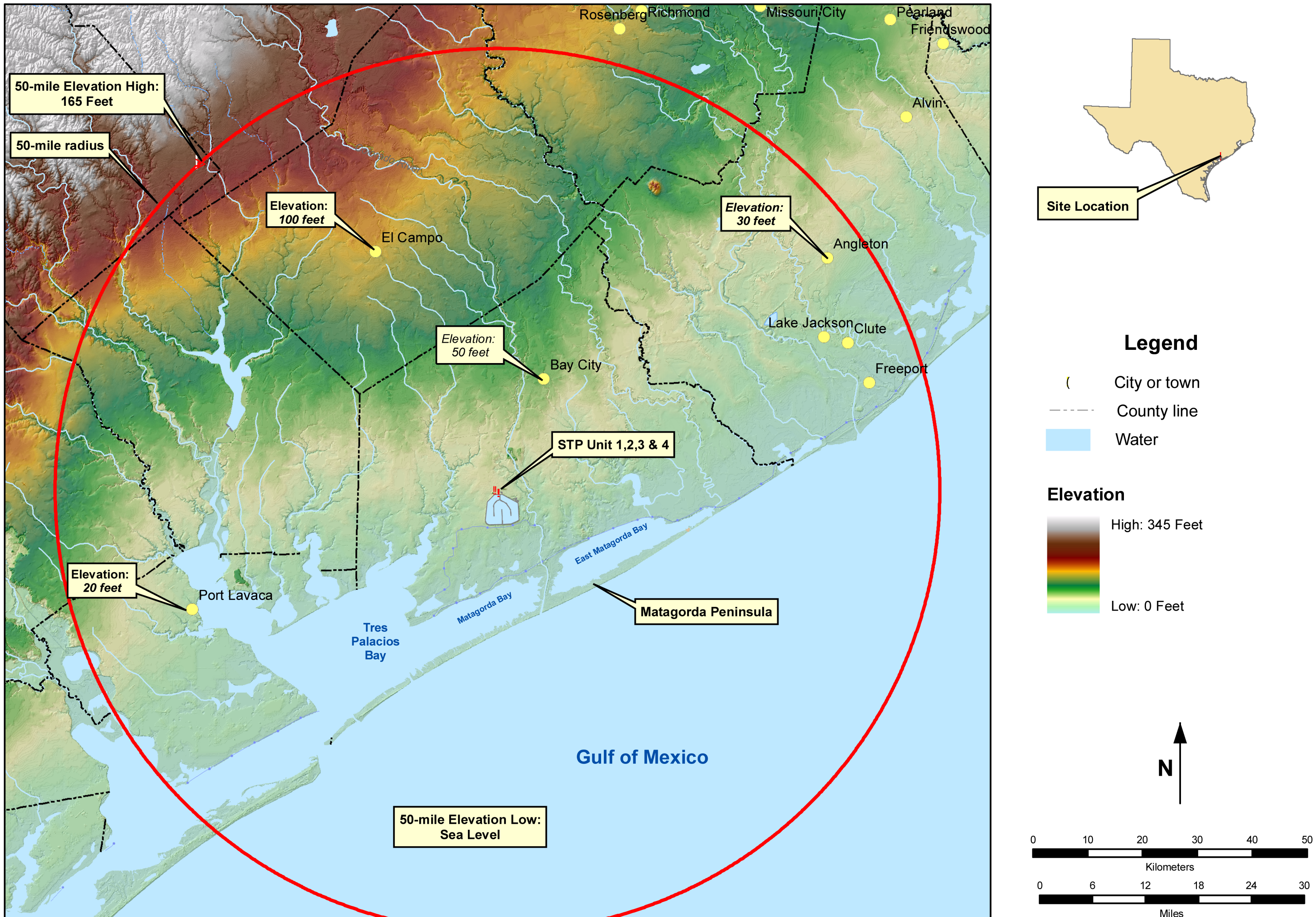


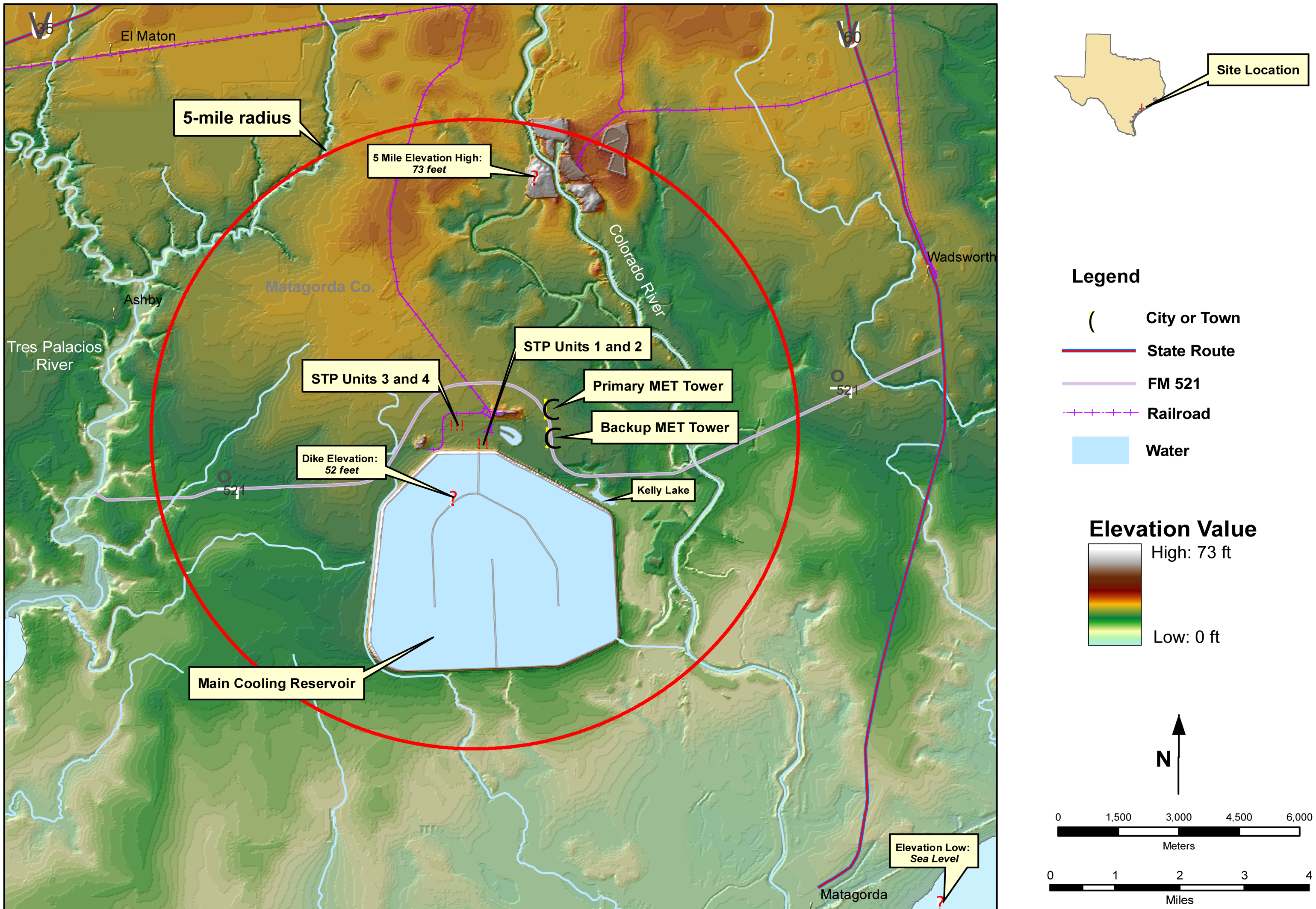
Figure 2.3S-13 STP 3 & 4 60-Meter Level 3-Year Composite Wind Rose - December (1997, 1999, and 2000) - Sheet 12 of 12



Source Data: ESRI, Data & Maps and StreetMap USA, 2005.
USGS, seamless data distribution, NED shaded relief

Projection: State Plane, Texas South Central
Datum: NAD 1927

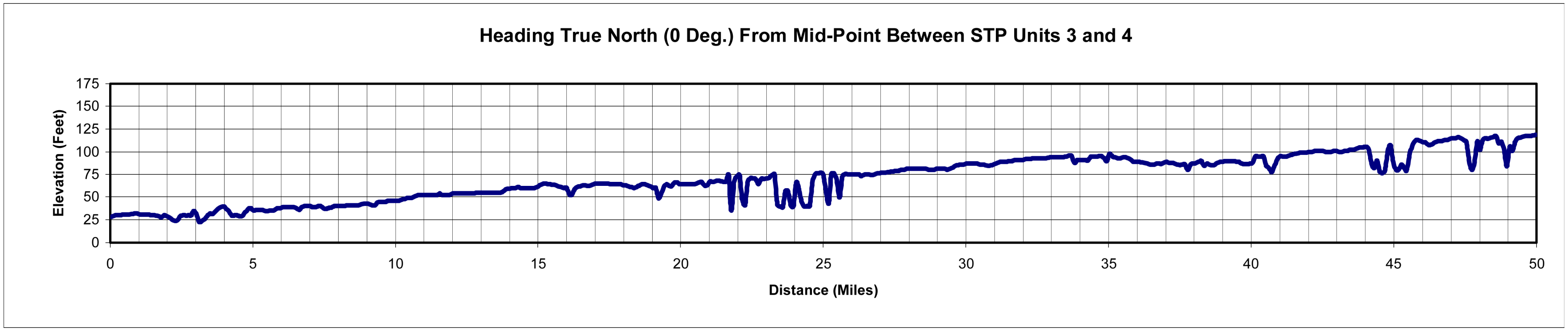
Figure 2.3S-14 Site Area Map (50-Mile Radius)



Source Data: ESRI, Data & Maps and StreetMap USA, 2005
USGS, seamless data distribution, NED shaded relief
Houston Lighting & Power Company, Drawing No. 9-Y-51-0-H-1151 Rev. 9

Projection: State Plane, Texas South Central
Datum: NAD 1927

Figure 2.3S-15 Site and Vicinity Map (5-Mile Radius)



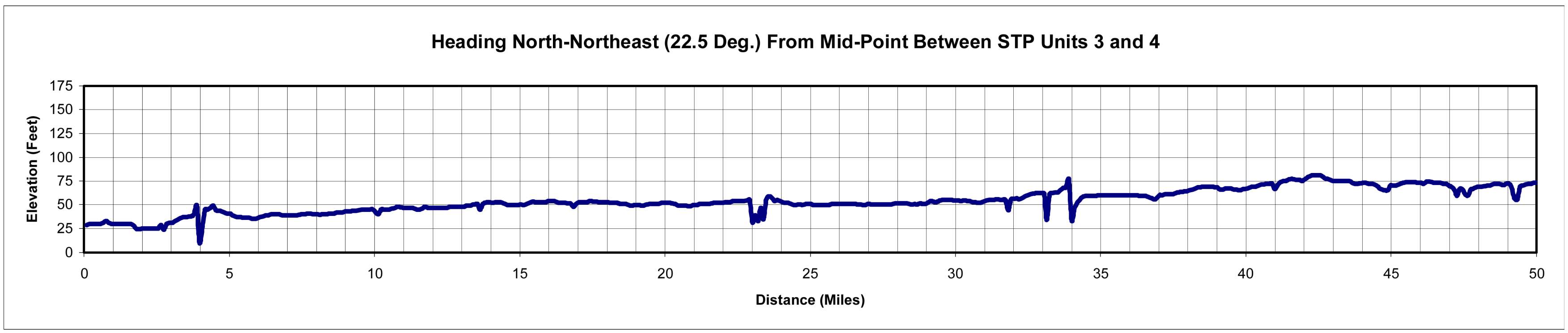
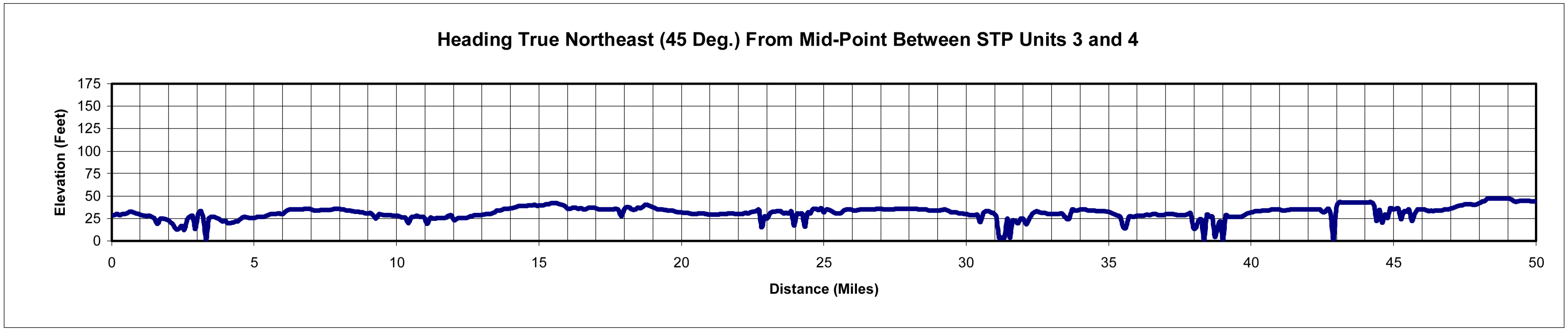


Figure 2.3S-16 Terrain Elevation Profiles Within 50 Miles of the STP 3 & 4 Site (Sheet 1 of 8)



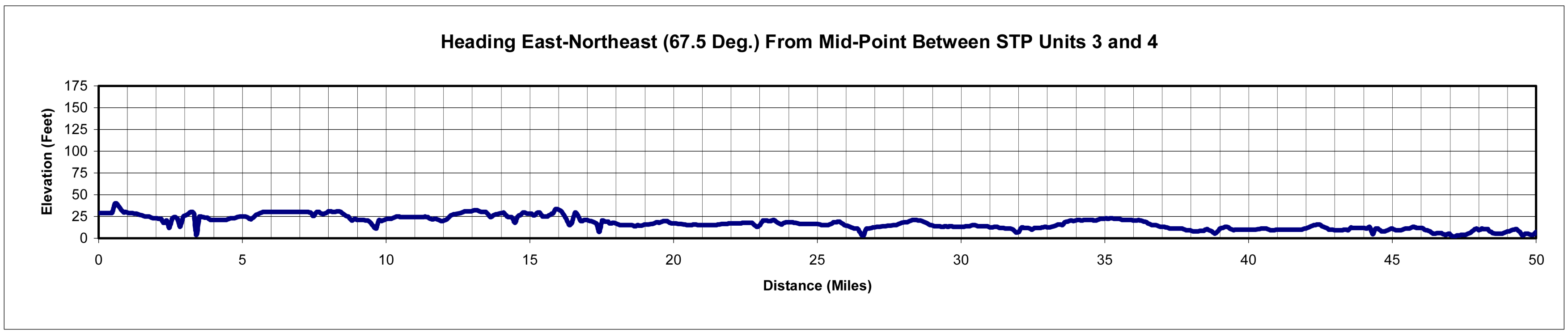
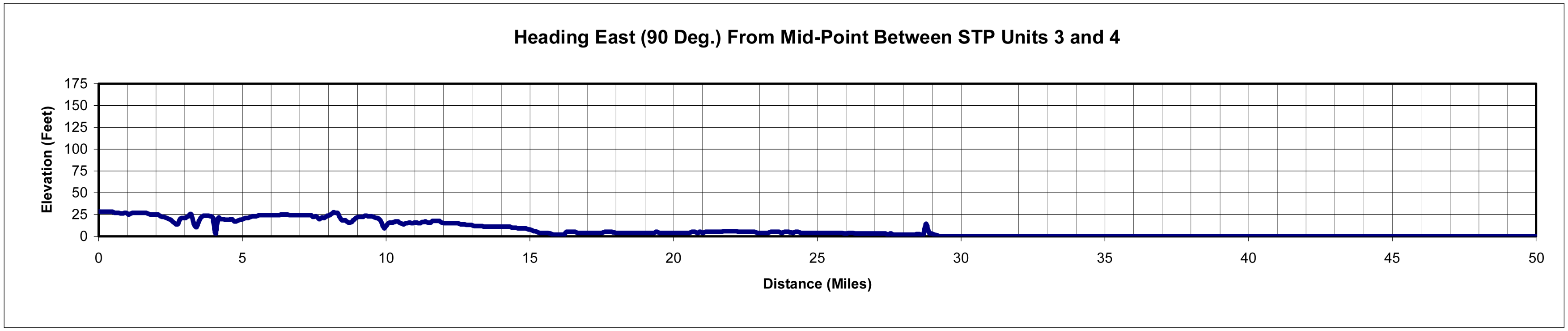


Figure 2.3S-16 Terrain Elevation Profiles Within 50 Miles of the STP 3 & 4 Site (Sheet 2 of 8)



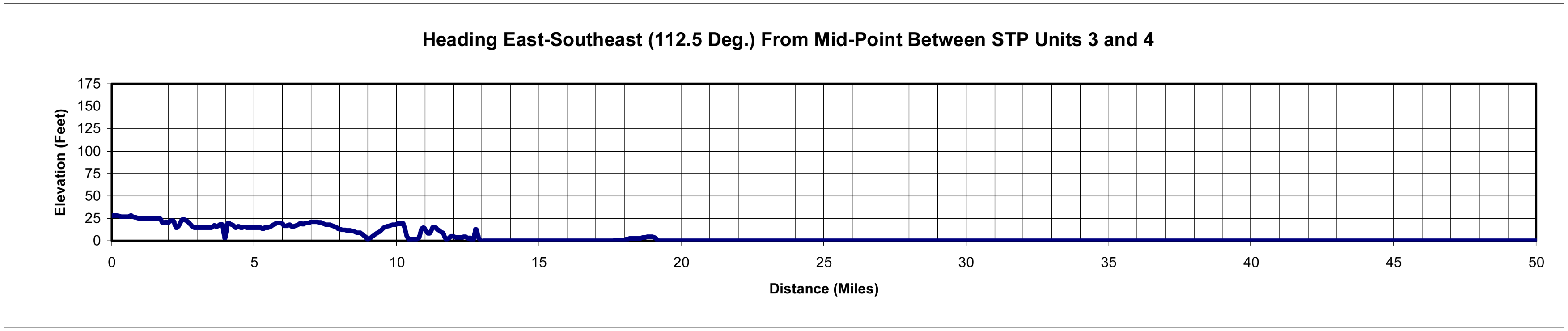
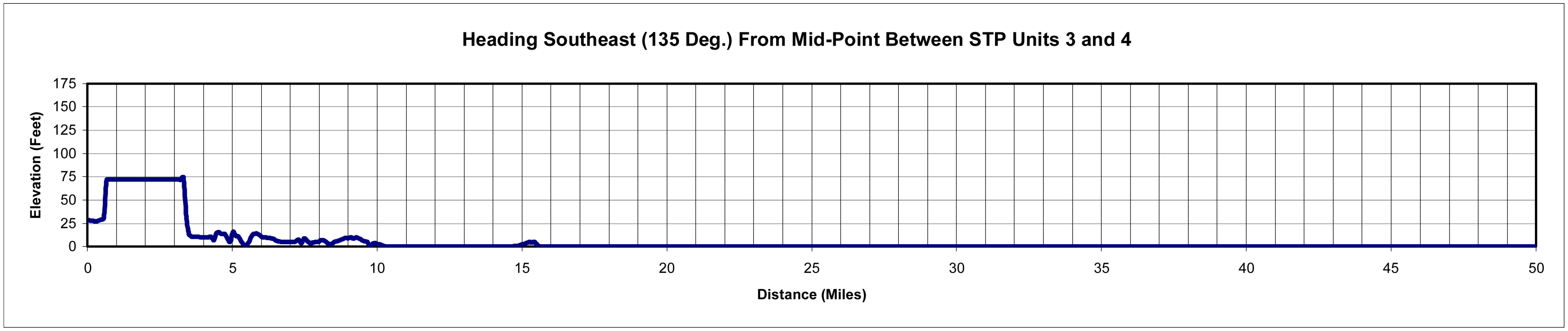


Figure 2.3S-16 Terrain Elevation Profiles Within 50 Miles of the STP 3 & 4 Site (Sheet 3 of 8)



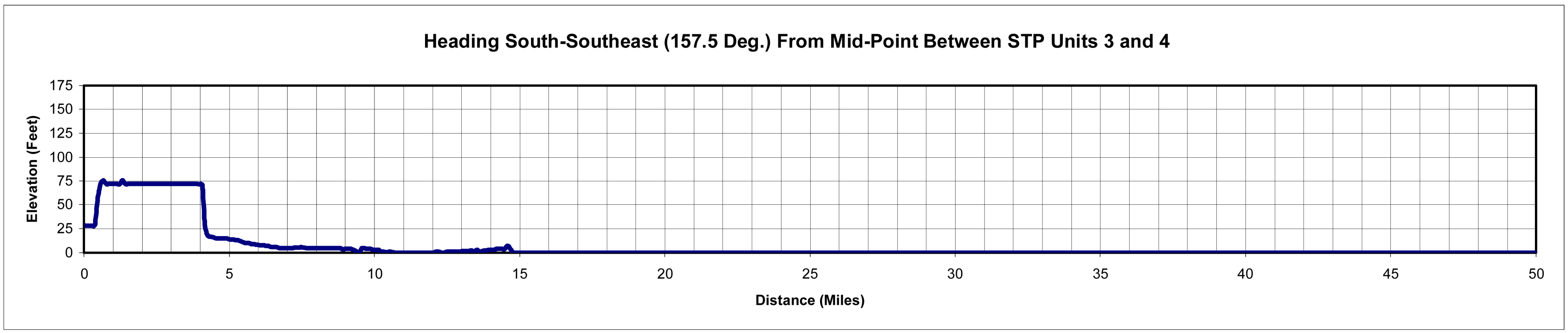
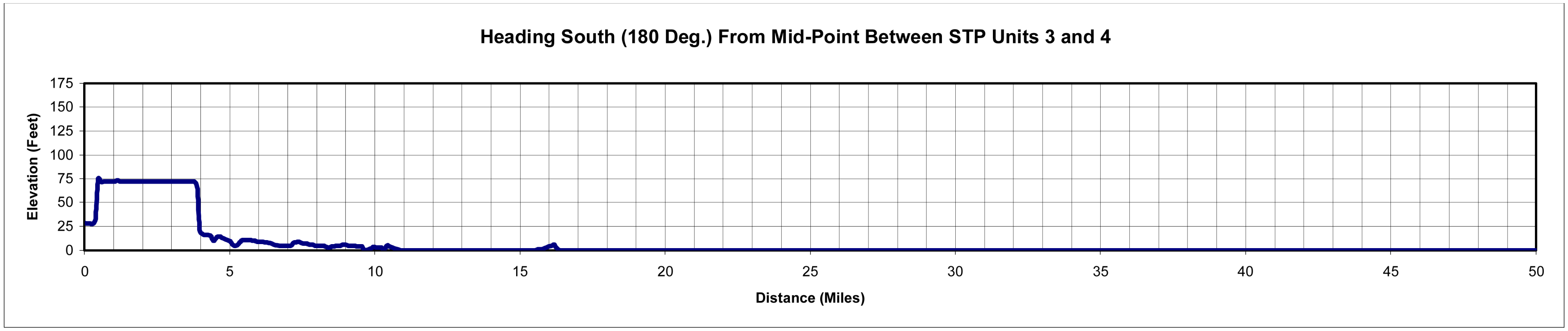


Figure 2.3S-16 Terrain Elevation Profiles Within 50 Miles of the STP 3 & 4 Site (Sheet 4 of 8)



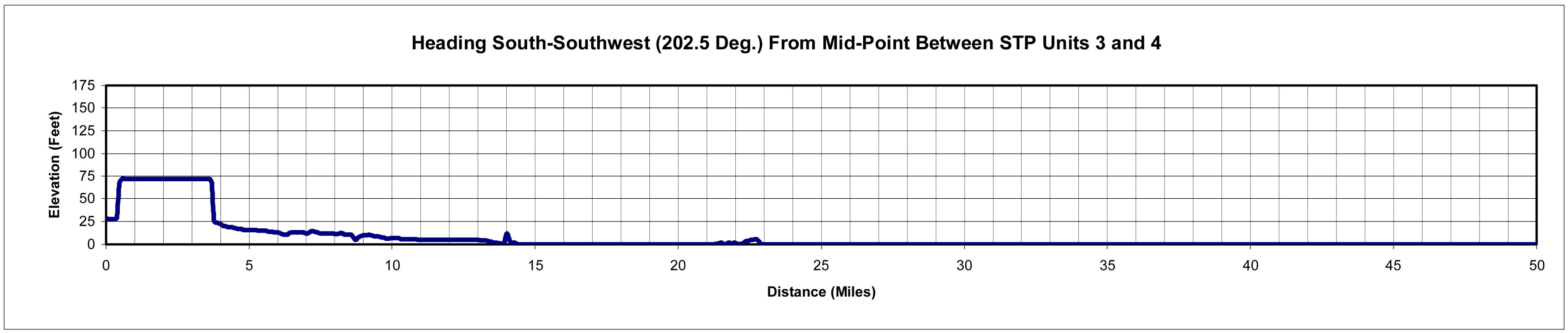
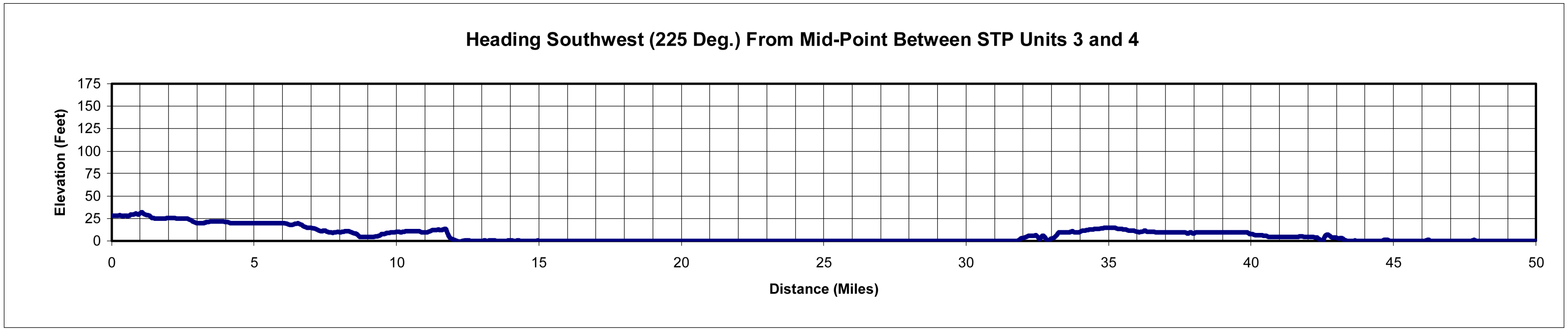


Figure 2.3S-16 Terrain Elevation Profiles Within 50 Miles of the STP 3 & 4 Site (Sheet 5 of 8)



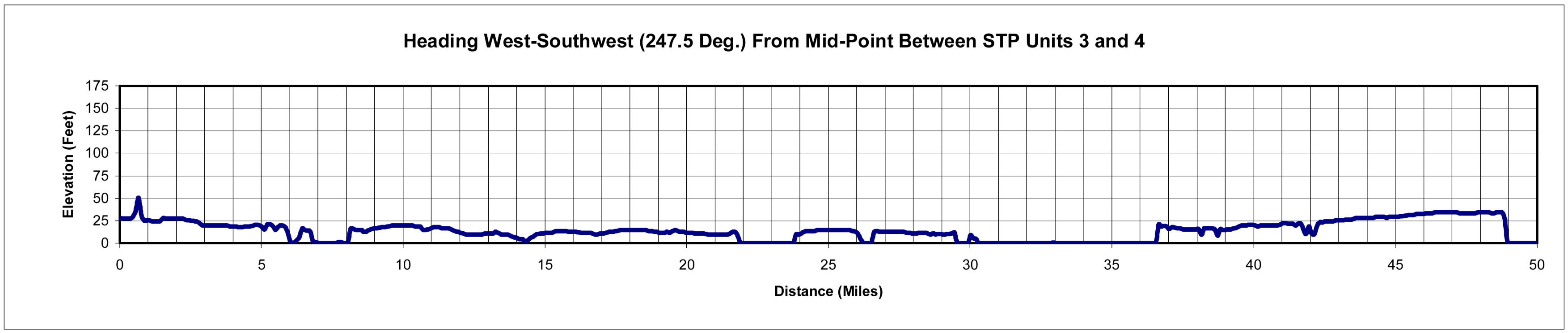
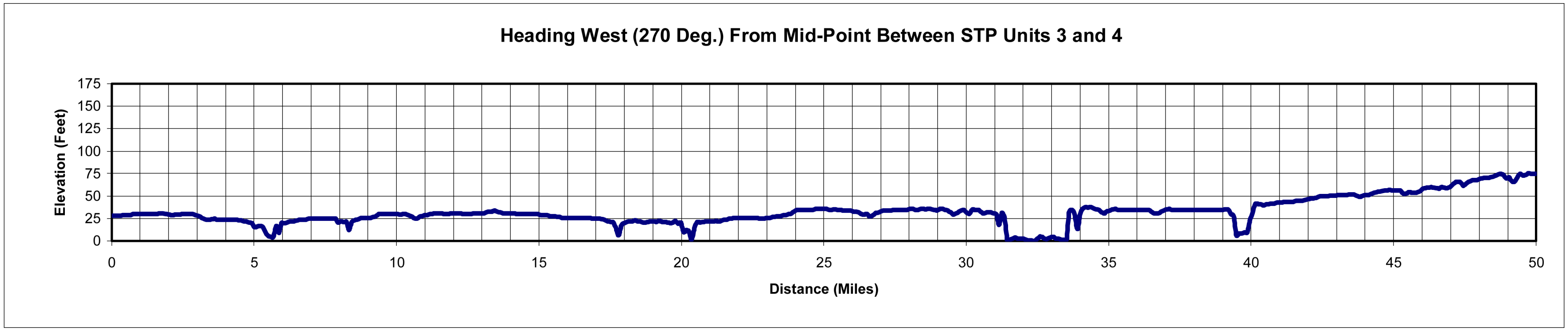


Figure 2.3S-16 Terrain Elevation Profiles Within 50 Miles of the STP 3 & 4 Site (Sheet 6 of 8)



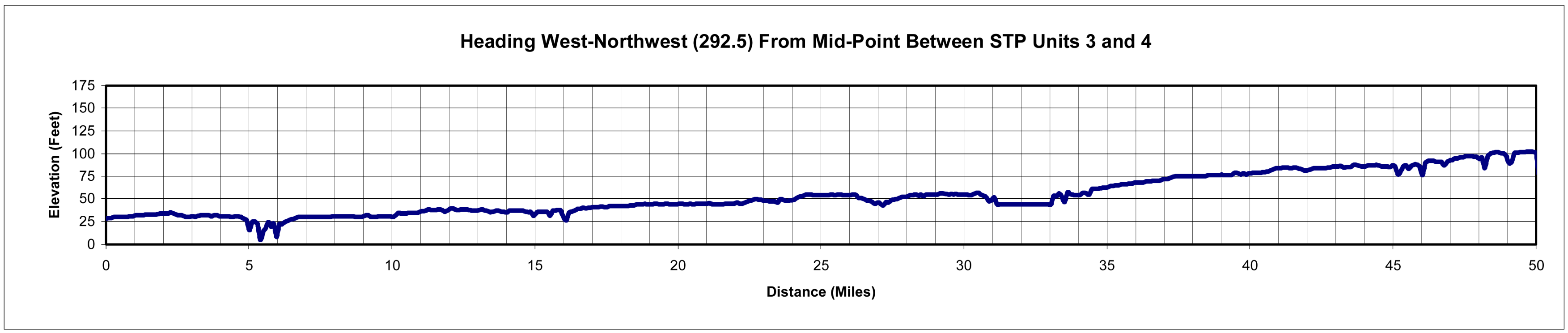
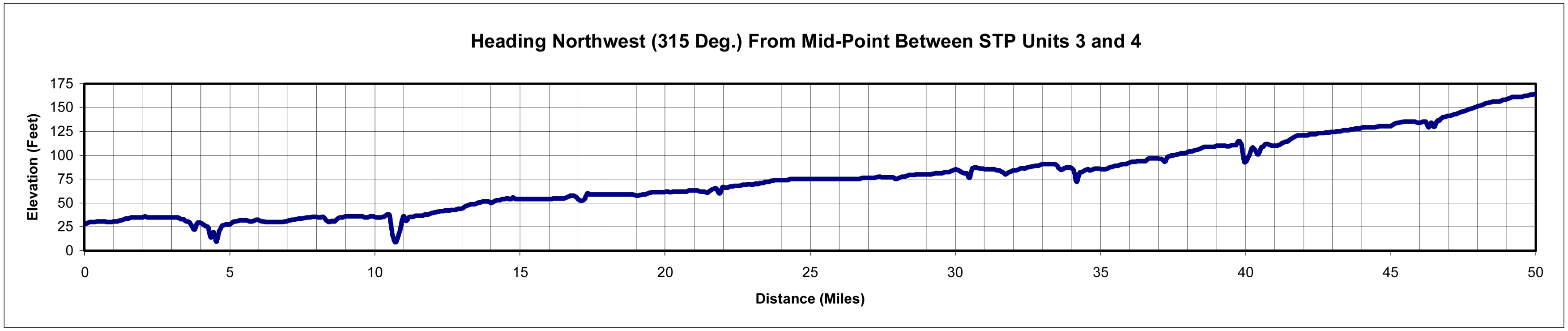


Figure 2.3S-16 Terrain Elevation Profiles Within 50 Miles of the STP 3 & 4 Site (Sheet 7 of 8)



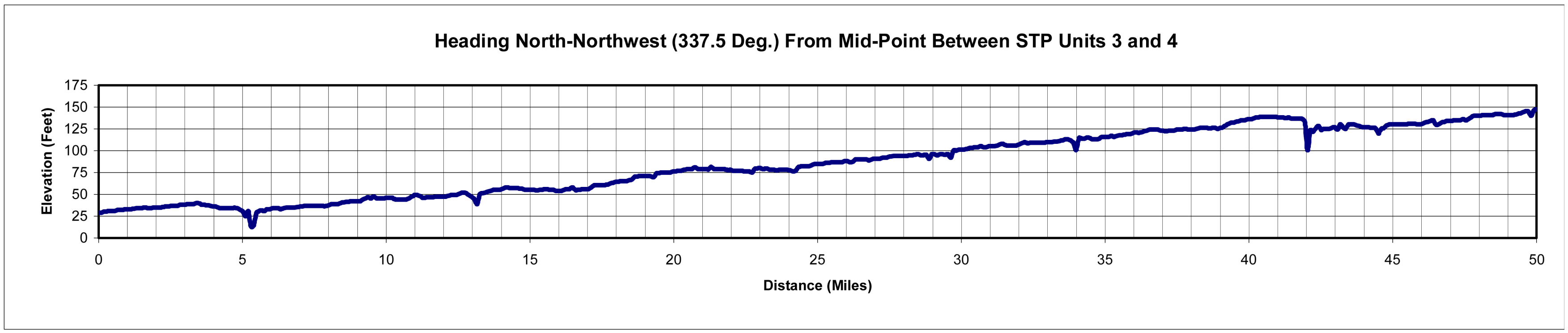


Figure 2.3S-16 Terrain Elevation Profiles Within 50 Miles of the STP 3 & 4 Site (Sheet 8 of 8)

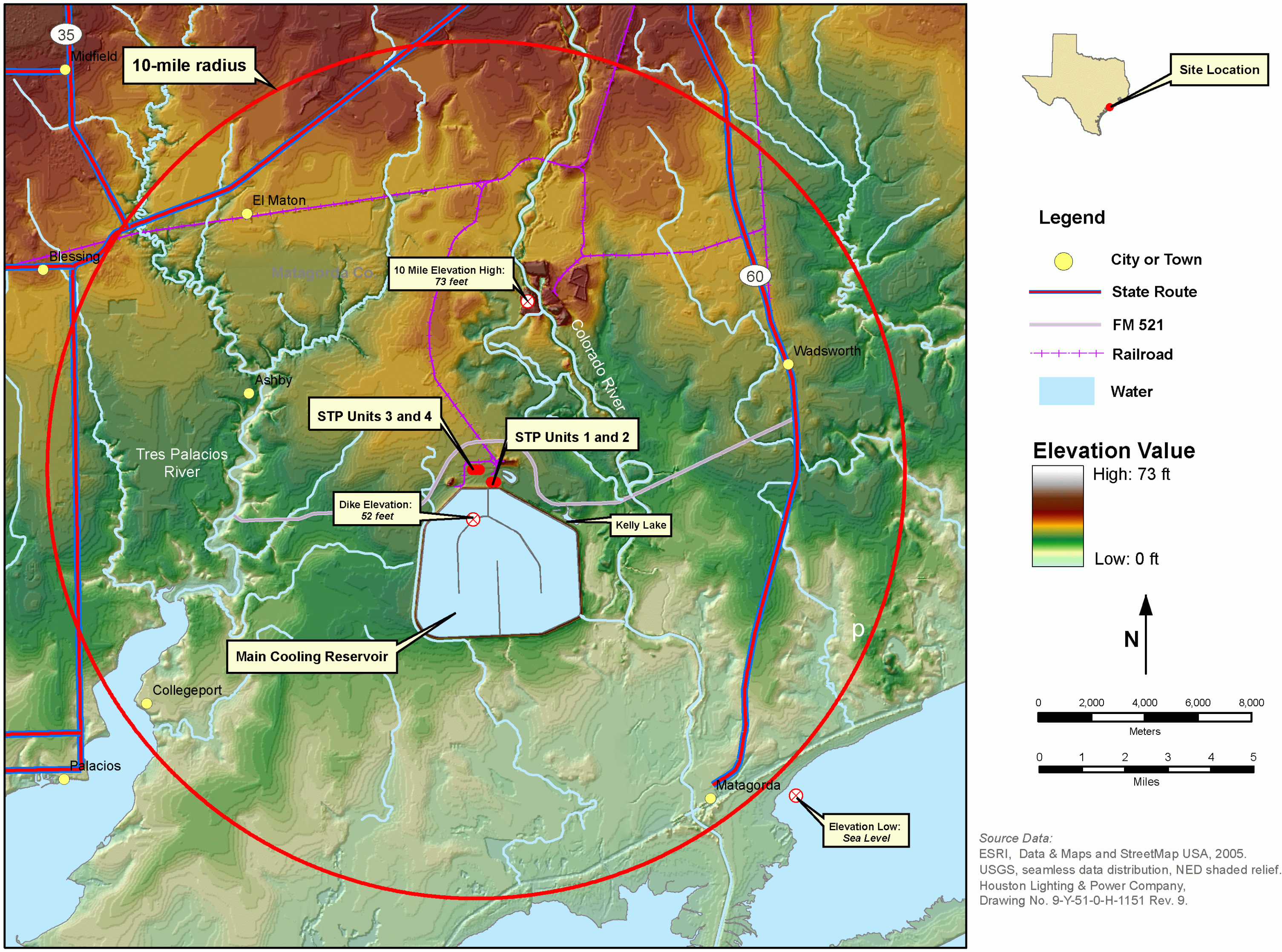


Figure 2.3S-17 Site and Vicinity Map (10-Mile Radius)

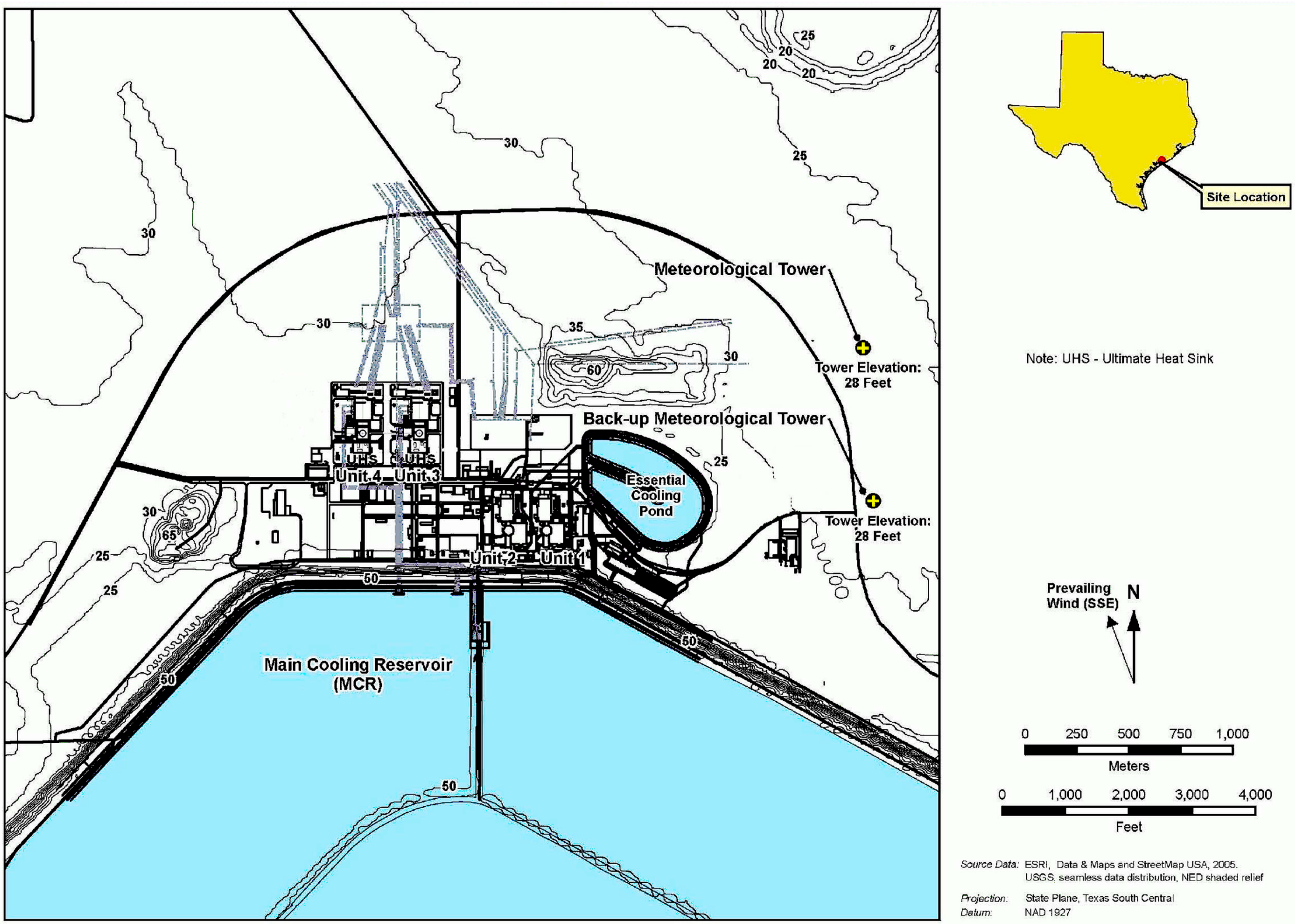


Figure 2.3S-18 Location of Meteorological Towers

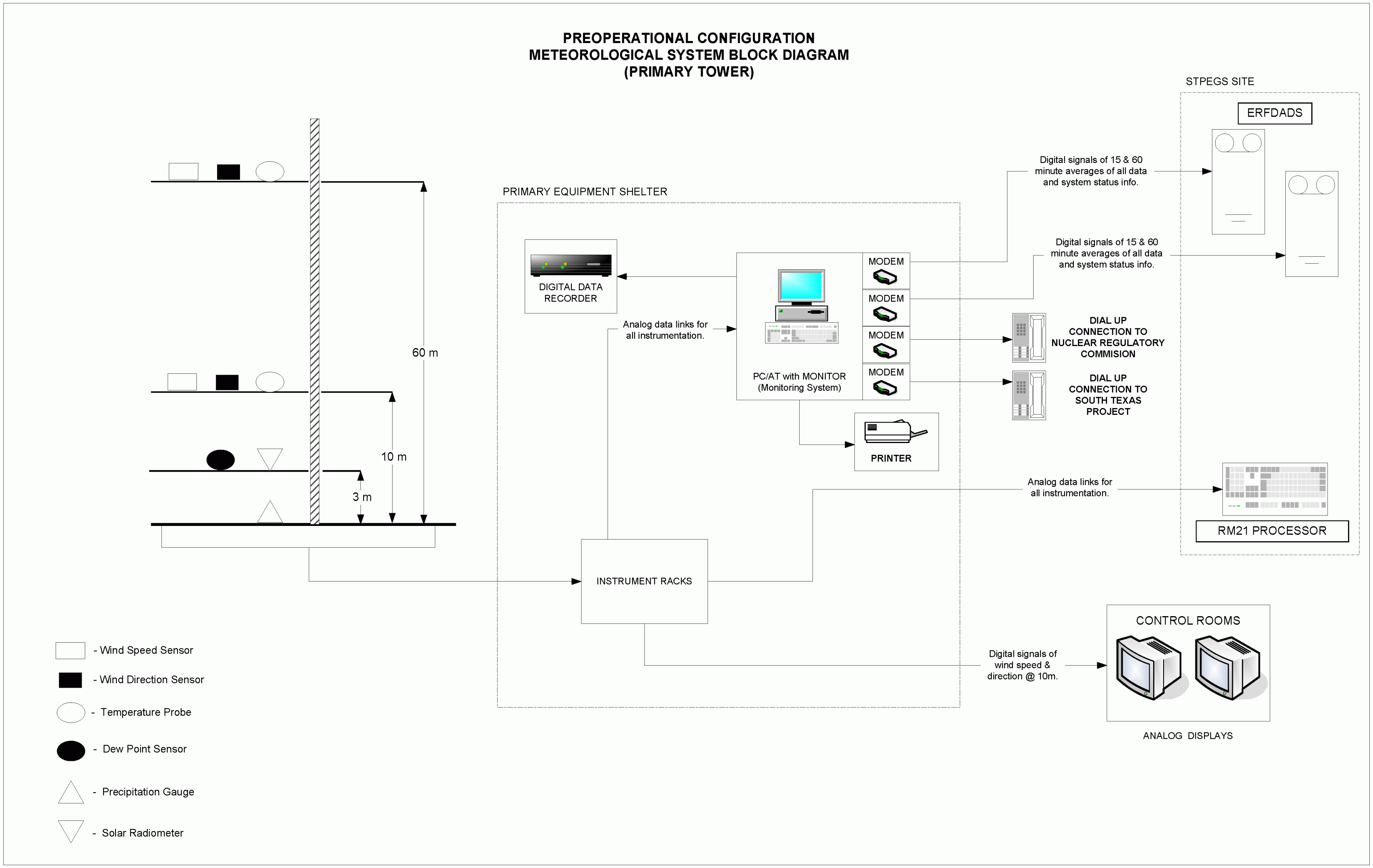


Figure 2.3S-19 Meteorological System Block Diagram (Primary Tower - Preoperational Configuration)

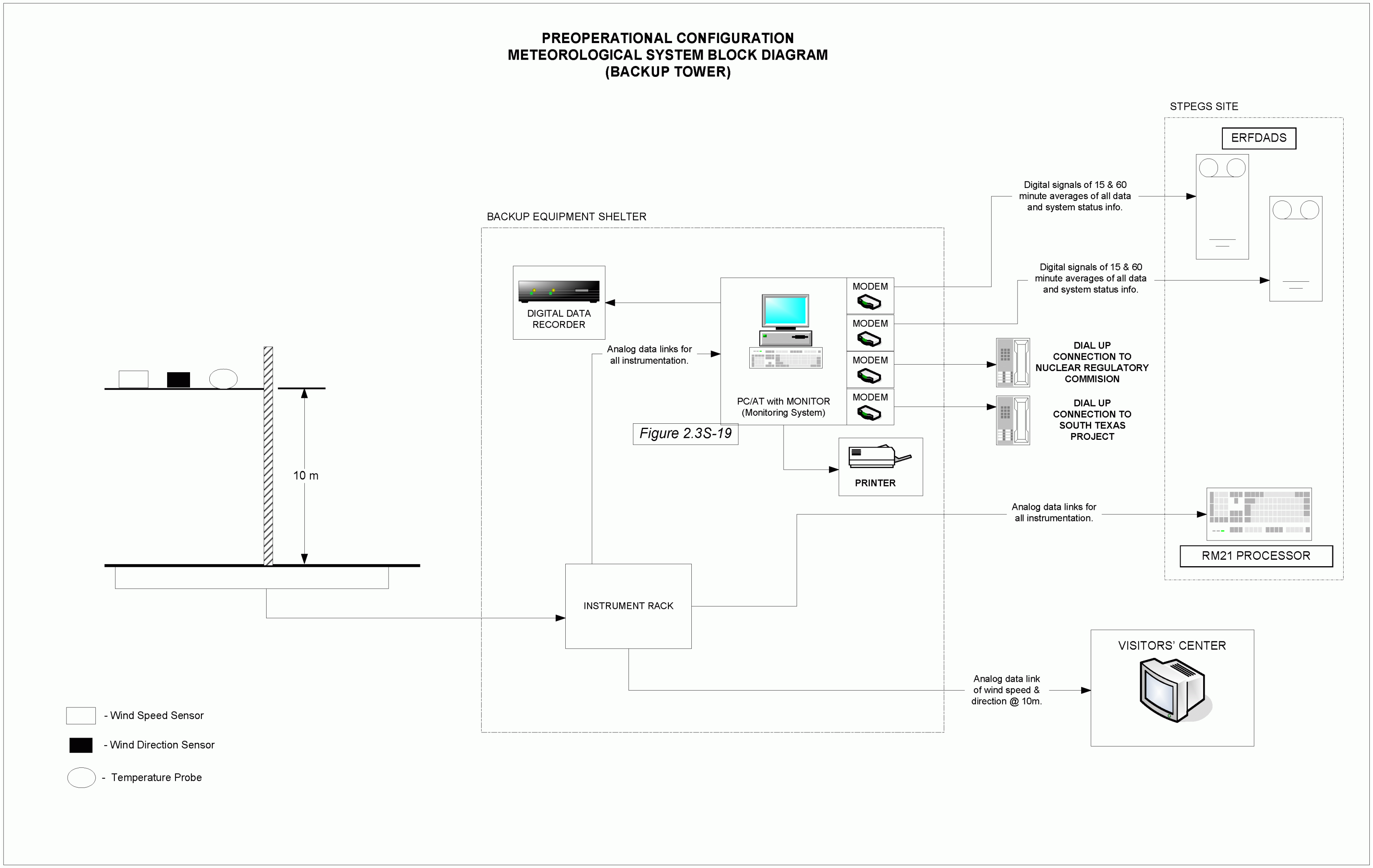


Figure 2.3S-20 Meteorological System Block Diagram (Backup Tower - Preoperational Configuration)

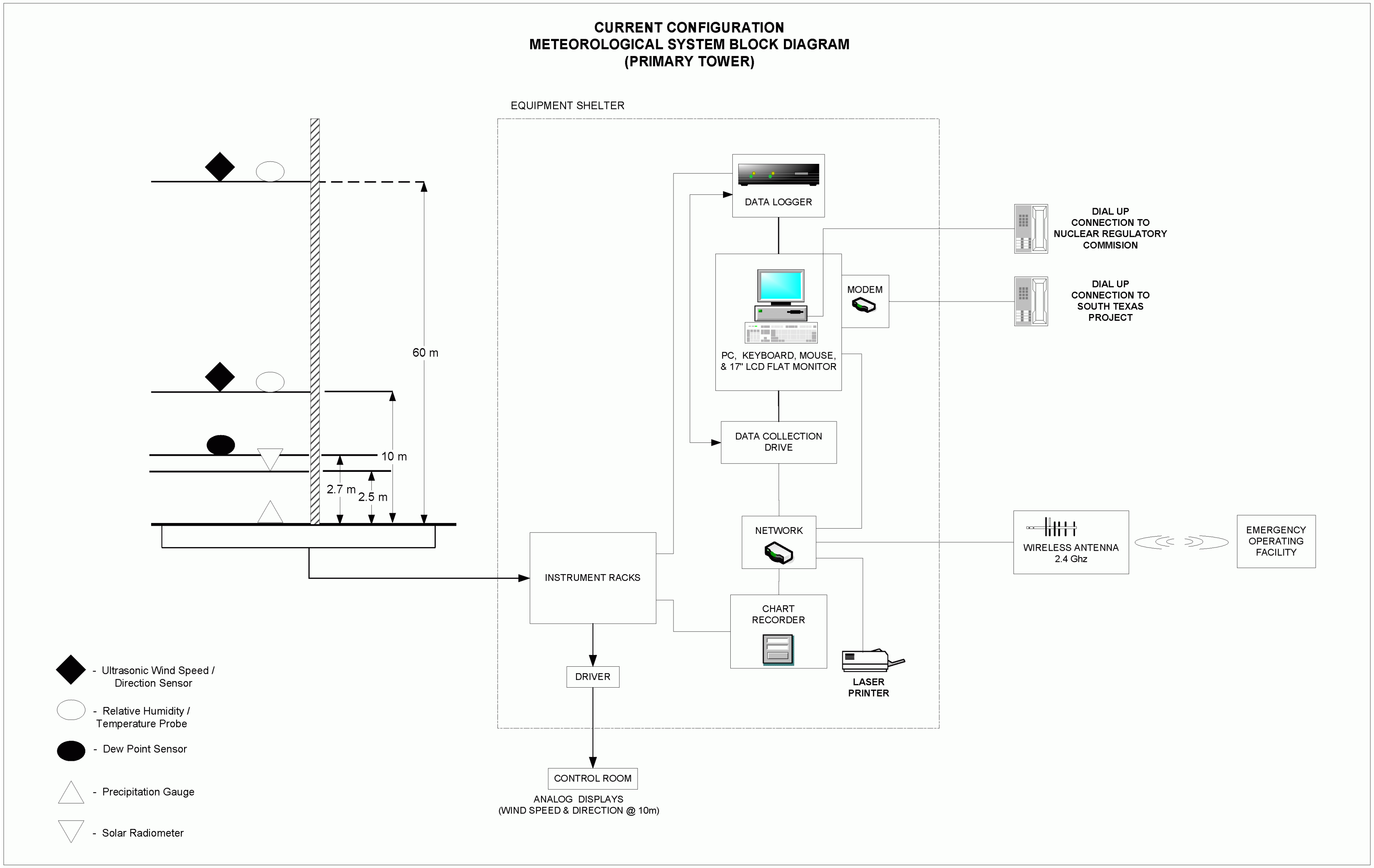


Figure 2.3S-21 Meteorological System Block Diagram (Primary Tower - Preoperational Configuration)

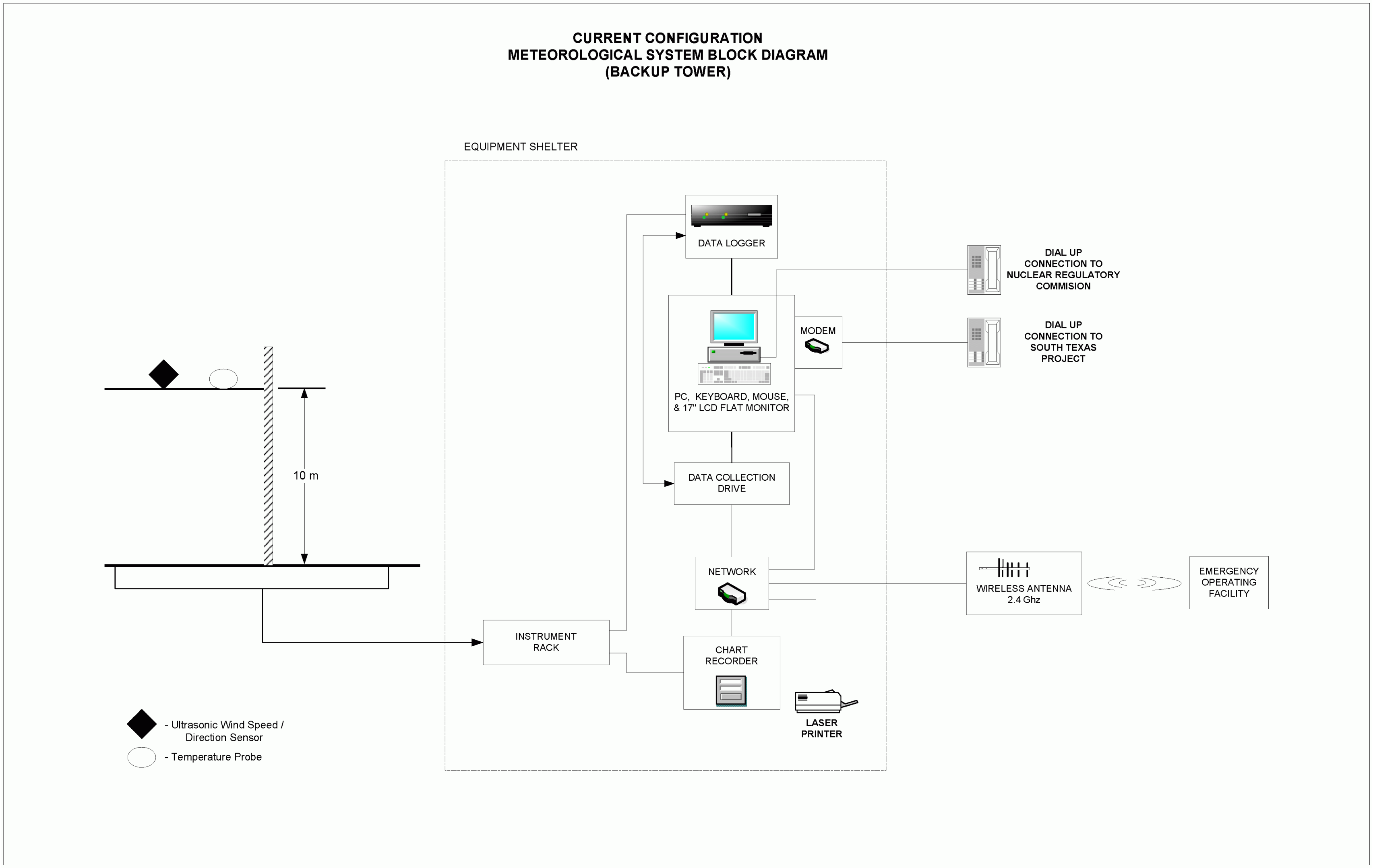


Figure 2.3S-22 Meteorological System Block Diagram (Backup Tower - Operational Configuration)

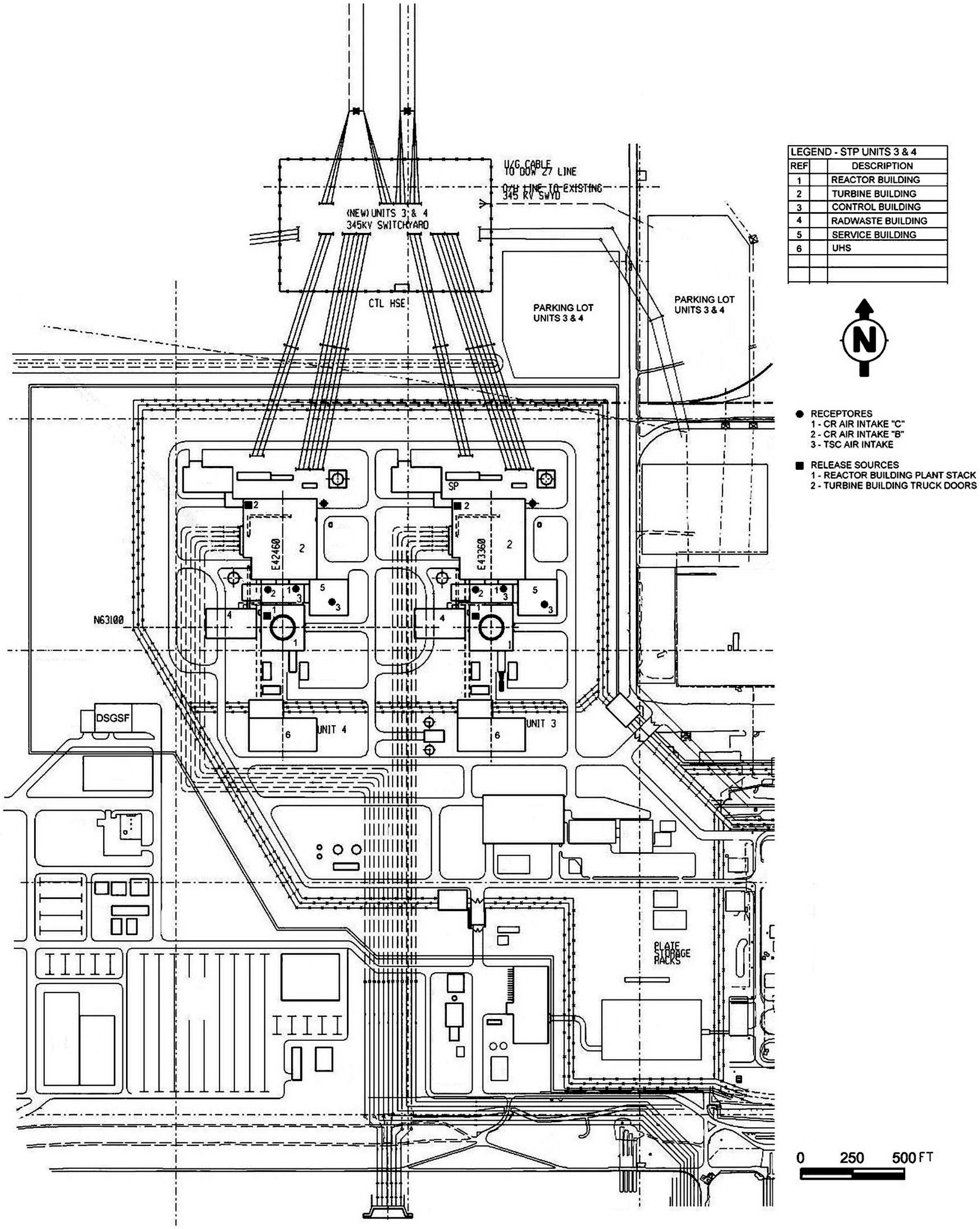


Figure 2.3S-23 Accident Release and Receptor Locations