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## 2.3 METEOROLOGY

The information in this section of the DCD is incorporated by reference with the following departure(s) and/or supplement(s).

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Insert the following text following DCD Subsection 2.3.

VCS SUP 2.3-1 This section discusses regional climatological and local meteorological conditions, the onsite meteorological measurement program, and short-term and long-term diffusion estimates.

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### 2.3.1 REGIONAL CLIMATOLOGY

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DCD The regional climatology is site specific and will be defined by the Combined License applicant.

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Insert the following subsections following DCD Subsection 2.3.1.

VCS COL 2.3-1 This subsection addresses various aspects of the climate in the site region and area around VCSNS Units 2 and 3. Subsection 2.3.1.1 identifies data sources used to develop these descriptions and Subsection 2.3.1.2 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 Units 2 and 3 are discussed in Subsections 2.3.1.3.1 through 2.3.1.3.6, and, respectively, include:

- Probabilistic and observed extreme wind conditions
- Tornadoes and related wind and pressure characteristics
- Tropical cyclones and related effects
- Precipitation extremes
- Frequency and magnitude of hail, snowstorms, and ice storms
- Frequency of thunderstorms and lightning.

Subsection 2.3.1.4 explains that the ultimate heat sink incorporated in the AP1000 design does not require long-term temperature and atmospheric water vapor characteristics to evaluate that system's performance. On the other hand, Subsection 2.3.1.5 provides design basis dry and wet bulb temperature statistics considered in the design and operating bases of other safety- and nonsafety-related structures, system, and components.

Subsection 2.3.1.6 characterizes conditions (from a climatological standpoint) in the site area and region that may be restrictive to atmospheric dispersion. Finally, Subsection 2.3.1.7 discusses climate changes in the context of the units' design bases and expected 40-year operating license period for Units 2 and 3 by evaluating the record of readily available and well-documented climatological observations of temperature and rainfall (normals, means, and extremes) as they have varied over the last 60 to 70 years, and the occurrences of severe weather events in the site area and region.

Climate-related site parameters on which the AP1000 design is based (*i.e.,* wind speed, tornadoes, precipitation, and air temperatures) are identified in DCD Tier 1, Table 5.0-1 and DCD Tier 2, Table 2-1. Site-specific characteristics that correspond to these site parameters are presented or addressed in Subsections 2.3.1.3.1 (for wind speed), 2.3.1.3.2 (for tornadoes), 2.3.1.3.4 (for precipitation), and 2.3.1.5 (for air temperatures). Table 2.0-201 in Section 2.0 of this chapter compares the applicable site parameters and corresponding site-specific characteristic values.

### 2.3.1.1 Data Sources

Several sources of data are used to characterize regional climatological conditions pertinent to Units 2 and 3. This includes data acquired by the National Weather Service (NWS) at its Columbia, South Carolina, first-order station and from 13 other nearby locations in its network of cooperative observer stations, as compiled and summarized by the National Climatic Data Center (NCDC).

These climatological observing stations are located in Fairfield, Newberry, Lexington, Union, Chester, Saluda, Kershaw, Lancaster, York, and Edgefield Counties, South Carolina. Table 2.3-201 identifies the specific stations and lists their approximate distance and direction from the midpoint between the Units 2 and 3 reactors at the site. Figure 2.3-201 illustrates these station locations relative to the site for Units 2 and 3.

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 VCSNS site. The 50-mile radius circle shown in Figure 2.3-201 provides a relative indication of the distance between the climate observing stations and the VCSNS site.

However, a 31-mile (50-kilometer) grid spacing is considered to be a reasonable fine mesh grid in current regional climate modeling and 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 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 included if it contributed one or more extreme conditions (*e.g.,* rainfall, snowfall, maximum or minimum temperatures) for that general direction or added context for variation of conditions over the site area.

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 event was considered to be reasonably representative for the site area, such stations were also included, regardless of directional coverage.

Normals (*i.e.,* 30-year averages), means, and extremes of temperature, rainfall, and snowfall are based on the:

- *2004 Local Climatological Data, Annual Summary with Comparative Data for Columbia, South Carolina* (Reference 213)
- *Climatography of the United States, No. 20, 1971–2000, Monthly Station Climate Summaries* (Reference 214)
- *Climatography of the United States, No. 81, 1971–2000, U.S. Monthly Climate Normals* (Reference 208)
- Southeast Regional Climate Center (SERCC), *Historical Climate Summaries and Normals for South Carolina* (Reference 222)
- *Cooperative Summary of the* Day*, TD3200, Period of Record Through 2001, for the Eastern United States, Puerto Rico, and the Virgin Islands* (Reference 211)
- *U.S. Summary of Day Climate Data (DS 3200/3210), POR 2002-2005* (Reference 215).

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). Table 2.3-202, excerpted from the 2004 local climatological data summary for the Columbia, South Carolina, NWS station, presents the long-term characteristics of these parameters.

Additional data sources were also used in describing the climatological characteristics of the site area and region, including, among others:

- *Solar and Meteorological Surface Observation Network*, 1961–1990, Volume 1, Eastern U.S. (Reference 217)
- *Hourly United States Weather Observations, 1990–1995* (Reference 207)
- *Engineering Weather Data, 2000 Interactive Edition*, Version 1.0 (Reference 202)
- *Minimum Design Loads for Buildings and Other Structures* (Reference 203)
- *Seasonal Variation of 10-Square-Mile Probable Maximum Precipitation Estimates, United States East of the 105th Meridian*, Hydrometeorological Report No. 53, June 1980, NUREG/CR-1486 (Reference 228)
- *Historical Hurricane Tracks Storm Query*, 1851 through 2006 (Reference 219)
- *The Climate Atlas of the United States* (Reference 210)
- *Storm Events for South Carolina*, Hail Event and Snow and Ice Event Summaries for Fairfield, Newberry, Lexington, and Richland Counties (Reference 216)
- *Storm Data (and Unusual Weather Phenomena with Late Reports and Corrections)*, January 1959 (Volume 1, Number 1) to January 2004 (Volume 46, Number 1) (Reference 212)
- *Air Stagnation Climatology for the United States (1948–1998)* (Reference 240)
- *Ventilation Climate Information System* (References 225 and 226)
- *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)* (Reference 209).

#### 2.3.1.2 General Climate

The site for Units 2 and 3 is located in the Piedmont region, lying between the Appalachian Mountains and the Atlantic Ocean, just north of the Fall Line that separates the Piedmont from the Coastal Plain (see Figure 2.5.1-201). The Appalachian Mountains, situated approximately 100 miles to the northwest of the site, have a general southwest-northeast orientation. The Atlantic Ocean is approximately 140 miles to the southeast.

Topographic features within 50 miles and 5 miles of the site are addressed in Subsection 2.3.2.3 Terrain in the site area generally consists of gently to moderately rolling hills. Elevations range from about 80 feet above MSL at a point approximately 50 miles to the southeast to about 920 feet above MSL at a point approximately 45 miles to the northwest.

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 United States. The Units 2 and 3 site is located near the boundaries of three separate climate divisions within the state of South Carolina. It is physically situated in the southwestern portion of Climate Division SC-03 (North Central), but also lies directly adjacent to the eastern extent of Climate Division SC-05 (West Central), and just north of the northwestern portion of Climate Division SC-06 (Central) (Reference 209).

Nevertheless, the general climate in this region 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 predominantly influenced by the Azores high-pressure system. Because of 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. Together, these systems govern South Carolina’s summertime temperature and precipitation patterns. This macro-circulation feature also has an effect on the frequency of high air pollution potential in the site region. These characteristics and their relationship to the Bermuda High, especially in the late summer and autumn, are addressed in Subsection 2.3.1.6.

The influence of this macroscale circulation feature continues during the transitional seasons and winter months; however, it is regularly disrupted by the passage of synoptic- and mesoscale weather systems. During winter, cold air masses may briefly intrude into the region with the cyclonic (*i.e.,* counterclockwise) northerly flow that follows the passage of low-pressure systems. These systems frequently originate in the continental interior around Colorado, 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, snow, sleet, and freezing rain, or mixtures, depending on the temperature characteristics of the weather system itself and the temperature of the underlying air (see Subsection 2.3.1.3.5). Similar cold air intrusion and precipitation patterns may also be associated with secondary low-pressure systems that form in the eastern Gulf of Mexico or along the Atlantic Coast and move northeastward along the coast (also referred to as “nor’easters”).

Larger and relatively more persistent outbreaks of very cold, dry air, associated with massive high-pressure systems that move southeastward out of Canada, also occasionally affect the site region. However, these weather conditions are moderated by the Appalachian Mountains to the northwest, which shelter the region in winter from these cold air masses as they sweep down through the continental interior. In general, the cold air that does reach the site area is warmed by its descent to the relatively lower elevations of the region, as well as by modification because of heating as it passes over the land.

Monthly precipitation exhibits a somewhat cyclical pattern. Table 2.3-202 indicates that the predominant maximum occurs during the summer (June, July, and August), accounting for a third of the annual total rainfall. A more variable, secondary maximum period occurs during winter into early spring (January through March). The summer maximum is due to thunderstorm activity. Heavy precipitation associated with late summer and early autumn tropical cyclones, as discussed in Subsection 2.3.1.3.3, is not uncommon. The winter maximum is associated with low-pressure systems moving eastward and northward through the Gulf States and up the Atlantic Coast, drawing in warm, moist air from the Gulf of Mexico and the Atlantic Ocean. These air masses receive little modification as they move into the region. The site for Units 2 and 3 is located far enough inland that the strong winds associated with tropical cyclones are much reduced by the time that such systems affect the site area.

2.3.1.3 Severe Weather

This subsection addresses severe weather phenomena that affect the Units 2 and 3 site area and region and that are considered in the design and operating bases for Units 2 and 3. These include:

- Observed and probabilistic extreme wind conditions (Subsection 2.3.1.3.1)
- Tornadoes and related wind and pressure characteristics (Subsection 2.3.1.3.2)
- Tropical cyclones and related effects (Subsection 2.3.1.3.3)
- Observed and probabilistic precipitation extremes (Subsection 2.3.1.3.4)
- The frequency and magnitude of hail, snowstorms, and ice storms (Subsection 2.3.1.3.5)
- The frequencies of thunderstorms and lightning (Subsection 2.3.1.3.6).

Among the information provided in several of these subsections are climate-related site characteristics and corresponding values with counterparts in DCD Tier 1, Table 5.0-1 and/or DCD Tier 2, Table 2-1 (see Subsections 2.3.1.3.1, 2.3.1.3.2, and 2.3.1.3.4) which are compared in Table 2.0-201.

2.3.1.3.1 Extreme Winds

Estimating the wind loading on plant structures for design and operating bases considers the “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 the ASCE-SEI design standard, *Minimum Design Loads for Buildings and Other Structures* (Reference 203).

The basic wind speed is about 95 mph, as estimated by linear interpolation from the plot of basic wind speeds in Figure 6-1 of Reference 203 for that portion of the United States that includes the site for Units 2 and 3. This interpolated value is about 5% higher than the basic wind speed reported in the Engineering Weather Data summary for the Columbia, South Carolina, NWS station (*i.e.,* 90 mph) (Reference 202), which is located approximately 26 miles south-southeast of the site. The former value is, therefore, considered to be a reasonably conservative indicator of the basic wind speed for the Units 2 and 3 site.

From a probabilistic standpoint, these values are associated with a mean recurrence interval of 50 years. Section C6.0 of the ASCE-SEI design standard provides conversion factors for estimating 3-second gust wind speeds for other recurrence intervals (Reference 203). Based on this guidance, the 100-year return period value is determined by multiplying the 50-year return period basic wind speed value by a scaling factor of 1.07, which yields a 100-year return period 3-second gust wind speed for the site of about 102 mph.

Subsection 2.3.1.3.3 addresses rainfall extremes associated with tropical cyclones that have passed within 100 nautical miles of the Units 2 and 3 site and concludes with a discussion of observed wind speeds and/or wind gusts accompanying several of the more intense hurricanes that have tracked through this radial area. All of these tropical cyclones—Hurricanes Hugo, Able, and Gracie—had maximum sustained wind speeds and/or peak gusts below the 100-year return period 3-second gust wind speed indicated above, although a slightly higher peak gust of 109 mph was recorded at a station about 45 miles southeast of the VCSNS site as Hurricane Hugo moved through the area.

This climate-related site characteristic value (*i.e.,* the 3-second gust wind speed) is one of the wind speed-related site parameters listed in DCD Tier 2, Table 2-1 (Sheet 1 of 3) (*i.e.*, Wind Speed – Operating Basis). Refer to Table 2.0-201 for a comparison of the corresponding parameter values.

#### 2.3.1.3.2 Tornadoes

The design basis tornado characteristics applicable to structures, systems, and components important to safety include the following parameters as identified in Regulatory Guide 1.76 (Reference 237):

- Maximum wind speed
- Translational speed
- Maximum rotational speed
- Radius of maximum rotational speed

- Pressure drop
- Rate of pressure drop.

Based on Figure 1 of Regulatory Guide 1.76, the VCSNS site is located within Tornado Intensity Region I. In confirming the applicability of this tornado intensity region to the site, information in Revision 2 of NUREG/CR-4461 (Reference 236) was taken into consideration. That document was the basis for most of the technical revisions to Regulatory Guide 1.76.

Table 6-1 of NUREG/CR-4461 lists tornado wind speed estimates for U.S. nuclear power plant sites, including the “Summer” site. The tornado wind speed associated with a $10^{-7}$ exceedance probability of occurrence, based on the Enhanced Fujita Scale of wind speeds, is 208 mph. Revision 1 of Regulatory Guide 1.76 retains the $10^{-7}$ exceedance probability for tornado wind speeds, the same as the original version of that Regulatory Guide. NUREG/CR-4461 discusses the relationship between and previous use of the original Fujita scale of wind speed ranges for different tornado intensity classifications and the Enhanced Fujita Scale wind speed ranges in the revised analysis of tornado characteristics.

Consequently, the design basis tornado characteristics for Tornado Intensity Region I considered to be applicable to the site for Units 2 and 3 are:

- Maximum wind speed = 230 mph
- Translational speed = 46 mph
- Maximum rotational speed = 184 mph
- Radius of maximum rotational speed = 150 feet
- Pressure drop = 1.2 pounds per square inch (psi)
- Rate of pressure drop = 0.5 psi/sec.

The tornado-related site parameters addressed in Table 2.0-201 are among the design basis tornado characteristics applicable to the site for Units 2 and 3.

2.3.1.3.3 Tropical Cyclones

Tropical cyclones include not only hurricanes and tropical storms, but systems classified as tropical depressions, subtropical depressions, and extratropical 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.

NOAA's Coastal Services Center (NOAA-CSC) 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 85 tropical cyclone centers or storm tracks have passed within 100 nautical miles of the Units 2 and 3 site during this historical period (Reference 219). Storm classifications and respective frequencies of occurrence over this 156-year period of record are:

- Hurricanes — Category 4 (1), Category 3 (1), Category 2 (3), Category 1 (7)
- Tropical storms — 37
- Tropical depressions — 22
- Subtropical storms — 1
- Subtropical depressions — 1
- Extratropical storms — 12

Tropical cyclones within this 100-nautical-mile radius have occurred as early as May and as late as November, with the highest frequency (31 out of 85 events) recorded during September, including all classifications except subtropical depressions. October and August account for 16 and 15 events, respectively, indicating that more than 70% of the tropical cyclones that affect the site area occur from mid-summer to early autumn. Tropical storms and tropical depressions have occurred in all months from May to November. Two-thirds of the hurricanes (*i.e.,* 8 of the 12) that have passed within 100 nautical miles of the site occurred during September, including one Category 4 and one Category 3 storm. Only three Category 2 hurricanes have occurred—two in August and one in September. Seven Category 1 hurricanes have been recorded within this radial distance of the site—one each in July and October, and five during September (Reference 219).

Tropical cyclones are responsible for at least 15 separate rainfall records among the 14 NWS and cooperative observer network stations listed in Table 2.3-201—nine 24-hour (daily) rainfall totals and six monthly rainfall totals (see Table 2.3-203).

In early September 1998, rainfall associated with Extratropical Storm Earl resulted in historical 24-hour maximum totals of 10.14 inches at the Kershaw 2SW station, 7.10 inches at the Pelion 4NW station, and 7.08 inches at the Parr observing station. Two 24-hour records were established due to Tropical Storm Cindy in early July 1959, at the Winnsboro cooperative observing station and at the Columbia, South Carolina, NWS station, 7.77 and 5.79 inches, respectively. Late August 1964 saw Tropical Depression Cleo result in maximum 24-hour rainfall totals of 6.35 inches at the Johnston 4SW station, and 6.05 inches at the Saluda observing station. In October 1990, a 24-hour rainfall total of 9.62 inches was recorded at the Camden 3W station due to Extratropical Storm Marco (along with a slow-moving cold frontal system); and, in July 1997, Tropical Depression Danny produced 7.77 inches of rain in a 24-hour period at the Catawba observing station (References 214, 211, 222, and, 219).

Monthly station records were established because of partial contributions from the following tropical cyclones: Hurricane Able in August 1952 (18.55 inches at Kershaw 2SW and 14.90 inches at Winnsboro); Extratropical Storm Marco in October 1990 (16.93 inches at Camden 3W); an unnamed storm in June 1965 (15.88 inches at Johnston 4SW); Hurricane Gracie in September 1959 (14.96 inches at Saluda); and, Tropical Depression Jeanne in September 2004 (14.76 inches at Santuck) (References 212, 214, 211, 215, 222, and 219).

As indicated above, significant amounts of rainfall can still be associated with a tropical cyclone once the system moves inland. Wind speed intensity, however, noticeably decreases as the system passes over terrain and is subjected to increased frictional forces. Examples of such effects, associated with some of the more intense tropical cyclones that have passed within 100 nautical miles of the VCSNS site, are:

- Hurricane Hugo (September 1989). Hugo was still estimated to be of hurricane strength as its center passed between Shaw Air Force Base, about 45 miles southeast of the VCSNS site, and Columbia, South Carolina. A maximum 1-minute average surface wind speed of 58 knots (about 67 mph) with a peak gust of 95 knots (about 109 mph) was recorded at Shaw Air Force Base. A maximum one-minute average surface wind speed of 46 knots (about 53 mph) with a peak gust of 61 knots (about 70 mph) was measured at the Columbia, South Carolina, NWS station. At another location in the Columbia area, designated Columbia AT&T, a peak gust of 86 knots (about 99 mph) was observed (Reference 212).

- Hurricane Able (August 1952). Able passed through central South Carolina, having been downgraded from a Category 2 to a Category 1 hurricane. It remained so during much of its overland track within the state, being further downgraded to tropical storm status in the northern part of South Carolina before exiting into west-central North Carolina. Category 1 hurricanes are characterized by maximum sustained surface (10-meter) wind speeds of 74 to 95 mph. NOAA-CSC records indicate a wind speed of 70 knots (about 81 mph) associated with this Category 1 status (Reference 219).

- Hurricane Gracie (September 1959). Gracie traversed central South Carolina, retaining a Category 3 hurricane designation for about 75 miles of its initial overland track, losing strength as it continued to move inland, and being downgraded to tropical storm status by the time it passed through the center of the state and exiting into western North Carolina. Tropical storms are characterized by maximum sustained surface (10-meter) wind speeds of 39 to 73 mph. NOAA-CSC records indicate a wind speed of 60 knots (about 69 mph) associated with this tropical storm status (Reference 219).

Subsection 2.3.1.3.1 discussed the wind speeds associated with Hurricane Hugo in relation to the other design basis wind speed characteristics developed for the Units 2 and 3 site.

2.3.1.3.4 Precipitation Extremes

Because precipitation is a point measurement, mean and extreme statistics, such as individual storm event, or daily or cumulative monthly totals typically vary from station to station. Assessing the variability of precipitation extremes over the site area for Units 2 and 3, in an effort to evaluate whether the available long-term data is representative of conditions at the site, depends largely on station coverage.

Historical precipitation extremes (rainfall and snowfall) are presented in Table 2.3-203 for the 14 nearby climatological observing stations listed in Table 2.3-201. Based on the maximum 24-hour and monthly precipitation totals recorded among these stations in the VCSNS site area and, more importantly, the areal distribution of these stations around the site, the data suggest that these statistics are reasonably representative of the extremes of rainfall and snowfall that might be expected to be observed at the site for Units 2 and 3.

As indicated in Subsection 2.3.1.3.3, most of the individual station 24-hour rainfall records (and to a lesser extent the monthly record totals) were established as a result of precipitation associated with tropical cyclones that passed within 100 nautical miles of the Units 2 and 3 site. However, the overall highest 24-hour rainfall total in the site area—10.42 inches on August 18, 1986 at the Newberry cooperative observing station (References 214 and 222), about 18 miles to the west of the Units 2 and 3 site—was not directly associated with a tropical cyclone, although the region was generally unsettled as Tropical Storm Charley had formed well off the South Carolina coast moving to the northeast only a few days earlier (Reference 212).

Similarly, the overall highest monthly rainfall total in the site area—18.55 inches recorded during August 1952 at the Kershaw 2SW cooperative observing station (References 222 and 211), about 44 miles to the east-northeast of the site for Units 2 and 3— represents the accumulation of 13 days of measurable precipitation during that month (Reference 211) with less than 25% of that total attributable to Hurricane (later Tropical Storm) Able, which passed through South Carolina on August 30 and 31 (see Subsection 2.3.1.3.3).

When a 24-hour rainfall record was established at a given observing station, significant amounts of rain were frequently measured at other stations in the site area on the same date (Reference 211), particularly when associated with the passage of a tropical cyclone. Greater variability among concurrent 24-hour station totals is seen for station records associated with more local-scale events such as thunderstorms. Monthly station rainfall totals concurrent with individual station monthly records are generally more variable, (Reference 211) primarily because of the length of time and varying synoptic conditions over the time interval that these totals are accumulated.

Site characteristic values corresponding to the site parameter precipitation (rain)—that is, 1-hour and 5-minute rainfall rates (intensities)—are addressed in Subsection 2.4.2.3.

Although the disruptive effects of any winter storm accompanied by frozen precipitation can be significant in the Piedmont of South Carolina, storms that produce large amounts of snow occur only occasionally. Among the 14 nearby observing stations listed in Table 2.3-203, six of the 24-hour maximum snowfall records were established as a result of the storm on February 10, 1973; the highest, 14.0 inches, being measured at the Johnston 4SW cooperative observing station about 46 miles to the southwest of the Units 2 and 3 site. Other station records on this date range from 7.5 inches at Parr, about 1 mile to the southwest, to 12.3 inches at the Columbia, South Carolina, NWS station (References 214 and 222).

Record 24-hour snowfall totals, greater than or equal to 10 inches, on other dates include:

- 13.5 inches at the Catawba observing station on February 27, 2004, about 45 miles to the north-northeast of the Units 2 and 3 site (References 222 and 215)
- 12.0 inches at both the Kershaw 2SW station on December 12, 1958 and the Blair observing station (about 10 miles to the north-northwest) on February 26, 1969 (References 222 and 211)
- 10.0 inches at the Little Mountain observing station on December 11, 1958, about 8 miles to the southwest of the site (References 222 and 211).

Seven of the maximum monthly snowfall totals in the VCSNS site area were also due to the early February 1973 storm, ranging from 7.5 inches at the Parr observing station to 16.0 inches at the Columbia, South Carolina, NWS station (References 214, 211, and 222). However, the overall highest monthly snowfall total (*i.e.*, 16.5 inches) was recorded in March 1960 at the Chester 1NW station, about 30 miles to the north of the Units 2 and 3 site as a result of two smaller snow events—the first occurring on March 2 and 3, and the second on March 9 and 11 (References 222 and 211). Monthly snowfall totals ranging from 3.2 to 10.0 inches were measured during March 1960 at ten of the other cooperative observing stations in the VCSNS site area; three of the 14 stations did not record snowfall during that month (Reference 211).

From a probabilistic standpoint, estimating the design basis snow load on the roofs of safety-related structures considers one or both of these climate-related components:

- The weight of the 100-year return period ground-level snowpack (to be included in the combination of normal live loads).
- The weight of the 48-hour probable maximum winter precipitation (to be included, along with the weight of the 100-year return period ground-level snowpack, in the combination of extreme live loads).

Based on Figure 7-1 of the ASCE-SEI design standard, *Minimum Design Loads for Buildings and Other Structures* (Reference 203), the 50-year return period ground-level snowpack for the Units 2 and 3 site area is about 10 pounds/square foot. Section C7.0 of this design standard provides conversion factors for estimating ground-level snowpack values for other recurrence intervals. A 100-year return period value is determined by dividing the 50-year ground-level snowpack by a factor of 0.82, which yields a 100-year return period ground-level snowpack of 12.2 pounds/square foot for the site area.

Based on the relationship of 1 inch of water being equivalent to 5.2 pounds per square foot, the estimated 100-year return period ground-level snow pack would be equivalent to about 2.35 inches of water (*i.e.,* 12.2 pounds per square foot /5.2 pounds per square foot/inch). Assuming a nominal snow density (*i.e.,* the ratio of the volume of melted snow to the volume of snow) of 1:10, a value typically used by the NCDC in estimating liquid precipitation equivalents during snowfall events, the snow depth associated with the water equivalent of the estimated 100-year return period ground-level snowpack would be 23.5 inches of snow. This snow depth is about 1.65 times higher than the maximum 24-hour snowfall recorded in the Units 2 and 3 site area (*i.e.*, 14.0 inches).

The 48-hour probable maximum winter precipitation component (unadjusted) for evaluating extreme live loads (as indicated above) is derived from plots of 6-, 24- and 72-hour, 10-square mile area, monthly probable maximum precipitation estimates as presented in NUREG/CR-1486 (Reference 228). The highest winter season (*i.e.,* December through February) probable maximum precipitation values for the Units 2 and 3 site area occur in December and are about 15, 23, and 30 inches, respectively, for these time intervals (Figures 25, 35, and 45 of NUREG/CR-1486).

The 48-hour probable maximum winter precipitation value (unadjusted), estimated by logarithmic interpolation on the curve defined by the 6-, 24-, and 72-hour probable maximum precipitation values for December, is 27.4 inches liquid depth. Subsection 2.4.10 discusses roof design provisions that relate to the prevention of rainfall accumulation.

The climate-related site characteristic value (*i.e.,* ground snow load) is one of the precipitation-snow/ice-related site parameters. Refer to Table 2.0-201 for a comparison of the corresponding parameter values.

2.3.1.3.5 Hail, Snowstorms, and Ice Storms

Frozen precipitation typically occurs in the form of hail, snow, sleet, and freezing rain. The frequencies of occurrence and characteristics of these types of weather events in the Units 2 and 3 site area are based on the current version of *The Climate Atlas of the United States* (Reference 210), which has been developed from observations made over the 30-year period of record from 1961 to 1990, and from the NCDC online Storm Events database (Reference 216).

Though hail can occur at any time of the year and is associated with well-developed thunderstorms, it has been observed primarily during the spring and early summer months (*i.e.,* April through July), reaching a peak during May, and occurring least often from late summer to late winter (*i.e.,* September through February) (Reference 216). The Climate Atlas indicates that Lexington, Richland, and the very southern portion of Fairfield County (which includes the VCSNS site), can expect, on average, hail with diameters 0.75 inch or greater about two to three days per year. The occurrence of hailstorms with hail greater than or equal to 1.0 inch in diameter averages about one to two days per year in Lexington and Richland Counties, the southern half of Fairfield County, and the extreme southeast portion of Newberry County (Reference 210), all of which surround the site.

NCDC cautions that hailstorm events are point observations and somewhat dependent on population density. This explains the areal extent of the higher frequencies reported above for most of Lexington and Richland Counties to the south of the site, which comprise the Columbia, South Carolina metropolitan area, and what could be interpreted as lower frequencies of occurrence in much of Fairfield County and most of Newberry County, which are relatively less populated. The slightly higher annual mean number of hail days is considered to be a more representative indicator for the Units 2 and 3 site.

Despite these long-term statistics, no hailstorms of note have been recorded in some years, while multiple events have been observed in this four-county area in other years, including:

- 9 events on 8 separate dates in 1988, and 7 events on 7 separate dates during 1996 in Richland County.
- 14 events on 7 separate dates in 2005, and 10 events on 7 separate dates during 2003 in Lexington County.
- 12 events on 7 separate dates in 2006 in Newberry County (Reference 216).

Golfball-size hail (about 1.75 inches in diameter) is not a rare occurrence, having been observed numerous times in all four counties surrounding the VCSNS site (Reference 216). However, in terms of extreme hailstorm events, baseball-size hail (about 2.75 inches in diameter) was reported in Richland County on May 2, 1984, about 26 miles southeast of the site; and 3-inch diameter hail stones were reported about 33 miles east-southeast of the site, also in Richland County.

Snow is not unusual in the Piedmont of South Carolina, where the VCSNS site is located, but heavy snowfalls occur only occasionally when a source of moist air from the Atlantic Ocean or the Gulf of Mexico interacts with a very cold air mass that penetrates across the otherwise protective Appalachian mountain range in northern Georgia and northwestern South Carolina. The Climate Atlas (Reference 210) indicates that the occurrence of snowfalls 1 inch or greater in the VCSNS site area averages less than one day per year (see also Table 2.3-202). Additional details regarding extreme snowfall events in the site area are provided in Subsections 2.3.1.3.4 and 2.3.2.2.6, and in Table 2.3-203.

Depending on the temperature characteristics of the air mass, snow events are often accompanied by or alternate between sleet and freezing rain as the weather system traverses the VCSNS region. The Climate Atlas (Reference 210) indicates that, on average, freezing precipitation occurs about 3 to 5 days per year in the area that includes the Units 2 and 3 site.

Storm event records from the winters of 1994 through 2006 for the four-county area surrounding the VCSNS site note that ice accumulations of up to 1 inch have occurred, although it is typically less than this thickness (Reference 216).

#### 2.3.1.3.6 Thunderstorms and Lightning

Thunderstorms can occur in the Units 2 and 3 site area at any time during the year. Based on a 57-year period of record, Columbia, South Carolina, averages about 52 thunderstorm-days (*i.e.,* days on which thunder is heard at an observing station) per year. On average, July has the highest monthly frequency of occurrence—about 12 days. Annually, nearly 60% of thunderstorm-days are recorded between late spring and mid-summer (*i.e.,* from June through August). From October through January, a thunderstorm might be expected to occur about one day per month. (Reference 213).

The mean frequency of lightning strokes to earth can be estimated using a method attributed to EPRI, as reported by the U.S. Department of Agriculture Rural Utilities Service in the publication entitled *Summary of Items of Engineering Interest* (Reference 224). 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 Columbia, South Carolina (*i.e.,* 52; see Table 2.3-202), the frequency of lightning strokes to earth per square mile is about 16 per year for the VCSNS site area. This frequency is essentially equivalent to the mean of the 5-year (1996 to 2000) flash density for the area that includes the Units 2 and 3 site, as reported by the NWS—4 to 8 flashes per square kilometer per year (Reference 218)—and, therefore, is considered to be a reasonable indicator.

The power block area (PBA) circle for Units 2 and 3 is represented in Figure 1.1-202 as an area bounded by a 750-foot-radius circle with its centroid at a point between the two units. The equivalent area of this circle is approximately 0.063 square mile. Given the estimated annual average frequency of lightning strokes to earth in the VCSNS site area, the frequency of lightning strokes in the power block area can be estimated as follows:

$$(16 \text{ lightning strokes/mi}^2\text{/year}) \times (0.063 \text{ mi}^2) = 1.01 \text{ lightning strokes/year}$$

or about once each year in the area.

### 2.3.1.4 Meteorological Data for Evaluating the Ultimate Heat Sink

The AP1000 reactor design uses a passive containment cooling system to provide the safety-related ultimate heat sink for the plant. The passive containment cooling system uses a high-strength steel containment vessel inside a concrete shield building. The steel containment vessel provides the heat transfer surface that removes heat from inside the containment by conduction. Heat from the containment surface is transferred to a water film by convection, and from the water film to the air by convection and the evaporation of the water film. Heat removal from the containment vessel is aided by continuous, natural circulation of air (see DCD Tier 2, Subsection 6.2.2).

The use of the passive containment cooling system in the AP1000 reactor design is not significantly influenced by local weather conditions. Therefore, the identification of meteorological conditions that are associated with maximum evaporation and drift loss of water, as well as minimum cooling by the ultimate heat sink (*i.e.,* periods of maximum wet bulb temperatures) is not necessary.

### 2.3.1.5 Design Basis Dry and Wet Bulb Temperatures

Long-term, engineering-related climatological data summaries, prepared by the Air Force Combat Climatology Center (AFCCC) and the NCDC for the nearby Columbia, South Carolina, NWS station (Reference 202) are used to characterize typical design basis dry and wet bulb temperatures for the VCSNS site. These characteristics include:

- Maximum ambient threshold dry bulb temperatures at annual exceedance probabilities of 2.0 and 0.4%, along with the mean coincident wet bulb temperatures at those values.

- Minimum ambient threshold dry bulb temperatures at annual exceedance probabilities of 99.0 and 99.6% (and properly interpreted as meaning that the dry bulb temperatures in the distribution of minimum temperatures are lower only 1.0 and 0.4% of the time, respectively).

- Maximum ambient threshold wet bulb temperatures at annual exceedance probabilities of 2.0 and 0.4%.

Based on a 24-year period of record from 1973 to 1996 for Columbia, South Carolina, the maximum dry bulb temperature with a 2.0% annual exceedance probability is 92°F, with a mean coincident wet bulb temperature of 75°F. The maximum dry bulb temperature with a 0.4% annual exceedance probability is 97°F with a corresponding mean coincident wet bulb temperature value of 76°F (Reference 202).

For the same period of record, the minimum dry bulb temperatures with 99.0 and 99.6% annual exceedance probabilities are 24°F and 20°F, respectively (Reference 202).

The same summary for Columbia lists the maximum wet bulb temperature with a 2.0% annual exceedance probability as 77°F; and the maximum wet bulb temperature with a 0.4% annual exceedance probability as 78°F (Reference 202).

The Westinghouse basis for the determination of maximum design basis dry and wet bulb temperature values reflected in the AP1000 reactor design is summarized below:

- Maximum Safety Dry Bulb and Coincident Wet Bulb Temperatures. These site parameter values represent a maximum dry bulb temperature that exists for 2 hours or more, combined with the maximum wet bulb temperature that exists in that population of dry bulb temperatures. Note that this coincident wet bulb temperature is not defined in the same way as the mean coincident wet bulb values presented previously.

- Maximum Safety Wet Bulb Temperature (Noncoincident). This site parameter value represents a maximum wet bulb temperature that exists within a set of hourly data for a duration of 2 hours or more.

- Maximum Normal Dry Bulb and Coincident Wet Bulb Temperatures. The dry bulb temperature component of this site parameter pair is represented by a maximum dry bulb temperature that exists for 2 hours or more, excluding the highest 1% of the values in an hourly data set. The wet bulb temperature component is similarly represented by the highest wet bulb temperature excluding the highest 1% of the data, although there is no minimum 2-hour persistence criterion associated with this wet bulb temperature. The coincident wet bulb temperature is not defined in the same way as the mean coincident wet bulb values presented previously.

- Maximum Normal Wet Bulb Temperature (Noncoincident). This site parameter value represents a maximum wet bulb temperature, excluding the highest 1% of the values in an hourly data set (i.e., a 1% exceedance), that exists for 2 hours or more.

- Minimum Safety Dry Bulb Temperature. This site parameter value represents a minimum dry bulb temperature that exists within a set of hourly data for a duration of 2 hours or more.

- Minimum Normal Dry Bulb Temperature. This site parameter value represents a minimum dry bulb temperature excluding the lowest 1% of the values in an hourly data set.

The VCSNS site characteristic maximum safety design basis dry bulb and wet bulb temperature values were developed based on a set of sequential hourly meteorological data recorded over 30 years of record from 1966 through 1995 at the Columbia, South Carolina, NWS station (References 217 and 207).

Consistent with the Westinghouse methodology, the highest dry bulb temperature that persisted for at least 2 hours over this 30-year period was 105.1°F. The highest coincident wet bulb temperature during this time period was determined to be 80.2°F. This pair of values represents the maximum safety dry bulb and coincident wet bulb temperatures applicable to the VCSNS site. The maximum safety wet bulb temperature (noncoincident), persisting for at least 2 hours, was determined to be 82.5°F (References 217 and 207).

The 1.0% annual exceedance probability dry and wet bulb temperature values from Reference 202 for Columbia, South Carolina, are conservative estimates for the maximum normal dry bulb and coincident wet bulb temperatures because the minimum 2-hour persistence criterion in the Westinghouse methodology is not reflected in those statistics. So, as an alternative, the 1.0% annual exceedance probability dry bulb and mean coincident wet bulb temperatures (94°F and 75°F, respectively) (Reference 202) are used to represent the maximum normal dry bulb and coincident wet bulb temperatures for the VCSNS site.

Following a similar conservative approach, the maximum normal wet bulb temperature (noncoincident) is represented by the 1.0% annual exceedance probability wet bulb temperature (*i.e.*, 78°F) (Reference 202).

Record minimum temperatures observed in the VCSNS site area are presented in Table 2.3-203 and summarized in Subsection 2.3.2.2.4. Among the 14 NWS and cooperative observer network stations listed in Table 2.3-201, the overall lowest temperature recorded was –5°F at a station (Chester 1NW) (References 214 and 222) located about 30 miles to the north of the site.

Temperature readings from these data sources represent minimum daily values as opposed to sequential hourly measurements taken at the Columbia, South Carolina, first-order NWS station. Nevertheless, this record low temperature for the site area represents a conservative estimate of both the minimum safety and the minimum normal dry bulb temperature in that it neither reflects the application of a 2-hour persistence criterion nor the exclusion of the lowest 1.0% of the observed values, but rather represents an overall, historical minimum temperature.

These climate-related site characteristic values are among the air temperature-related site parameters listed in:

- DCD Tier 1, Table 5.0-1 (*i.e.,* maximum safety dry bulb and coincident wet bulb temperatures, maximum safety wet bulb temperature [noncoincident], and minimum safety dry bulb temperature).
- DCD Tier 2, Table 2-1 (Sheet 1 of 3) (*i.e.,* maximum safety dry bulb and coincident wet bulb temperatures, maximum safety wet bulb temperature [noncoincident], minimum safety dry bulb temperature, maximum normal dry bulb and coincident wet bulb temperatures, maximum normal wet bulb temperature [noncoincident], and minimum normal dry bulb temperature).

Refer to Table 2.0-201 for a comparison between the site characteristic values and the corresponding site parameter values.

The Air Force Combat Climatology Center-NCDC data summaries from which the dry bulb and mean coincident wet bulb temperatures (presented earlier) and the 1.0% annual exceedance probability dry bulb and wet bulb temperatures (presented above) 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 30 years (*i.e.,* from 1966 through 1995) at the Columbia, South Carolina, NWS station (References 217 and 207). Because the 100-year return period dry bulb temperature values are extrapolated from a regression curve on that parameter alone, no corresponding mean coincident wet bulb temperatures are associated with this return interval.

Based on the linear regression analyses of these data sets for a 100-year return period, the maximum dry bulb temperature is estimated to be 112.4°F, the minimum dry bulb temperature is estimated to be approximately –8.9°F, and the maximum wet bulb temperature is estimated to be 87.3°F.

### 2.3.1.6 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 and wind speed. Subsection 2.3.2.2.1 addresses wind characteristics for the VCSNS site vicinity based on measurements from the existing meteorological monitoring program operated in support of Unit 1. The persistence of those wind conditions is discussed in Subsection 2.3.2.2.2.

In general, lower wind speeds represent less-turbulent airflow, which is restrictive to both 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 consecutive days or more. An updated air stagnation climatology has been published with data for the continental United States based on over 50 years of observations—from 1948 through 1998. Although interannual frequency varies, the data in Figures 1 and 2 of that report indicate that, on average, the VCSNS site area can expect about 15 to 20 days per year with stagnation conditions, or about 3 to 4 cases per year, with the mean duration of each case lasting about 5 days (Reference 240).

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 Reference 240, Figures 17 to 67, the highest incidence of air stagnation is recorded in the latter half of that period between August and October, typically reaching its peak in September. As the local climatological data summary for Columbia, South Carolina, in Table 2.3-202 indicates, this three-month period coincides with the lowest monthly mean wind speeds during the year. Within this “extended” summer season, air stagnation is at a relative minimum during July because of the influence of the Bermuda high-pressure system. (Reference 240)

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. In Reference 206, Holzworth reported mean seasonal and annual morning and afternoon mixing heights and wind speeds for the contiguous United States based on observations over the five-year period from 1960 to 1964 from a network of 62 NWS stations at which daily surface and upper air sounding measurements were routinely made.

However, an interactive, spatial database developed by the U.S. Department of Agriculture–Forest Service, referred to as the Ventilation Climate Information System, is readily available and provides monthly and annual graphical and tabular summaries of relevant dispersion-related characteristics (*e.g.,* morning and afternoon modeled mixing heights, modeled surface wind speeds, and resultant ventilation indices) (Reference 225). The system, although developed primarily for fire management and related air quality purposes, extends the period of record to a climatologically representative duration of 40 years.

Table 2.3-204 summarizes minimum, maximum, and mean morning and afternoon mixing heights, surface wind speeds, and ventilation indices on a monthly, seasonal, and annual basis for the VCSNS site area. As atmospheric sounding measurements are still only made from a relatively small number of observation stations, these statistics represent model-derived values within the interactive database for a specific location (Reference 225)—in this case, the Units 2 and 3 site. The seasonal and annual values listed in Table 2.3-204 were derived as weighted means based on the corresponding monthly values.

From a climatological standpoint, the lowest morning mixing heights occur in the autumn and are highest during the spring although, on average, morning mixing heights are only slightly lower in the winter and summer months. Conversely, afternoon mixing heights reach a seasonal minimum in the winter and a maximum during the summer (only slightly lower during the spring) (Reference 226), as might be expected because of more intense summertime heating.

The wind speeds listed in Table 2.3-204 are reasonably consistent with the local climatological data summary for Columbia, South Carolina, in Table 2.3-202 in that the lowest mean wind speeds are shown to occur during summer into early autumn (References 213 and 226). This period of minimum wind speeds likewise coincides with the "extended" summer season described by Wang and Angell in Reference 240 that is characterized by relatively higher air stagnation conditions.

The ventilation index is based on the product of the wind speed and the mixing height. Because it uses surface winds instead of higher trajectory winds, the index values represent conservative estimates of ventilation potential and so would be more indicative of the dispersion potential near the ground (Reference 225).

Based on the classification system for ventilation indices (Reference 225), the morning ventilation indices for the VCSNS site area indicate only marginal ventilation potential on an annual average basis with conditions rated as marginal during the winter and spring and poor during the summer and autumn (Reference 226); again, consistent with the characteristics reported by Wang and Angell in Reference 240.

Ventilation indices markedly improve during the afternoon with conditions rated as good on an annual average basis and during the spring and summer seasons; afternoon ventilation potential is rated as fair during the autumn and winter (Reference 226). Because mean wind speeds do not vary significantly in the site area over the course of the year, the relatively better ventilation index classifications are attributable to the higher mixing height levels, which for the summer season tends to mask the general potential for more restrictive dispersion conditions during the "extended" summer referred to by Wang and Angell in Reference 240. Nevertheless, the transition from good to fair ventilation indices between the summer and autumn months is still evident and consistent with the monthly variations and July minimum for air stagnation discussed previously.

#### 2.3.1.7 Climate Changes

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

With regard to the expected 40-year operating license period for Units 2 and 3, which could extend until the year 2056 for Units 2 and 2059 for Unit 3, based on estimated commercial operation dates of 2016 and 2019, respectively (see Section 1.1), 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 are 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 209). The report summarizes these observations for the 344 climate divisions in the 48 contiguous states.

As Subsection 2.3.1.2 indicates, the VCSNS site is located near the boundaries of three separate climate divisions within the state of South Carolina. It is physically situated in the southwestern portion of Climate Division SC-03 (North Central), but also lies directly adjacent to the eastern extent of Climate Division SC-05 (West Central), and just north of the northwestern portion of Climate Division SC-06 (Central) (Reference 209).

Summaries of successive annual temperature and rainfall normals as well as the composite 70-year average are provided below for these climate divisions (Reference 209).

| Period | Temperature (°F) | | | Rainfall (inches) | | |
|---|---|---|---|---|---|---|
| | **SC-03** | **SC-05** | **SC-06** | **SC-03** | **SC-05** | **SC-06** |
| 1931–2000 | 61.2 | 62.2 | 63.3 | 46.22 | 46.99 | 46.21 |
| 1931–1960 | 61.7 | 62.9 | 63.8 | 45.41 | 44.88 | 43.52 |
| 1941–1970 | 61.2 | 62.3 | 63.3 | 45.83 | 46.46 | 46.41 |
| 1951–1980 | 60.9 | 61.8 | 63.0 | 46.63 | 47.53 | 47.31 |
| 1961–1990 | 60.7 | 61.6 | 62.8 | 46.92 | 48.46 | 47.95 |
| 1971–2000 | 61.0 | 61.8 | 63.2 | 47.03 | 48.36 | 48.09 |

This data indicates a slight cooling trend over most of the 70-year period, with a slight increase of about 0.2°F to 0.4°F during the most recent normal period. In general, total annual normal rainfall has trended upward in these divisions ranging from an increase of about 1.6 inches in Climate Division SC-03 to about 4.6 inches in Climate Division SC-06. Similar trends are observable for all of the other climate divisions in South Carolina with the exception of Climate Division SC-01

(Mountain) in the extreme northwest part of the state, which is a characteristically different climatic regime (Reference 209).

The preceding values represent variations of “average” temperature and rainfall conditions over time. The occurrence of extreme temperature and precipitation (*i.e.,* rainfall and snowfall) events does not necessarily follow the same trends. However, characteristics about the occurrence of such events over time are indicated by the summaries for observed extremes of temperature, and rainfall and snowfall totals recorded in the VCSNS site area (see Table 2.3-203).

Individual station records for maximum temperature have been set between 1952 and 2002 (the overall highest value for the site area having been recorded in 1954)—that is, no discernible trend for these extremes in the site area. Similarly, record-setting 24-hour rainfall totals were established between 1959 and 1998, with station records for total monthly rainfall being set between 1952 and 2004—again, no clear trend. Cold air outbreaks that result in overall extreme low temperatures occur infrequently, as is the case with record-setting snowfall events. Nevertheless, records of these types span a range of years similar to the maximum temperature and rainfall extremes indicated above. Among the stations in Table 2.3-203, record 24-hour snowfall totals have been set between 1935 and 2004; record monthly snowfall totals between 1958 and 2004 (References 214, 211, 215, and 222).

The occurrence of all tropical cyclones within 100 nautical miles of the VCSNS site has been fairly steady since about 1910 when considered on a 10-year basis. In terms of 30-year intervals, similar to the “normal” periods used to evaluate temperature and rainfall data, tropical cyclone frequency has varied little since 1930, having decreased in frequency since the first 30 years of the last century (Reference 219).

In general, 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.

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 40-year operating license period of the units. The design basis characteristics determined previously under Subsection 2.3.1.3 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 Units 2 and 3 site.

## 2.3.2 LOCAL METEOROLOGY

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DCD The local meteorology is site specific and will be defined by the Combined License applicant.

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Insert the following subsections following DCD Subsection 2.3.2.

VCS COL 2.3-2 This subsection addresses various meteorological and climatological characteristics of the site and vicinity around Units 2 and 3; Subsection 2.3.2.1 identifies data resources used to develop the climatological descriptions and introduces information about the onsite meteorological monitoring program used to characterize site-specific atmospheric dispersion conditions.

The information presented in Subsection 2.3.2.2 has two focuses. First, site-specific characteristics related to atmospheric transport and diffusion, based on measurements from the onsite meteorological monitoring program operated in support of Unit 1, are detailed, respectively, in Subsections 2.3.2.2.1 and 2.3.2.2.2 (*i.e.*, wind speed and wind direction, and wind direction persistence) and in Subsection 2.3.2.2.3 (*i.e.*, atmospheric stability).

Second, climatological normals, means, and extremes (including temperature, rainfall, snowfall, and fog), based on the long-term records from nearby observing stations, are addressed in Subsections 2.3.2.2.4 through 2.3.2.2.7 and evaluated to substantiate that those observations are representative of conditions that might be expected to occur at the Units 2 and 3 site.

Subsection 2.3.2.3 illustrates topographic features at and in the vicinity of the site, as well as in the broader site area. Within the context of the meteorological and climatological conditions considered to be representative of the Units 2 and 3 site, and taking into consideration the terrain setting around the site, Subsection 2.3.2.4 follows by addressing the potential influence on these normal, mean, and extreme conditions due to the construction, and the presence and operation of the plant and its related facilities.

Finally, Subsection 2.3.2.5 discusses current ambient air quality conditions in the site area and region that have a bearing on plant design and operations, indicates the types of nonradiological air pollutant emission sources at the facility, summarizes expected air quality impacts during facility construction and operation, and identifies related state regulations and permit documents.

None of the site parameters and values listed in DCD Tier 1, Table 5.0-1 or DCD Tier 2, Table 2-1 have counterparts under Subsection 2.3.2.

#### 2.3.2.1 Data Sources

The primary sources of data used to characterize local meteorological and climatological conditions representative of the Units 2 and 3 site include long-term summaries for the first-order NWS station at Columbia, South Carolina, and 13 other nearby cooperative network observing stations, and measurements from the onsite meteorological monitoring program operated in support of Unit 1. Table 2.3-201 identifies the offsite observing stations and provides the approximate distance and direction of each station relative to the Units 2 and 3 site; their locations are shown in Figure 2.3-201.

The NWS 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 Units 2 and 3. 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:

- *2004 Local Climatological Data, Annual Summary with Comparative Data for Columbia, South Carolina* (Reference 213)
- *Climatography of the United States, No. 20, 1971–2000, Monthly Station Climate Summaries* (Reference 214)
- *Climatography of the United States, No. 81, 1971–2000, U.S. Monthly Climate Normals* (Reference 208)
- Southeast Regional Climate Center (SERCC), *Historical Climate Summaries and Normals for South Carolina* (Reference 222)
- *Cooperative Summary of the* Day, *TD3200, Period of Record Through 2001, for the Eastern United States, Puerto Rico, and the Virgin Islands* (Reference 211)
- *U.S. Summary of Day Climate Data (DS 3200/3210), POR 2002-2005* (Reference 215).

Measurements from the tower-mounted meteorological monitoring system that currently supports the operation of Unit 1—specifically, wind direction, wind speed, and atmospheric stability—are the basis for determining and characterizing atmospheric dispersion conditions in the vicinity of the site. The data from this monitoring program, used to support Units 2 and 3, include measurements taken over a period of three consecutive annual cycles from July 1, 2003 through June 30, 2006.

Refer to Subsection 2.3.3.2 for a discussion of relevant details about this preoperational monitoring program, including:

- Tower location
- Terrain features and elevations at the existing Unit 1 tower and in the vicinity of Units 2 and 3
- Instrumentation and measurement levels
- Data recording and processing
- System operation, maintenance, and calibration activities.

#### 2.3.2.2 Normal, Mean, and Extreme Values of Meteorological Parameters

Wind and atmospheric stability characteristics, based on meteorological data obtained from the monitoring program operated in support of Unit 1, are described in Subsections 2.3.2.2.1 through 2.3.2.2.3. This site-specific data also provides input to dispersion modeling analyses of impacts, at onsite and offsite receptor locations, due to accidental and routine radiological releases to the atmosphere (see Subsections 2.3.4 and 2.3.5).

Subsection 2.3.2.2 also provides summaries of normals, and period-of-record means and/or extremes for several standard weather elements—that is, temperature, atmospheric water vapor, precipitation, and fog (see Subsections 2.3.2.2.4 through 2.3.2.2.7, respectively).

##### 2.3.2.2.1 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 macroscale and by large-scale topographic features (e.g., mountain ranges). These characteristics are addressed in Subsection 2.3.1.2.

Site-specific or microscale (*i.e.,* on the order of 2 kilometers or less) wind conditions, while they may reflect these larger scale circulation effects, are influenced primarily by local and, to a lesser extent (in general), by mesoscale or regional scale (*i.e.,* up to about 200 kilometers), topographic features. Wind measurements at these smaller scales are currently available from the meteorological monitoring program operated in support of Unit 1 and, for comparison, from data recorded at the nearby Columbia, South Carolina, NWS station.

Subsection 2.3.3.2 includes a description of the preoperational monitoring program that provides onsite meteorological data. Wind direction and wind speed measurements were made at two levels on a 61-meter instrumented tower (*i.e.,* the lower level at 10 meters and the upper level at 61 meters). A tower replacement and upgrade occurred during the last 9 months of the 3-year period over which these onsite measurements were made (see Subsection 2.3.3.2 for details).

Figures 2.3-202 through 2.3-206 present annual and seasonal wind rose plots (*i.e.*, 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 a period of three consecutive annual cycles from July 1, 2003 through June 30, 2006.

The wind direction distribution at the 10-meter level generally follows a southwest-northeast orientation annually (see Figures 2.3-202). The prevailing wind (*i.e.,* defined as the direction from which the wind blows most often) is from the southwest; with about 40% of the winds blowing from the south-southwest through west sectors. Conversely, winds from the north-northeast through east-southeast sectors occur about 20% of the time.

Seasonally, winds from the southwest quadrant predominate during the spring and summer months (see Figures 2.3-204 and 2.3-205). This is also the case during the winter, although westerly winds prevail and the relative frequency of west-northwest winds during this season is greater (see Figure 2.3-203) because of increased cold frontal passages. Winds from the northeast quadrant predominate during the autumn months (see Figure 2.3-206). Plots of individual monthly wind roses at the 10-meter measurement level are presented in Figure 2.3-207.

Wind rose plots based on measurements at the 61-meter level are shown in Figures 2.3-208 through 2.3-213. By comparison, wind direction distributions for the 61-meter level are fairly similar to the 10-meter level wind roses on composite annual and seasonal bases in terms of the predominant directional quadrants and variation over the course of the year. Prevailing winds differ between the two levels by one adjacent direction sector, generally veering (*i.e.,* turning clockwise) with height as might be expected. Plots of individual monthly wind roses at the 61-meter level are presented in Figure 2.3-213.

Wind information summarized in the local climatological data summary for the Columbia, South Carolina, NWS station (see Table 2.3-202) indicates a prevailing west-southwesterly wind direction annually, as well as seasonal variations (Reference 213), that appear to be similar to the 10-meter level wind flow at the VCSNS site. Differences between the two wind direction distributions are attributable to many factors (*e.g.,* topographic setting, sensor exposure, instrument threshold and accuracy, length of record).

Table 2.3-206 summarizes seasonal and annual mean wind speeds based on measurements from the upper and lower levels of the meteorological tower operated in support of Unit 1 over the 3-year period of record from July 1, 2003 through June 30, 2006, and from wind instrumentation at the Columbia, South Carolina, NWS station based on a 49-year period of record (Reference 213). The elevation of the wind instruments at the Columbia NWS station is nominally

20 feet (approximately 6.1 meters) (Reference 213), comparable to the lower (10-meter) level measurements at the VCSNS site.

Annually, mean wind speeds at the 10- and 61-meter levels are 3.2 and 4.6 meters per second, respectively, at the VCSNS site. The annual mean wind speed at Columbia (*i.e.,* 3.0 meters/second) is similar to the 10-meter level at the VCSNS site, differing by only 0.2 meters/second. Seasonal average wind speeds at Columbia are similar throughout the year except during the autumn, when speeds are about 0.8 meters/second lower than at the VCSNS site. Seasonal mean wind speeds for both locations follow the same pattern discussed in Subsection 2.3.1.6 in relation to the seasonal variation of relatively higher air stagnation and restrictive dispersion conditions in the site region.

There was only one occurrence of calm wind conditions recorded by the meteorological monitoring system for Unit 1 over the 3-year period from July 1, 2003 through June 30, 2006—that for the 61-meter level. Minimal incidence of calm conditions can be attributed to the very low measurement threshold of the sonic anemometers that were in place over this 3-year period of record (see Subsection 2.3.3.2.2).

#### 2.3.2.2.2 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 2.3-207 and 2.3-208 present wind direction persistence/wind speed distributions based on measurements from the Unit 1 monitoring program over a period of three consecutive annual cycles from July 1, 2003 through June 30, 2006. The distributions account for durations ranging from 1 to 48 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 (61-meter) tower levels, respectively, identified in the preceding subsection.

At the 10-meter level, the longest persistence period is 30 hours for winds from the northeast sector. This duration appears only in the lowest two wind speed groups (*i.e.,* for wind speeds greater than or equal to 5 and 10 mph). Persistence periods lasting for at least 18 hours are indicated for several direction sectors for wind speeds greater than or equal to 5 mph, including winds from the east-northeast, east, and south sectors; periods of 24 hours duration are also indicated from the west sector for this wind speed group. For wind speeds greater than or equal to 20 mph, maximum persistence is limited to 4 hours.

At the 61-meter level, the longest persistence period is 18 hours and occurs for winds from eight different direction sectors (see Table 2.3-208) for wind speeds greater than or equal to 5 mph, from six different sectors for wind speeds greater than or equal to 10 mph, and from two sectors (*i.e.,* east and west-southwest) for wind speeds greater than or equal to 15 mph. For wind speeds greater than or equal to 20 mph, maximum persistence periods are limited to 8 hours with the exception of 12-hour duration periods for winds from the west sector.

2.3.2.2.3 Atmospheric Stability

Atmospheric stability is a relative indicator for the potential diffusion of pollutants released into the ambient air. Atmospheric stability, as discussed in this FSAR, was based on the delta-temperature (Δ**T**) method defined in Table 1 of Regulatory Guide 1.23 (Reference 238).

The approach classifies stability based on the temperature change with height (*i.e.,* the difference in °C per 100 meters). Stability classifications are assigned according to the following criteria:

- Extremely Unstable (Class A): $\Delta T/DZ \leq -1.9°C$
- Moderately Unstable (Class B): $-1.9°C < \Delta T/DZ \leq -1.7°C$
- Slightly Unstable (Class C): $-1.7°C < \Delta T/DZ \leq -1.5°C$
- Neutral Stability (Class D): $-1.5°C < \Delta T/DZ \leq -0.5°C$
- Slightly Stable (Class E): $-0.5°C < \Delta T/DZ \leq +1.5°C$
- Moderately Stable (Class F): $+1.5°C < \Delta T/DZ \leq +4.0°C$
- Extremely Stable (Class G): $+4.0°C < \Delta T/DZ$

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

Over the period of three consecutive annual cycles from July 1, 2003 through June 30, 2006, Δ**T** was determined from the difference between temperature measurements made at the 61- 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 2.3-209.

The data indicate a predominance of neutral stability (Class D) and slightly stable (Class E) conditions throughout the year, ranging from about 56 to 62% of the time for these stability classes combined. Extremely unstable conditions (Class A) are more frequent during the summer and occur least often during the winter months owing, in large part, to greater and lesser solar insolation, respectively, and relatively lower (summertime) and, generally, relatively higher (wintertime) mean wind speeds. Extremely and moderately stable conditions (Classes G and F, respectively) are most frequent during the winter (about 21% of the time), owing in part to increased radiational cooling at night, and occur least often during the summer months.

Joint frequency distributions of wind speed and wind direction by atmospheric stability class and for all stability classes combined for the 10-meter and 61-meter wind measurement levels are presented in Table 2.3-210 and Table 2.3-211, respectively, based on the 3-year period of record from July 1, 2003 through June 30, 2006. The 10-meter level joint frequency distributions are used to evaluate short-term dispersion estimates for accidental atmospheric releases (see Subsection 2.3.4) and long-term diffusion estimates of routine releases to the atmosphere (see Subsection 2.3.5).

2.3.2.2.4 Temperature

Daily mean temperatures are based on the average of the daily mean maximum and minimum temperature values. Annual daily normal temperatures over the site area range from 59.9°F at the Camden 3W station (about 38 miles east of the Units 2 and 3 site) to 63.6°F at the Columbia, South Carolina, NWS station (about 26 miles to the south-southeast) (see Table 2.3-205). The lower normal temperatures at Camden 3W may be due to local topographic effects as the station elevation for this location (*i.e.,* 140 feet above MSL) is the lowest among all of the stations considered. Nevertheless, daily mean ambient temperatures are fairly similar over the site area.

Likewise, the diurnal (day-to-night) temperature ranges, as indicated by the differences between the daily mean maximum and minimum temperatures, are fairly comparable, ranging from 21.1°F at Little Mountain (about 8 miles to the southwest of the site) to 26.8°F at the Johnston 4SW station (about 46 miles to the southwest) (Reference 208). The breadth of this range may also be a reflection of the station elevation, with Little Mountain at 711 feet above MSL (the highest among all of the stations considered).

On a monthly basis, the local climatological data summary for Columbia, South Carolina, indicates that the daily normal temperature is highest during July (82.0°F) and reaches a minimum in January (44.6°F) (Reference 213).

Extreme maximum temperatures recorded in the vicinity of the site for Units 2 and 3 have ranged from 106°F to 111°F, with the highest reading observed at the Camden 3W cooperative station on June 28, 1954. The station record high temperature for the Columbia, South Carolina, NWS station (*i.e.,* 107°F) has been reached on five separate occasions—three times within a period of seven days in July 1952. As Table 2.3-203 and the accompanying notes show, individual station extreme maximum temperature records were set at multiple locations on the same or adjacent dates (*e.g.,* Winnsboro, Camden 3W, Kershaw 2SW, and Columbia on June 27 and 28, 1954; Columbia, Newberry, Chester 1NW, and Parr on August 21 and 22, 1983; Little Mountain and Columbia July 23 and 24, 1952; and Columbia and Santuck on July 29, 1952) (References 214 and 222).

Extreme minimum temperatures in the vicinity of the Units 2 and 3 site have ranged from –1°F to –5°F, with the lowest reading on record observed at the Chester 1NW cooperative station (about 30 miles to the north) on December 13, 1962. Station record low temperatures were also set at Parr and Winnsboro on December 12 and 13, 1962. More noteworthy, though, Table 2.3-203 and the accompanying notes indicate that record low temperatures were established at ten of the nearby cooperative observing stations on January 21 and 22, 1985. (References 214 and 222)

The extreme maximum and minimum temperature data indicate that synoptic scale conditions responsible for periods of record-setting excessive heat as well as significant cold air outbreaks tend to affect the overall VCSNS site area. The similarity of the respective extremes and their dates of occurrence suggest that these statistics are reasonably representative of the temperature extremes that might be expected to be observed at the Units 2 and 3 site.

2.3.2.2.5 Atmospheric Water Vapor

Based on a 21-year period of record, the local climatological data summary for the Columbia, South Carolina, NWS station (see Table 2.3-202) indicates that the mean annual wet bulb temperature is 57.0°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 73.5°F in July (only slightly less during August); the lowest monthly mean value (40.1°F) occurs during January (Reference 213).

The local climatological data summary shows a mean annual dew point temperature of 51.6°F, also reaching its seasonal maximum and minimum during the summer and winter, respectively. The highest monthly mean dew point temperature is 69.9°F in July; again, only slightly less during August. The lowest monthly mean dew point temperature (33.2°F) occurs during January (Reference 213).

The 30-year normal daily relative humidity averages 70% annually, typically reaching its diurnal maximum in the early morning hours (around 0700 local standard time) and its diurnal minimum during the early afternoon hours (around 1300 local standard time). There is less variability in this daily pattern with the passage of weather systems, persistent cloud cover, and precipitation. Nevertheless, this diurnal pattern is evident throughout the year. The local climatological data summary indicates that average early morning relative humidity levels are greater than or equal to 90% during the months of August, September, and October (Reference 213).

2.3.2.2.6 Precipitation

With the exception of the Pelion 4NW station, normal annual rainfall totals for the 13 other nearby observing stations listed in Table 2.3-205 differ by approximately 5.7 inches (or about 12%), ranging from 43.59 inches at the Blair 1NE observing station (about 10 miles to the north-northwest of the Units 2 and 3 site) to 49.33

inches at the Newberry station (about 18 miles to the west) (Reference 208). The normal rainfall total for Blair 1NE is based on the current station location; other precipitation extremes and normal annual snowfall totals are based on summaries available for the previous station location referred to only as Blair. The current 30-year average for the Pelion 4NW station (about 39 miles to the south) is somewhat higher, at 51.03 inches (Reference 208).

The local climatological data summary of normal rainfall totals for Columbia, South Carolina, indicates two seasonal maximums—the highest (15.94 inches) during the summer (June through August) and the second (13.09 inches) during the winter into early spring (January through March). Together, these periods account for almost 60% of the annual total for the Columbia, South Carolina, NWS station, although rainfall is greater than 2.8 inches during every month of the year. The overall maximum monthly total rainfall occurs during July (5.54 inches) (Reference 213).

Subsection 2.3.1.3.4 discussed historical precipitation extremes (*i.e.,* rainfall and snowfall), as presented in Table 2.3-203 for the 14 nearby climatological observing stations listed in Table 2.3-201. Based on the maximum 24-hour and monthly precipitation totals recorded among these stations and, more importantly, the areal distribution of these stations around the site, the data suggests that these statistics are reasonably representative of the extremes of rainfall and snowfall that might be expected to be observed at the Units 2 and 3 site.

2.3.2.2.7 Fog

The closest station to the Units 2 and 3 site at which observations of fog are made and routinely recorded is the Columbia, South Carolina, NWS station about 26 miles to the south-southeast. The 2004 local climatological data summary for this station (Table 2.3-202) indicates an average of about 26 days per year of heavy fog conditions, based on a 56-year period of record. The NWS defines heavy fog as fog that reduces visibility to 1/4 mile or less (Reference 213).

Seasonally, heavy fog conditions occur most often during the autumn and winter months, reaching a peak frequency in November and December, averaging about 3 days per month. Heavy fog conditions occur least often from mid-spring to early summer (*i.e.,* April to June), averaging less than 1.5 days per month (Reference 213).

The frequency of heavy fog conditions at the Units 2 and 3 site would be expected to be somewhat greater than at Columbia, South Carolina because of the site's nearness to the Monticello and Parr Reservoirs, its location near the Broad River, and gradually increasing elevations towards the northwest. This is consistent with the higher frequency of occurrence reported in *The Climate Atlas of the United States,* which indicates an annual average frequency of 31 to 35 days per year in the area that includes the VCSNS site and a lower annual frequency of 26 to 30 days in the area that includes Columbia, South Carolina. The seasonal variation is similar to that in the 2004 local climatological data summary for the Columbia NWS station, although peak months are December and January (Reference 210).

Enhancement of naturally occurring fog conditions due to operation of the mechanical draft cooling towers associated with Units 2 and 3 is addressed in ER Subsection 5.3.3.1.

#### 2.3.2.3 Topographic Description

The Units 2 and 3 site lies within the larger VCSNS site property that encompasses about 2,560 acres. The area for Units 2 and 3 covers about 870 acres, within which the PBA circle takes up about 32 acres.

The Units 2 and 3 site is about 1 mile inland (to the south) of the southern shore of the Monticello Reservoir, and, at its closest approach, approximately 0.75 mile east of the Parr Reservoir along the Broad River. Unit 2 is located approximately 4,600 feet to the south-southwest of Unit 1; Unit 3 is situated about 900 feet south-southwest of Unit 2 (see Figure 1.1-202).

Terrain features within 50 miles of the Units 2 and 3 site, based on digital map elevations, are illustrated in Figure 2.3-214. Terrain elevation profiles along each of the 16 standard 22.5-degree compass radials out to a distance of 50 miles from the site are shown in Figure 2.3-215. Because Units 2 and 3 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 Units 2 and 3 shield buildings.

The nominal plant grade elevation for Units 2 and 3 is approximately 400 feet above MSL (NAVD88). Located within the Piedmont, terrain within 50 miles of the Units 2 and 3 site is gently rolling hills to hilly with elevations decreasing to the east through the southeast beyond approximately 15 to 20 miles. Figure 2.3-214 indicates that the lowest elevation within 50 miles of the site, 80 feet above MSL (NAVD88), is to the southeast near the confluence of the Congaree and Wateree Rivers above Lake Marion (see Figure 2.4-209).

Relief of up to approximately 300 feet is found along headings to the south-southwest through the west starting at distances of about 20 to 25 miles from the Units 2 and 3 site. Terrain elevations tend to increase to the west-northwest through to the north-northeast beyond about 20 miles from the site with relief of up to about 400 feet relative to nominal plant grade. Figure 2.3-214 indicates that the highest elevation within 50 miles of the site is 920 feet above MSL (NAVD88). This spot elevation does not fall along one of the 16 standard direction radials presented in Figure 2.3-215.

More detailed topographic features within 5 miles of the Units 2 and 3 site, based on digital map elevations, are shown in Figure 2.3-216. Terrain within this radial distance of the site primarily consists of gentle, low-rolling hills with relief, relative to nominal plant grade, up to about 150 feet higher (towards the south-southwest), and to approximately 200 feet lower in a number of direction headings, primarily due to the Broad River which traverses this area from the north-northwest to the south-southeast (see Figure 2.3-216) and to the Little River (see Figure 2.4-209) along the eastern perimeter of this radial area. The closest topographic feature of note is the 6,800-acre Monticello Reservoir located approximately one mile to the north of the site.

#### 2.3.2.4 Potential Influence of the Plant and Related Facilities on Meteorology

While there will be site clearing, grubbing, excavation, leveling, and landscaping activities associated with the construction of the units (see ER Section 3.9), these alterations to the existing site terrain would be localized and would 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 would be affected as a result of plant construction.

The dimensions and operating characteristics of the facilities associated with Units 2 and 3 (as well as Unit 1), including paved, concrete, or other improved surfaces, are considered to be insufficient to generate discernible, long-term effects to local or microscale meteorological conditions, or to the mean and extreme climatological characteristics of the site area discussed previously under Subsection 2.3.2.2 and in Subsection 2.3.1.3.4.

Wind flow will be altered in areas immediately adjacent to and downwind of larger site structures. However, these effects will likely dissipate within ten structure heights downwind of the intervening structure(s). 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 mean or extreme ambient temperature patterns.

Units 2 and 3 use mechanical draft cooling towers as a means of heat dissipation during normal operation (see Subsection 1.2.2). Potential meteorological effects due to the operation of these cooling towers could 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 in detail in ER Subsections 5.3.3.1 and 5.3.3.2.

Subsections 2.3.3.3.1, 2.3.3.3.2, and 2.3.3.3.3 provide additional details regarding the considerations made in siting and equipping the recently installed meteorological tower in support of Units 2 and 3 in relation to the construction of, and/or major structures associated with, those units.

#### 2.3.2.5 Current and Projected Site Air Quality

This subsection addresses current ambient air quality conditions in the VCSNS site area and region (*e.g.,* the compliance status of various air pollutants) that have a bearing on plant design, construction, and operating basis considerations (Subsection 2.3.2.5.1). It also cross-references subsections of the ER that address the types and characteristics of nonradiological emission sources associated with plant construction and operation and the expected impacts associated with those activities (Subsection 2.3.2.5.2). Previously, Subsection 2.3.1.6 characterized conditions (from a climatological standpoint) in the site area and region that may be restrictive to atmospheric dispersion.

#### 2.3.2.5.1 Regional Air Quality Conditions

The Units 2 and 3 site is located within the Columbia Intrastate Air Quality Control Region and includes Fairfield, Lexington, Newberry, and Richland Counties (40 CFR 81.108). 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 EPA-promulgated National Ambient Air Quality Standards. Criteria pollutants are those for which the National Ambient Air Quality Standards have been established: sulfur dioxide, particulate matter (*i.e.,* PM10 and PM2.5—particles with nominal aerodynamic diameters less than or equal to 10.0 and 2.5 microns, respectively), carbon monoxide, nitrogen dioxide, ozone, and lead (40 CFR Part 50).

Fairfield and Newberry Counties are designated as being in attainment for all criteria air pollutants (40 CFR 81.341). Similarly, Lexington and Richland Counties, to the south and southeast of the site, are in attainment for all criteria pollutants with the exception of the 8-hour National Ambient Air Quality Standards for ozone (40 CFR 81.341). The 8-hour ozone non-attainment area comprises the Columbia, South Carolina Metropolitan Planning Organization, whose boundaries basically include the northeastern half of Lexington County, most of Richland County, and a small portion of southwestern Kershaw County (Reference 205). The northern extent of this Metropolitan Planning Organization in Richland County is about 3 miles to the south of the VCSNS site; the Lexington County portion is about 6 miles away from the site.

There are no pristine areas designated as “Mandatory Class I Federal Areas Where Visibility is an Important Value” that are located within 100 miles of the site. The two closest Class I areas are both about 120 miles away—the Shining Rock Wilderness Area to the northwest and the Linville Gorge Wilderness Area to the north-northwest in North Carolina (40 CFR 81.422).

#### 2.3.2.5.2 Projected Air Quality Conditions

The Units 2 and 3 nuclear steam supply systems and other related radiological systems are not sources of criteria pollutants or other air toxics. Supporting equipment (*e.g.,* diesel generators, auxiliary boilers, fire pump engines), and other nonradiological emission-generating sources (*e.g.,* storage tanks and related equipment) or activities are not expected to be a significant source of criteria pollutant emissions.

Emergency equipment will only be operated on an intermittent test or emergency-use basis. Therefore, these emission sources are not expected to significantly impact ambient air quality levels in the vicinity of the VCSNS site, nor are they anticipated to be a significant factor in the design and operating bases of Units 2 and 3. Likewise, because of the relatively long distance of separation from the VCSNS site, visibility at any of these Class I federal areas are not expected to be significantly impacted by project construction and facility operations.

Nevertheless, these nonradiological emission sources will likely be regulated by the South Carolina Department of Health and Environmental Control (SCDHEC) under Regulation 61-62 (Air Pollution Control Regulations and Standards), and permitted under the state's Title V Operating Permit Program implemented by the SCDHEC pursuant to 40 CFR Part 70, as a revision to the then current Title V Operating Permit for the existing VCSNS site. Current federal and SCDHEC air quality-related regulations and permits, expected to be applicable to Units 2 and 3, are identified in ER Section 1.2.

Emission-generating sources and activities related to construction of Units 2 and 3, potential impacts, and mitigation measures are addressed in ER Subsection 4.4.1.3. Nonradiological emission-generating sources associated with routine facility operations are discussed further in ER Subsection 3.6.3.1. Characteristics of these emission sources and the potential effects on air quality and visibility associated with their operation are addressed under ER Subsections 5.8.1 and 5.3.3, respectively.

## 2.3.3 ONSITE METEOROLOGICAL MEASUREMENTS PROGRAM

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DCD The onsite meteorological measurement program is site specific and will be defined by the Combined License applicant. The number and location of meteorological instrument towers are determined by actual site parameters.

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Insert the following subsections following DCD Subsection 2.3.3.

VCS COL 2.3-3 This subsection addresses COL Item 2.3-3, *Onsite Meteorological Measurements Program,* as indicated above. Specifically, the subsection provides a discussion of the preoperational and operational meteorological monitoring programs for Units 2 and 3, including a description and site map showing tower locations with respect to man-made 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 239).

Because of the proximity of Unit 1, data collected by the Unit 1 meteorological towers have been used to establish a baseline for identifying and assessing safety and environmental impacts resulting from operation of Units 2 and 3.

The existing meteorological towers are shown on Figure 1.1-202. The Unit 1 Meteorological Program has been conducted over a span of time that included the use of two meteorological towers. The first tower was retired in October 2005 and later dismantled. The second meteorological tower was erected before October 2005 and has been the tower of record since October 2005. Therefore, the data from Unit 1 Meteorological Program used to support the preoperational data needs for Units 2 and 3 was obtained from two different meterorological towers. To confirm the representativeness of the data used for developing the Units 2 and 3 X/Q estimates, a meterorological tower was constructed nearer to Units 2 and 3.

The Units 2 and 3 meteorological monitoring program consists of two phases:

1. Preoperational Monitoring — Includes data from the Unit 1 meteorological monitoring program and confirming data from the Units 2 and 3 monitoring program.

2. Operational Monitoring — The new meteorological monitoring program for Units 2 and 3 will continue to be used during operation of Units 2 and 3.

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.
- Compare with offsite sources to determine the appropriateness of climatological data used for design considerations.
- Evaluate environmental risk from the radiological consequences of a spectrum of postulated accidents.
- Provide an adequate meteorological database for evaluation of the effects from plant construction and operation, including radiological and nonradiological impacts and real-time predictions of atmospheric effluent transport and diffusion.
- Develop emergency response plans, including provision for real-time meteorological data and plume trajectory dispersion modeling capabilities for dose and exposure predictions.

#### 2.3.3.1 Site Description, Topographic Features of the Site Area, and Location of Towers

The location at which meteorological measurements are necessary depends largely on the complexity of the terrain in the vicinity of the site. This subsection describes the topographic features of the VCSNS site area relevant to the siting of the meteorological towers onsite.

The VCSNS site is located near the center of the state, approximately 140 miles northwest of the Atlantic Ocean and 100 miles southeast of the Appalachian Mountains. Columbia, South Carolina is 26 miles south-southeast of the site. The terrain in the general area consists of gently to moderately rolling hills. Subsection 2.3.2.3 discusses topographic characteristics within a 50-mile radius of the Units 2 and 3 site. A topographic map of the site area within 50 miles of the site is shown in Figure 2.3-214.

Units 2 and 3 are located approximately one mile south of Unit 1. The site is bordered by the southerly running Broad River approximately one mile to the west and the Monticello Reservoir approximately one mile to the north. The north-south oriented Monticello Reservoir is approximately six miles long and 2.5 miles across. The design grade of Units 2 and 3 is at elevation 400 feet (NAVD88). As shown in Figure 2.3-215, the terrain within five miles of Units 2 and 3 is gentle rolling with maximum variations about 70 feet higher, except toward the south-southwest of the site at the edge of the 5-mile radius. The terrain at this location gradually rises to 160 feet higher than the site, marking the beginning of Little Mountain. Additional information describing these terrain variations by downwind sector is included in Subsection 2.3.2.3 and Figure 2.3-216.

The original Unit 1 onsite meteorological tower, which was retired in October 2005, was located at the southern end of the Monticello Reservoir and approximately 1 mile north of Units 2 and 3. The tower served Unit 1 for more than 20 years. The replacement Unit 1 (current) tower, which is located 60 feet west of the original (retired) tower and approximately 188 feet off of the Monticello Reservoir, is identical to the original tower in height, parameters measured, and levels of measurements for wind speed, wind direction, and ambient temperature (for stability class determination). The siting study for both towers and the representativeness of the data collected at these towers for characterization of dispersion meteorology in the site area are documented in the Unit 1 FSAR.

#### 2.3.3.2 Preoperational Monitoring Program

Regulatory Guide 1.206, Subsection C III.1.2.3.3 suggests that the applicant should provide meteorological data for at least two consecutive annual cycles (and preferably data for three or more entire years), including the most recent one-year period, at the time of application submittal.

For Units 2 and 3, the three most recent consecutive annual cycles of data are from July 2003 through June 2006, which was collected at the Unit 1 meteorological towers. This data was used to characterize the dispersion conditions of Units 2 and 3 and the vicinity. Among these three years, most of the data (*i.e.,* July 2003–October 2005) was from the retired Unit 1 tower, while the remainder (*i.e.,* October 2005–June 2006) is from the current Unit 1 tower.

##### 2.3.3.2.1 Confirmation of the Unit 1 Meteorological Tower Locations

This subsection confirms that the measurements made on the Unit 1 towers represent the overall site meteorology of Units 2 and 3.

Factors considered in determining the appropriate measurement locations include the surrounding topography, prevailing wind direction, and location of man-made and vegetation obstructions. Findings of the confirmation are summarized in Table 2.3-212.

###### 2.3.3.2.1.1 Topographic Effects

As described in Subsection 2.3.3.1, the terrain within five miles of Units 2 and 3 is gently rolling hills with maximum variations approximately 70 feet above the site, except toward the south-southwest of the site at the edge of a five-mile radius. Therefore, there are no nearby terrains that could affect the wind measurements on the tower.

The retired Unit 1 meteorological tower (UTM coordinates: Northing/Y: 12452226.245, and Easting/X: 1543884.127) was a 61-meter high, self-supporting, open lattice tower with the tower base elevation at 437 feet (NGVD29). The current Unit 1 tower (UTM coordinates: Northing/Y: 12452224.582, and Easting/X: 1543822.780) is 60 feet west of the retired tower with essentially the same tower base elevation (436 feet, NGVD29) as the retired tower.

The tower base for both the current and the retired Unit 1 meteorological towers is slightly higher than the design plant grade of 400 feet (NAVD88) for Units 2 and 3. Since the terrain between the towers and Units 2 and 3 is gently rolling hills with small elevation differences of approximately 37 feet, wind measurements made at the Unit 1 towers are considered to be representative of the Units 2 and 3 site area approximately 1 mile south of the meteorological towers.

#### 2.3.3.2.1.2 Potential Influence from Heat and Moisture Sources

Based on the 3-year (*i.e.,* July 2003–June 2006) onsite data, prevailing wind (*i.e.,* 11.2%) at the site is from the southwest. As shown in Figure 1.1-202, the Unit 1 meteorological tower sits upwind of the Monticello Reservoir under the prevailing wind direction. Other than for turbine building closed-cycle cooling, Unit 1 does not use cooling towers. The small cooling tower used for the turbine building closed-cycle cooling is located east of the Unit 1 meteorological towers at a distance of more than 1,000 feet as shown on Figure 1.1-202. The probability of the cooling tower plume intercepting the dew point and temperature sensors on the Unit 1 meteorological towers is minimized by the location of the turbine building cooling tower not being directly downwind under the prevailing wind direction of the site (*i.e.,* southwest). In addition, the expected cooling tower plume height would be more than 200 feet above ground at 1,000 feet downwind due to the plume buoyancy. Therefore, the effect on ambient temperature and atmospheric moisture measurements at the Unit 1 towers (retired and current) due to the small-scale turbine building cooling tower operation would be minimal at this large distance separation.

The closest parking lot, for the new Nuclear Learning Center, is approximately 650 feet south of the Unit 1 tower. There are no large asphalt parking lots, plowed fields, or spoils storage areas nearby that could affect the temperature and dew point measurements made on the Unit 1 tower.

The terrain immediately surrounding the Unit 1 tower is relatively flat and covered by a mixture of gravel, dirt, and grass. This type of ground cover is not expected to unnaturally affect the wind or temperature measurements made on the towers.

Since Unit 1 is bordered by the Monticello Reservoir immediately to its north, the data collected at its meteorological towers, including both the retired and current tower, was examined to confirm that it is representative of the area surrounding Units 2 and 3 when the tower is under the influence of the Monticello Reservoir. A study was conducted to determine the extent of the reservoir effect and the potential impact of the lake warming and cooling on the local dispersion characteristics. The study concluded that the X/Qs could be under-predicted for approximately 0.5% in a year, and the reservoir effect is considered minimal. Additional information on the study is provided in Subsection 2.3.3.4.1 (Reference 223).

2.3.3.2.1.3 Potential Airflow Modifications

Potential airflow modifications due to existing and planned plant structures and nearby trees were evaluated and the findings are reported in Subsection 2.3.3.2.3. The results of the evaluation indicate that these man-made and natural obstructions have minimal effect on the wind and temperature measurements made on the towers.

In summary, it is concluded that the measurements made on the Unit 1 towers are reasonably representative of the overall site meteorology.

Recent NRC site inspections provided the following feedback:

- In 2000, the NRC evaluated the meteorological tower siting of the retired Unit 1 tower and determined that it conformed to the requirements that existed at that time (Reference 234).
- In early 2006, the NRC assessed the current Unit 1 meteorological monitoring tower siting based on near-field obstruction, ground cover, proximity to Unit 1, and distance from terrain that could affect the representativeness of the measurements and determined that it is acceptable (Reference 235).

2.3.3.2.2 Measurements Made and Instrument Elevations

In general, the location and heights of meteorological measurements depend greatly on the data applications. For making atmospheric dispersion estimates for both postulated accidental and expected routine airborne releases of effluents, wind speed, wind direction, and atmospheric stability class at the area of interest, the nature of the release, the effluent atmospheric release height, and the surrounding building configuration are important.

System block diagrams are provided in Figures 2.3-217 and 2.3-218 for both the Unit 1 towers.

The basic meteorological parameters measured at both of the Unit 1 towers (retired and current) include:

- Wind speed at two levels (*i.e.,* 10 and 61 meters)
- Wind direction at two levels (*i.e.,* 10 and 61 meters)
- Ambient temperature at three levels (*i.e.,* 10, 40, and 61 meters)
- Vertical temperature difference between 61 and 10 meters and 40 and 10 meters (calculated based on the temperature measurements for stability class determination).

The most probable atmospheric releases of Units 2 and 3 are through the plant vent, 182.7 feet (55.7 meters) above ground. Other potential accident release points include releases from the passive containment cooling system air diffuser (69.8 meters or 229 feet above ground) and other atmospheric release points (see Subsection 2.3.4.2.1.2). Since the plant vent and all other potential release points are among the building complex, none can be treated solely as an elevated release due to building wake effects. Based on the location and nature of these release points and the configuration of the nearby buildings, wind speed, wind direction, and temperature measurements made at the Unit 1 towers provide a reasonable and adequate data base for making atmospheric dispersion analysis.

Dew point temperature was measured on a separate 10-meter climbable pole approximately 20 feet west of the retired Unit 1 tower. Relative humidity and temperature are measured at approximately the 1- to 2-meter level on the current Unit 1 tower. Additional relative humidity and temperature sensors at three levels (*i.e.,* 10, 30, and 60 meters) were installed on the new tower (Figure 2.3-219). These measurement heights represent a range of possible heights of the moisture from vapor release from the Units 2 and 3 mechanical draft cooling towers.

Precipitation is measured on an individual 5-foot pedestal located approximately 8 feet from the southwest leg of the Unit 1 tower.

2.3.3.2.3 Exposure of Instruments

The local exposure of the wind and temperature sensors was reviewed to ensure that the measurements are representative of the general site area. Regulatory conformance of instrument siting on the Unit 1 tower is summarized in Table 2.3-213.

2.3.3.2.3.1 Obstructions

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. Because the tower structure can affect downwind measurements, wind sensors on the side of a tower should be mounted at a distance equal to at least twice the longest horizontal dimension of the tower.

An assessment regarding whether the wind measurements made at locations and heights on the towers would avoid airflow modifications by obstructions was made and the findings are described below:

- The terrain within 5 miles of Units 2 and 3 is gently rolling hills with relatively small terrain variations as discussed previously in Subsection 2.3.3.2.1. Therefore, it is concluded that there are no nearby terrains that could affect the wind measurements on the towers at the VCSNS site.

- Nearby trees ranging from 50 to 60 feet tall are mainly to the west of the tower. This north-to-south running treeline begins approximately 320 feet southwest of the retired Unit 1 tower and extends southwesterly for a distance more than 1 mile where it meets the Broad River at an elevation of 320 feet. The trees close to the Unit 1 tower are to be trimmed every two years to minimize their potential influence on the wind measurements made on the current Unit 1 meteorological tower.

- The Unit 1 reactor building, the tallest nearby obstruction (*i.e.,* 165 feet high) is 1,563 feet east of the current Unit 1 tower. The separation distance between the Unit 1 reactor building and both of the Unit 1 towers is more than nine times the reactor building height. At this large separation distance, influence of the building on the tower measurements was determined to be minimal (Reference 234).

  Since Units 2 and 3 are approximately 1 mile south of the Unit 1 towers, no influence on wind measurements would be expected.

- An 8-foot x 120-foot equipment shelter was approximately 120 feet from the center of the retired Unit 1 tower. This shelter had a nominal height of 10 feet, which was less than half of the lower sensor height (*i.e.,* 10 meters or 33 feet) at the tower. Based on the distance from the tower and the height of the shelter, no airflow modifications by the shelter would be expected.

  There is no equipment shelter used for the current Unit 1 tower. Instead, an equipment cabinet rack is mounted at the base of the Unit 1 tower on an open-sided structure located on a concrete pad. Therefore, no airflow modifications from this small cabinet rack would be expected.

- Wind sensors were mounted on 10- and 8-foot booms for the retired and current Unit 1 towers, respectively. Since both of the tower structures were identical and the width of the tower base is approximately 19 feet, it is impractical to use a 50-foot instrument boom. Since the framework of the tower structure is open lattice with crossed bars widely spaced and the bracing is approximately 3-inch x 3-inch angle, the tower structure influence on the wind measurements on the booms is minimal.

  The wind sensors were mounted perpendicular to the southwest and northeast prevailing winds to minimize tower structure influence.

2.3.3.2.3.2 Heat and Moisture Sources

Based on the structure location as shown in Figure 1.1-202, the ambient temperature, dew point, and relative humidity measurements on the existing towers were assessed to determine whether they would avoid air modification by any heat and moisture sources (*e.g.,* ventilation sources, cooling towers, water bodies, large parking lots) and the findings are described below:

- All towers are located on open fields containing a mixture of grass, soil, and gravel underlying the meteorological tower. In addition, the current

Unit 1 tower has a small 14-foot x 7-foot concrete pad for instrumentation adjacent to the tower base.

- The closest asphalt parking lots and ventilation sources are located immediately south of the new Nuclear Learning Center, which is more than 650 feet from the Unit 1 towers.

- There are no large parking lots or temporary land disturbances such as plowed fields or storage areas nearby.

Heat reflection characteristics of the surface underlying the Unit 1 meteorological towers that could have localized influence on the measurements are estimated to be minimal as also concluded in the assessment of the 2006 NRC VCSNS site visit (Reference 235).

With the large distance separation between the meteorological towers and these potential heat and moisture sources, influence on the ambient temperature, dew point, and relative humidity measurements is expected to be minimal.

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

Because of the existence of the Monticello Reservoir and its proximity to the Unit 1 towers, a study was conducted to determine the extent of the reservoir effect on local dispersion characteristics that could affect dose calculations. The study concluded that the X/Qs could be under-predicted for approximately 0.5% of the time in a year and, therefore, the reservoir effect is considered minimal. Additional study information is provided in Subsection 2.3.3.4.1.

Dew point measurements made on the Unit 1 towers, while reflecting the existing condition at the site, could overstate the ambient moisture content in the area surrounding Units 2 and 3. However, dew point data from Columbia NWS, South Carolina, was used for the preoperational data (see Subsection 2.3.3.4.1). For the operational program, dew point measurements are made on the tower for Units 2 and 3.

###### 2.3.3.2.3.3 Wind-Induced Water Loss

The precipitation gauge was equipped with an aerodynamically shaped wind shield to minimize loss of precipitation caused by wind.

##### 2.3.3.2.4 Description of Instruments Used, Sensor Performance Specifications, and Operating Experience

The sensor type, manufacturer model, and sensor specifications are provided in Tables 2.3-214, 2.3-215, and 2.3-216 for the retired Unit 1, current Unit 1, and the Units 2 and 3 tower, respectively.

On the retired Unit 1 tower, wind speed and wind direction were measured using Handar Model 425 ultrasonic wind sensors. Ambient temperature was measured by Rosemount RTD T-200 probes. A precipitation gauge (Weather Measure Corporation Model P511E) was located at ground level near the base of the tower. A dew point sensor (General Eastern M1) was located 20 feet west of the tower on a separate 10-meter pole.

On the current Unit 1 tower, wind speed and wind direction are measured using Vaisala WS425 ultrasonic wind sensors. Ambient temperature measurements are made by Vaisala QMT102 RTDs (Pt-100 type). At the base of the tower, a barometric pressure device (Vaisala PMT16A) and a Vaisala QMR102 (rain gauge) precipitation sensor are located. Dew point temperature is calculated based on measurements made by a Vaisala QMH102 relative humidity/ temperature sensor.

Meteorological sensors used onsite were designed to operate in the environmental conditions found at the VCSNS site. Specifically, this instrumentation is capable of withstanding the following environmental conditions as provided in the specification of the meteorological monitoring system (Tables 2.3-214 and 2.3-215):

- Ambient temperature range of –40°F to +140°F
- Wind load up to 144 mph
- Relative humidity range of 0% to 100%

Ultrasonic wind sensors, which have no moving parts, have been used to measure wind speed and wind direction since 1999. Operational experience indicates that this type of sensor is durable and requires much less calibration and maintenance service. A platinum resistance temperature device is used for temperature measurements.

No effects from corrosion, blowing sand, salt, air pollutants, birds, or insects on the sensors used onsite have been detected that affect operability.

2.3.3.2.5 Recording of Meteorological Sensor Output

The methods of recording and the recording equipment used are described in this subsection. The location of the recording equipment is shown in Figures 2.3-217, 2.3-218, and 2.3-219.

2.3.3.2.5.1 Retired Unit 1 Meteorological Tower

Sensor outputs from the instruments on the tower were processed in a nearby air-conditioned equipment enclosure. All sensor outputs were sampled on 10-second intervals.

The major hardware of the recording system consisted of an analog/digital transmission system and necessary signal conversion and conditioning, which interconnected to the Unit 1 plant computer system. The analog/digital transmission system was interfaced to the parameters monitored at the meteorological tower. The system was microprocessor based and used standard ASCII representation for data transmission.

The equipment enclosure also housed Westronics chart recorders for dew point and temperature data. In addition, indication was provided for temperature, wind speed, and wind direction inside the enclosure. From the enclosure, wind speed, wind direction, and temperature data was recorded on the main control board in the Unit 1 control room, where indication and Westronics SmartView digital recorders were provided. Digital values were transmitted to and recorded by the Unit 1 integrated plant computer system (IPCS) located in the auxiliary service building computer room, along with the dew point and precipitation data. The recorded data provided a backup source to the data on the IPCS.

Surge protection circuitry was installed to protect against lightning strikes and power surges for both instrumentation and data communications equipment.

2.3.3.2.5.2 Current Unit 1 Meteorological Tower

Sensor outputs from the instruments on the current tower are processed by a remote computer (Vaisala QML102 data logger) that is mounted on a cabinet rack at the base of the tower. Data is stored locally on internal memory and a compact flash card, which provides a source of backup meteorological data (Reference 220). Data is transmitted from the QML102 data logger to the Unit 1 IPCS via a fiber-optic line.

All sensor outputs are sampled from the current Unit 1 meteorological tower instrumentation by the remote processing computer on the following frequencies:

- Wind speed/wind direction (1 second)
- Ambient temperature (10 seconds)
- Relative humidity/temperature (10 seconds)
- Values for temperature difference and dew point are calculated by the remote processing computer.

The March 2007 revision to Regulatory Guide 1.23 indicates that digital sampling of data should be at least once every five seconds. However, NRC assessed the Unit 1 meteorological monitoring system reliability and data recovery during the first quarter of 2006 and determined that it was acceptable (Reference 235).

Data is recorded by the remote processing computer on the following frequencies:

- Wind speed/wind direction (10-second average value)

- Dew point (60-second average value)
- Relative humidity (60-second average value)
- Ambient temperature (60-second average value)
- Differential temperature (60-second average value).

Similar to the retired Unit 1 meteorological monitoring system, data is stored locally at the remote processing computer, which provides a source of backup meteorological data. Data collected at the current Unit 1 meteorological tower is transmitted from the remote processing computer to the Unit 1 IPCS via fiber-optic line driver modems.

2.3.3.2.5.3 Units 2 and 3 Meteorological Tower

All sensor output is sampled from the Units 2 and 3 meteorological tower instrumentation by the tower base processing computer on the following frequencies:

- Wind speed/wind direction (1 second)
- Ambient temperature (5 seconds)
- Relative humidity/temperature (5 seconds)
- Values for temperature difference and dew point are calculated by the processing computer.

Data is recorded by the processing computer on the following frequencies:

- Wind speed/wind direction (10-second average value)
- Dew point (60-second average value)
- Relative humidity (60-second average value)
- Ambient temperature (60-second average value)
- Differential temperature (60-second average value).

2.3.3.2.6 Instrumentation Surveillance (Current and Retired Unit 1 Towers)

Calibration and maintenance activities of the onsite meteorological monitoring system are performed in accordance with Regulatory Guide 1.23, Section C 5, *Regulatory Position, Instrument Maintenance and Servicing Schedules* and ANSI/ ANS 3.11, Section 7, *System Performance* (Reference 204). The instrumentation used to calibrate the meteorological system (where applicable) has been maintained traceable to the National Institute of Standards and Technology.

Meteorological instrumentation is calibrated semiannually. To ensure data quality and accuracy, the meteorological instruments and recorders are calibrated in accordance with approved procedures. Inspection of meteorological tower hardware is performed during the semiannual calibration, while the tower structure is inspected annually to ensure structure safety.

As an integral part of the onsite meteorological monitoring system calibration and maintenance program, the following operational procedures are enforced:

- Meteorological Monitoring Site Checks —- To identify any abnormal functions and check site conditions (at least two a week)
- Data Review — To identify equipment failures (several times a week)
- Biweekly Data Verification — To identify the need for maintenance and calibration checks.

During the meteorological monitoring site checks, tower instrumentation is visually checked and proper positioning of the instrument boom is verified. Support systems are also checked to ensure their continued operation (*i.e.,* phone, lighting, etc.). Maintenance activity includes cleaning the rain gauge.

During the data review, meteorological data for the previous 24 hours (or period of interest) are checked for any suspect data. If suspect data is identified, it is noted in the daily check log and investigated. If an equipment failure is suspected, a condition report is generated and supervisory personnel are notified. The cause of failure will be investigated and corrected, if required.

Data checks are made every two weeks during the biweekly data verification or any time a channel is suspected to be malfunctioning.

These online monitoring verification programs, periodic calibrations, biweekly data verifications, and daily checks ensure that the measurements of the meteorological variables are valid. Further verification that the procedures for the maintenance, data collection, and data reduction are in accordance with the recommendations of Regulatory Guide 1.23 is demonstrated by the greater-than-90% data recovery for all primary variables (*e.g.,* wind speed, wind direction, and delta temperature).

#### 2.3.3.2.7 Data Reduction and Compilation

Data analysis for both wind distribution and dispersion characteristics of the site requires three basic atmospheric variables—wind speed, wind direction, and stability class.

2.3.3.2.7.1 Available Backup Data

Before October 2005, the three variables together with the primary and secondary (backup) measurements for each variable were:

| | |
|---|---|
| Horizontal wind speed: | primary measurement - 10-meter wind speed<br>secondary measurement - 61-meter wind speed |
| Horizontal wind direction: | primary measurement - 10-meter wind direction<br>secondary measurement - 61-meter wind direction |
| Temperature difference (for stability class determination): | primary measurement - (61 – 10 meters)<br>secondary measurement - (40 – 10 meters) |

The secondary measurements were needed only during periods of calibration and maintenance of the primary system. It should be noted that the wind measurement (wind speed and direction) was replaced with secondary sensor data when either the primary wind speed or primary wind direction was declared invalid.

The current meteorological tower, which has been operating since October 2005, has three levels of complete redundant (west side) instrumentation serving as a backup in case the primary sensors on the east side fail. East side tower instrumentation (channel A) meteorological data is normally fed to the IPCS unless maintenance is being performed. In this instance, the west side instrumentation (channel B) is used by the IPCS. The redundant systems ensure that the 90% data recovery requirement of Regulatory Guide 1.23 is met.

2.3.3.2.7.2 Data Validation and Screening

Plant-specific computer programs are used in the screening process to identify recurring types of data errors, including:

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

The meteorological database is reviewed to identify and edit erroneous data. In case of computer failure, backup data may be used to replace erroneous or missing data. A two-tier process, including both daily and monthly data analysis and review, has been implemented.

The daily meteorological data analysis and review includes:

- Reviewing hourly meteorological data for the 24-hour period several times a week to identify equipment failure
- Noting any suspect data in the daily check log including erroneous data caused by abnormal weather conditions
- Ensuring a report with corrective actions is generated
- Comparing the meteorological data to the predetermined acceptance criteria (Reference 220).

The monthly meteorological data analysis and review includes:

- Printing and reviewing the 15-minute and hourly meteorological databases for potential and actual invalid parameter values. (This provides a cumulative current estimate of the data recovery rate to help ensure the annual 90% goal.)
- Reviewing the maintenance/calibration records, daily computer check log, and the IPCS data to identify time period during which the meteorological data is erroneous.
- Inspecting the 15-minute printout to determine if at least 15 minutes of valid data is available for a particular hour. The invalid IPCS hourly average is replaced using backup data or valid 15-minute IPCS data.
- Using IPCS data to verify backup data. The data is considered valid when backup observation and IPCS data comparisons meet the preset acceptance criteria.
- Editing large periods of missing hourly primary data (for which backup or 15-minute IPCS data is available) to ensure 90% annual data recovery. (A minimum of 15 minutes of data per missing hour must be available to qualify as an hourly average. In cases where valid 15-minute IPCS data is available for replacement of missing hourly IPCS data, the available data should be averaged.)
- Editing IPCS data corresponding to periods in which square wave wind direction traces are observed using backup data and exceed 15 minutes of an hourly observation. (Data within an hourly observation period not affected by the low wind speed condition should be used to calculate a replacement value.)

To support Unit 1 operation, meteorological data validation is limited to wind speed (10 meters), wind direction (10 meters), and $\Delta$**T** (61-10 meters) since these meteorological parameters are the primary ones used for assessment of gaseous radioactive releases.

An independent data validation for the most recent three consecutive annual cycles of Unit 1 tower data (*i.e.,* July 2003–June 2006) was performed in addition to the scheduled internal validation. The data validation scope included wind speed, wind direction, and temperature difference measurements at all levels from the Unit 1 tower (Reference 201).

2.3.3.2.7.3 Data Processing, Reporting, and Archiving

The IPCS located in the Unit 1 auxiliary service building computer room performs engineering unit conversion and calculates the 15-minute averages and the hourly averages. The IPCS is used to acquire the meteorological data from its associated input/output subsystem located in the Technical Support Center computer room.

In addition, the IPCS computer performs data acquisition, averaging, display, and trending (short-term). Permanent historical storage of data is performed on the general data processing computers located in the Unit 1 auxiliary service building computer room, to which the IPCS is linked.

A sequential listing of the hourly data for a full year constitutes the annual meteorological record of the site. The annual record provides the input data for all types of meteorological analyses needed to define the site atmospheric dispersion capability.

The basic data is also compiled into annual joint frequency distributions of wind speed and wind direction by atmospheric stability class.

2.3.3.2.8 System Accuracy and Annual Data Recovery Rate

2.3.3.2.8.1 System Accuracy

The overall system accuracies include the errors introduced by sensors, cables, signal conditioners, temperature environments for signal conditioning and recording equipment, recorders, processors, data displays, and the data reduction process. The time-average accuracies for digital systems have been calculated for the Unit 1 meteorological data collection system. The results of these calculations are provided in Tables 2.3-214, 2.3-215, and 2.3-216.

The overall system accuracy meets the regulatory requirements of Regulatory Guide 1.23.

2.3.3.2.8.2 Data Recovery Rates

Overall, the data recovery rate meets the requirements of Regulatory Guide 1.23. Specifically, the annual data recovery rates for data period from July 2003 through June 2006 are greater than 90% for the three primary variables (*i.e.,* wind speed, wind direction, and temperature difference).

The annual data recovery rate for individual parameter and three primary variables combined are provided in Table 2.3-217.

#### 2.3.3.3 Operational Program

The operational meteorological program for Units 2 and 3 consists of the Units 2 and 3 meteorological tower serving as the primary data collection system, with the Unit 1 tower as a backup.

The meteorological monitoring system block diagram for Units 2 and 3 is provided in Figure 2.3-220.

##### 2.3.3.3.1 Units 2 and 3 Tower Site Selection Study

To select a location for the new meteorological tower, several potential meteorological tower sites in the vicinity of Units 2 and 3 were identified and evaluated using the following siting criteria:

- The tower should be located where the measurements will accurately represent the overall site vicinity meteorology
- The base of the tower should be at approximately the same elevation as the finished plant grade
- The tower should ideally be 10 obstruction heights away from any natural (*e.g.,* hills, trees) or man-made obstructions (*e.g.,* containment structures, cooling towers)
- The tower should be located directly upwind of the obstructions or heat dissipation system under the prevailing wind direction
- Interference by construction activities (*e.g.,* concrete batch plants, movement of heavy and large equipment) should be avoided.

Other factors that were also considered in the site selection include avoidance of wetland intrusion and historic site disturbance, minimizing tree clearing, Federal Aviation Administration lighting requirements, site security, and electric power availability.

The final site selected is adjacent to the Pearson Cemetery, as shown on Figure 1.1-202, since it best met the above siting criteria.

##### 2.3.3.3.2 Siting of the Units 2 and 3 Meteorological Tower

The new 60-meter guyed meteorological tower sits on a gently sloping plateau toward the west and south and along a dirt road leading to the Pearson Cemetery limits, which are about 600 feet northeast. The tower site is about 200 feet east of the major transmission corridor, which has large, recently cleared areas in the vicinity. The selected location offers a northern exposure similar to the Units 2 and 3 site. The UTM coordinates of the new meteorological tower are Northing/Y: 124435266.991 and Easting/X: 1541812.303.

During site preparation for Units 2 and 3, most of the trees growing between the new meteorological tower and the Units 2 and 3 site will be removed. Trees at the General Pearson Cemetery are preserved for historic reasons. All the trees surrounding the new tower, including those trees located within the boundary of the cemetery, meet the 10-obstruction-heights-separation criteria; therefore, no discernible influence on the wind measurements on the tower is expected.

Within five miles of Units 2 and 3, the surrounding terrain is gently rolling hills with small terrain variations. Therefore, a minimal local wind flow alteration or disruption surrounding the site and its vicinity is expected.

The terrain variations (*i.e.,* 35.5 feet) between the Units 2 and 3 meteorological tower base (at El. 435.5 feet NAVD88) and Units 2 and 3 design finish grade (at El. 400 feet NAVD88) are minimal such that no noticeable local wind flow alteration or disruption can be expected. Therefore, the meteorological data collected at the Unit 1 tower can be considered representative of the location for Units 2 and 3 from a terrain effect perspective.

The new tower is approximately 4,367 feet south-southwest from the center of the Unit 2 containment and approximately 3,469 feet from the center of the Unit 3 containment. The Units 2 and 3 shield buildings are approximately 229 feet high. Based on the horizontal separation of these shield buildings from the new tower, wind flow pattern alterations caused by the buildings are expected to be negligible.

The closest treeline is approximately 620 feet to the south (with tree heights above the tower base ranging from 40 to 64 feet) and 400 feet to the north (with tree heights approximately 22 feet above the tower base). Based on the horizontal separation of these remaining trees to the new tower, wind flow pattern alterations caused by these trees are expected to be negligible.

2.3.3.3.3 Meteorological Instrumentation

Instrumentation siting of the new tower is in accordance with the guidance of Regulatory Guide 1.23 (Reference 238)and the industry guidance provided in ANSI/ANS 3.11-2005 (Reference 204).

On the Units 2 and 3 tower, wind speed and wind direction are monitored at 10-meter and 60-meter levels. The upper level wind measurements are made at an approximate elevation of the plant vent (55.7 meters above grade). Temperature difference between the 60-meter and 10-meter levels is made for stability class determination. Because mechanical draft cooling towers are used for heat dissipation, relative humidity and temperatures are made at 10, 30, and 60 meters, where the 30-meter level measurements best represents the approximate discharge height of the cooling tower plumes. Since rainfall and barometric pressure variations between Unit 1 and Units 2 and 3 are expected to be minimal, no precipitation and barometric pressure measurements are made at the new meteorological tower. Instead, precipitation and barometric pressure data collected for Unit 1 is used.

The tower site has been cleared of trees to a distance of ten times or greater the height of the tallest tree and existing and planned buildings as described in Subsection 2.3.3.3.2.

The wind sensors are mounted on booms into the prevailing wind direction about 8 feet away from the open-lattice tower. This position on the boom is more than two tower widths (1 tower width is 1.5 feet) away from the tower. Wind sensors are mounted perpendicular to the southwest prevailing winds, and northeast of the second highest prevailing wind direction, and oriented toward true north. Temperature and moisture sensors are mounted on booms at a distance of approximately 4 feet from the tower so that the sensors are unaffected by thermal radiation from the tower. To further ensure that air temperature measurements avoid air modification by heat and moisture, their sensors are mounted in fan-aspirated solar radiation shields.

The ground surface surrounding the base of the tower is covered with grass instead of concrete or asphalt to minimize effects that could result in air temperature and moisture modification.

The booms are attached to carriages on an elevator system to lower the sensors to ground level for service and maintenance.

The tower is equipped with a lightning protection system to ground any direct lightning strikes to the tower. A lightning rod with grounding cable is attached to the tower and grounded at an appropriate distance away from the tower and electronic components.

2.3.3.3.4 Meteorological Sensors Used

Wind direction and wind speed are measured using a WS425 Ultrasonic Wind Sensor (heated option). The WS425 has no moving parts and is resistant to contamination and corrosion. The WS425 provides data availability and accuracy in all wind directions due to a three-transducer layer. The measurement range for wind speed is 0 to 144 mph. The WS425 has a starting threshold of virtually zero and accuracy of ±0.3 mph.

Temperature and relative humidity are measured using the HMP45D relative humidity/temperature sensor equipped with an environmental filter. The sensor was installed with a specially modified fan-aspirated radiation shield. The temperature sensor has a measurement range of –40°F to 140°F and an accuracy of ±0.36°F. The relative humidity sensor has a measurement range of 0.8% to 100% and an accuracy of ±2%, 0-90% RH, ±3%, 90-100% RH at 68°F.

An examination of the instrument siting at the Units 2 and 3 tower concludes that the parameters measured, levels and location of measurements, meteorological sensor type, and sensor performance specifications are in accordance with Regulatory Guide 1.23 (Reference 238) and industry guidance provided in ANSI/ANS-3.11-2005 (Reference 204). Findings of the examination are summarized in Table 2.3-216.

#### 2.3.3.3.5 Data Acquisition and Reduction

##### 2.3.3.3.5.1 Data Collection System

A microprocessor data logger system mounted at the base of the tower on a cabinet rack is used to receive, process, manage, and archive the collected data. The system calculates temperature difference and dew point temperature based on the temperature and humidity measurements. This unit includes a flash memory module (for data logging), processor modules, communication ports, system software, LCD display and keyboard, backup batteries, and a removable compact flash memory card (for onsite data retrieval). The data logger has sufficient storage capacity to archive several months of data.

All sensor output is sampled from the Units 2 and 3 meteorological tower instrumentation by the tower base processing computer on the following frequencies:

- Wind speed/wind direction (1 second)
- Ambient temperature (5 seconds)
- Relative humidity/temperature (5 seconds)
- Values for temperature difference and dew point are calculated by the processing computer.

Data is recorded by the processing computer on the following frequencies:

- Wind speed/wind direction (10-second average value)
- Dew point (60-second average value)
- Relative humidity (60-second average value)
- Ambient temperature (60-second average value)
- Differential temperature (60-second average value).

##### 2.3.3.3.5.2 Data Transmission

During plant operation, data will be transmitted directly to the control room and technical support center computer room.

During plant operation, data will be transmitted to the control room and the technical support center computer room designated to serve Units 2 and 3. However, the design of the units is not advanced enough to describe the Cyber security requirements regarding devices/servers in the data path.

At present, data is collected locally at the tower. The 15-minute and hourly averages are calculated by a remote computer used for data validation.

In the long term, the data will be radio-transmitted to the Nuclear Training Center and then transmitted to the Unit 1 plant computer. The 15-minute and hourly averages will then be calculated by the IPCS when the data is communicated to the IPCS.

2.3.3.3.5.3 Data Reduction and Reporting

The data collection software application has been customized to be compatible with the Unit 1 data collection requirements, generate data reports, and support data transmission using a variety of interfaces (radio telemetry, terminal, etc.). Currently, the data collection system is configured to have communication reports.

The anticipated data reports for the new tower system will include:

- Real-time Report — A snapshot of instantaneous wind speed and wind direction data.
- Main Data Feed Report — 10-second averages of wind speed, wind direction, temperature, relative humidity, and $\Delta$**T** from the specified levels.
- Tower Maintenance Report — 15-minute and 1-hour averages of wind speed, wind direction, temperature, relative humidity, and $\Delta$**T** from the specified levels.

2.3.3.3.6 Instrumentation Surveillance

The calibration of the meteorological systems has been performed according to accepted nuclear industry practices. Like the Unit 1 meteorological tower, the instrumentation used to calibrate the meteorological system (where applicable) has been maintained traceable to the National Institute of Standards and Technology.

The maintenance of the meteorological instrumentation for Units 2 and 3 will fall under the VCSNS I&C-Maintenance Program. Calibration procedures similar to those used for Unit 1 are used for the operation and maintenance of the Units 2 and 3 instrumentation.

2.3.3.3.7 Emergency Preparedness Support

The Units 2 and 3 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 will be used to represent meteorological conditions within the 10-mile emergency planning zone radius.

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 Units 2 and 3 control rooms, technical support center, and emergency operations facility. All the meteorological channels required for input to the dose assessment models are available and presented in a format compatible for input to these dose assessment models.

Currently, provisions are in place for Unit 1 to obtain representative regional meteorological data from the NWS or a meteorological contractor during an emergency, if the site meteorological system is unavailable. Units 2 and 3 will use the same emergency plan procedures, and the current arrangement will continue.

Data from the meteorological measurements system is provided to an onsite data capture computer. Meteorological data necessary for the estimation of offsite dose projections is available via terminals to personnel in the control room, technical support center, and emergency operations facility. Should the computerized information or the computer-based assessment system not be available, or if results are suspect, alternate procedural manual methods are available to provide appropriate assessment. When onsite meteorological information is not available for the estimation of offsite dose projections, meteorological data from the NWS in Columbia, South Carolina, will be used. If there is an additional meteorological tower (*i.e.,* Unit 1) available, it would be used as an alternate source before using the NWS in Columbia, South Carolina.

An approved dose assessment computer model for the site is used to perform dose assessment.

### 2.3.3.4 Meteorological Data

#### 2.3.3.4.1 Representativeness and Adequacy of Data

##### 2.3.3.4.1.1 Meteorological Data from the Unit 1 Meteorological Towers

Wind speed, wind direction, and temperature difference measurements collected by the Unit 1 meteorological towers were used to estimate the dispersion factors (X/Qs) for Units 2 and 3.

An investigation of the topographic features at the Units 2 and 3 area (see Subsection 2.3.3.2.1) concluded that the terrain variations (*i.e.,* 37 feet) between the Unit 1 meteorological tower base (at 437 feet NGVD29) and Units 2 and 3 design finish grade (at 400 feet NAVD88) are minimal such that no noticeable local wind flow alteration or disruption can be expected. In addition, the difference between the base elevation of the Unit 1 tower and the design plant grade of Units 2 and 3 is minimal. Therefore, the meteorological data collected at the Unit 1 towers can be considered representative of the location for Units 2 and 3 from a terrain effects perspective.

Because of the proximity of the Monticello Reservoir, a study was conducted to determine the extent of the reservoir effect and the potential impact of the lake warming and cooling on the local dispersion characteristics that would affect the dose calculation.

Two years of hourly meteorological data from the Unit 1 towers in conjunction with the concurrent water temperatures of the reservoir for 2004 and 2005 were analyzed in the study. Study results indicate that the influence of the reservoir on the data collected by the Unit 1 meteorological towers is limited to a small percentage (about 2.5%) of the time during a year. When the Unit 1 towers are under the influence of the reservoir, the X/Q estimates for Units 2 and 3, based on the Unit 1 towers' data, will be overpredicted, unaffected, or under-predicted for the dispersion conditions at the Units 2 and 3 site. For those cases when the X/Qs are overpredicted, the dispersion estimates are conservative. The study concluded that the X/Qs could be under-predicted for about 0.5% of the time in a year. However, when taking account of the under-predictions, the corrected X/Qs will remain bounded by the site parameter X/Q values in DCD Table 2-1 (Reference 223).

In summary, based on the above results, the meteorological data (*i.e.,* wind speed, wind direction, and stability class) collected at the Unit 1 towers can be considered representative for Units 2 and 3.

The initial one year of data from the new Units 2 and 3 tower will be used to confirm the representativeness of the Unit 1 data used for Units 2 and 3. The confirmation and the data used will be provided to NRC following completion of the evaluation.

2.3.3.4.1.2 Long-Term and Climatological Conditions

Long-term meteorological data from the Columbia NWS, South Carolina, and onsite data at the VCSNS site has been examined extensively in the Unit 1 UFSAR. Comparisons of average wind direction and speed, frequency of calm, wind direction persistence, prevailing wind direction, and atmospheric stability with these offsite NWS data summaries show relatively close agreement. Therefore, the onsite meteorological data is considered to be reasonably representative of the long-term climatological average.

To provide evidence to show how well the onsite data represents long-term conditions at the site, the three-year onsite wind data (*i.e.,* July 2003–June 2006) used to support Units 2 and 3 was compared with two periods of long-term wind data (*i.e.,* 1951-1960 and 1956-1975) at Columbia NWS, South Carolina. The results of the comparisons are presented in Table 2.3-218. As clearly shown in the table, the wind frequency distributions between the Columbia NWS and the VCSNS site are in agreement, with the same bimode prevailing wind (southwest and northeast) and most of the winds are from four of the west southerly wind sectors (*i.e.,* south-southwest, southwest, west-southwest, and west).

Since there are no $\Delta$**T** measurements made at the NWS, methodology for determining stability class is different for the Columbia NWS and the VCSNS site. Therefore, a comparison of stability class between these two locations is not meaningful. Instead, a comparison of stability classes was made based on one year of onsite data (1975) and three years of recent onsite data. The results as shown in Table 2.3-218 indicate a reasonable agreement with the highest frequencies occurring at classes D and E. The major difference (22.4% versus 15.3%) was in stability classes F and G. This difference is inconsequential to the development of the 5 percentile X/Q. In conclusion, the comparison supports that the onsite data used for Units 2 and 3 is generally representative of the long-term climatological conditions at the site.

2.3.3.4.1.3 Need of Additional Data Sources for Airflow Trajectories

Topographic features and the dispersion characteristics of the site area were examined in FSAR Subsections 2.3.2 and 2.3.3.1. The site area is generally gentle rolling hills and the site is considered 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 XOQDOQ dispersion model, an NRC-sponsored computational model based on Regulatory Guide 1.111 (Reference 227), is a constant mean wind direction model, using meteorological data from a single station to calculate dispersion estimates out to 50 miles of a site of interest. In the model, application of terrain-induced airflow-recirculation factor options are provided 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 an airflow-recirculation factor 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 from a site located within open terrain is not required. Therefore, using data collected from the onsite meteorological monitoring station for making dispersion estimates out to 50 miles from the site is considered to be reasonable.

Thus, data collected by the existing system was used for the description of atmospheric transport and diffusion characteristics within 50 miles of the VCSNS site. No other offsite data collection systems have been considered while determining the dispersion characteristics of the VCSNS site area. The X/Q and D/Q values and results are described in Subsections 2.3.4 and 2.3.5.

2.3.3.4.1.3.1 Supplemental Data for Environmental Impacts Evaluation

Dew point temperatures collected at the Columbia NWS were used to assess the environmental impacts associated with operation of the mechanical draft cooling towers onsite.

Because of the proximity of the Monticello Reservoir to the Unit 1 towers, ambient air at the tower location is expected to be more humid than at one mile inland. Thus, the dew point temperature measurements at the Unit 1 towers would be higher when winds come off from the Monticello Reservoir indicating higher potential for visible cooling tower plume formation. Consequently, frequency of occurrence and length of visible cooling tower plume, frequency of fogging, and drift deposition would be overpredicted based on the dew point data measured at the Unit 1 towers. Three years (2003–2005) of dew point measurements collected at the Columbia NWS in conjunction with the concurrent wind speed, wind direction, and stability class determined from the Unit 1 towers were used instead of the dew point data collected at the Unit 1 towers.

Columbia NWS is 26 miles south-southeast of the VCSNS site with no significant terrain features in between this NWS and the site. The NWS is also not near any sizable body of waters. Therefore, dew point data collected at this NWS can be considered representative of Units 2 and 3 for making predictions of cooling tower plume impacts.

For evaluation of the environmental risk from the radiological consequences of a spectrum of severe accidents, three years (2003–2005) of hourly precipitation data measurements collected at the Columbia NWS in conjunction with the concurrent wind speed, wind direction, and stability class determined from the Unit 1 towers were used.

#### 2.3.3.4.2 Annual Joint Frequency Distribution of Data

The required joint frequency distributions are presented in Subsection 2.3.2.2.3 and in Tables 2.3-210 and 2.3-211 in the format specified in Regulatory Guide 1.23 for the wind speed and wind direction by stability class and by all stability classes combined for the 10- and 61-meter level measurements.

## 2.3.4 SHORT-TERM DIFFUSION ESTIMATES

This subsection of the referenced DCD is incorporated by reference with the following departure(s) and/or supplement(s).

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Insert the following subsections following DCD Subsection 2.3.4.

### 2.3.4.1 Objective

VCS COL 2.3-4

To evaluate potential health effects for the AP1000 reactor design basis accidents, 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 a period of three consecutive annual cycles from July 1, 2003 through June 30, 2006, was used to quantitatively evaluate such a hypothetical accident at the site. Onsite data provide representative measurements of local dispersion conditions appropriate to Units 2 and 3, and a 3-year period is considered to be reasonably representative of long-term conditions as discussed in Subsection 2.3.3.

According to 10 CFR Part 100, it is necessary to consider the doses for various time periods immediately following the onset of a postulated containment release at the exclusion distance and for the duration of exposure for the low population zone (LPZ) and population center distances. The relative air concentrations (X/Qs) are estimated for various time periods ranging from 2 hours to 30 days.

Onsite meteorological data has been used to determine various postulated accident conditions as specified in Regulatory Guide 1.145 (Reference 229). Compared to an elevated release, a ground-level release usually results in higher ground-level concentrations at downwind receptors because of less dilution from shorter traveling distances. Since the ground-level release scenario provides a bounding case, all of the releases were conservatively assumed to occur at the ground level.

### 2.3.4.2 Calculations

The NRC-sponsored PAVAN computer code, as described in NUREG/CR-2858 (Reference 230) has been used to estimate ground-level X/Qs for potential accidental releases of radioactive material to the atmosphere. Such an assessment is required by 10 CFR Part 100 and 10 CFR Part 50, Appendix E.

For the purpose of determining X/Qs input to subsequent radiation dose analyses, Units 2 and 3 were treated as being encompassed within an area referred to as the Power Block Area Circle (PBAC). The PBAC has a radius of 750 feet from a point centered between the two units — 450 feet (138 meters) from each unit’s Shield Building. To ensure conservatism in the X/Q dispersion modeling, an accidental release was assumed to have occurred at any point on the PBAC instead of occurring at the actual location of Unit 2 or Unit 3 (thus minimizing the travel distance for any direction sector). As a result, the estimated X/Qs and subsequent radiation doses are conservatively higher.

One of the downwind distances for estimating X/Qs is referred to as the “Dose Evaluation Periphery” and is illustrated in Figure 2.3-221, along with the PBAC. This Dose Evaluation Periphery is a concentric circle around the PBAC located at a distance equal to the minimum radial distance between the PBAC and the actual Site Boundary/Exclusion Area Boundary (EAB) (*i.e*., 2,640 feet or 805 meters downwind). The distance to the Dose Evaluation Periphery and the Site Boundary/EAB is the same for the east-southeast clockwise through the west-northwest direction radials evaluated by the PAVAN model.

For the northwest clockwise through the east direction radials, the distance to the Dose Evaluation Periphery is less than the distance between the PBAC and the actual Site Boundary/EAB (see Figure 2.3-221). So, an additional level of conservatism (*i.e*., due to a shorter travel distance) is reflected in the modeled X/Q values for these direction radials.

The LPZ boundary is a 3-mile (4,828-meter) radius circle centered at the Unit 1 reactor building. Since the LPZ boundary is centered on Unit 1, the distance from the PBAC for Units 2 and 3 to the LPZ boundary is different for each directional sector. These distances are presented in Table 2.3-219.

The PAVAN program implements the guidance provided in Regulatory Guide 1.145 (Reference 229). Primarily, the code computes X/Qs at the EAB and the LPZ boundary 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 X/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 X/Q value that is equaled or exceeded 0.5% of the total time becomes the maximum sector-dependent X/Q value.

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

The larger of the two values (*i.e.,* the maximum sector-dependent 0.5% X/Q or the overall site 5% X/Q) is used to represent the X/Q value for a 0–2 hour time period. To determine X/Qs for longer time periods, the program calculates an annual average X/Q value using the procedure described in Regulatory Guide 1.111 (Reference 227). The program then uses logarithmic interpolation between the 0–2 hour X/Qs for each sector and the corresponding annual average X/Qs to calculate the values for intermediate time periods (*i.e.,* 8 hours, 16 hours, 72 hours, and 624 hours). As suggested in NUREG/CR-2858 (Reference 230), each of the sector-specific 0–2 hour X/Qs provided in the PAVAN output file are examined for “reasonability” by comparing them with the ordered X/Qs also presented in the model output.

The PAVAN model has been configured to calculate offsite X/Q values, assuming both wake-credit allowed and wake-credit not allowed. The entire Dose Evaluation Periphery is located beyond the wake influence zone induced by the Units 2 and 3 shield buildings. And, because the LPZ boundary is located farther away from the plant site than the Dose Evaluation Periphery, the “wake-credit not allowed” scenario of the PAVAN results was used for the X/Q analyses at both the Dose Evaluation Periphery and the LPZ boundary.

The PAVAN model input data is presented below:

- Meteorological data: 3-year (July 1, 2003 to June 30, 2006) composite onsite joint frequency distributions of wind speed, wind direction, and atmospheric stability
- Type of release: ground-level (a default height of 10 meters as suggested by Reference 230 was used)
- Wind sensor height: 10 meters
- Vertical temperature difference: (61 meters – 10 meters)
- Number of wind speed categories: 12 (including calm)
- Distances from release points along the PBAC to Dose Evaluation Periphery: 805 meters, for all downwind sectors
- Distances from release point to LPZ boundary for all downwind sectors (see Table 2.3-219)

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

To be conservative, the shortest distance (805 meters) between the PBAC and the Dose Evaluation Periphery has been entered as input for each downwind sector to calculate the X/Q values at the Dose Evaluation Periphery. Similarly, the shortest distances (see Table 2.3-219) from the PBAC to the LPZ boundary is entered as input to calculate the X/Q values at the LPZ boundary.

#### 2.3.4.2.1 Postulated Accidental Radioactive Releases

##### 2.3.4.2.1.1 Offsite Dispersion Estimates

Based on the PAVAN modeling results, the maximum 0–2 hour, 0.5 percentile, direction-dependent X/Q value is compared with 5 percentile overall site X/Q value at the Dose Evaluation Periphery. The higher of the two is used as the proper X/Qs at the Dose Evaluation Periphery. The same approach is used to determine the proper X/Qs at the LPZ boundary.

The maximum X/Qs presented in Tables 2.3-220 and 2.3-221 for the Dose Evaluation Periphery and the LPZ boundary, respectively, are summarized below for the 0 to 2-hour time period and other intermediate time intervals evaluated by the PAVAN model. The corresponding DCD values are also provided for comparison purposes.

| Receptor Location | 0–2 hours | 0–8 hours | 8–24 hours | 1–4 days | 4–30 days | Annual Average |
|---|---|---|---|---|---|---|
| Dose Evaluation Periphery | 2.59E-04 | + | + | + | + | + |
| DCD* | 1.0E-03 | - | - | - | - | - |
| LPZ Boundary | + | 3.87E-05 | 2.81E-05 | 1.40E-05 | 5.30E-06 | + |
| DCD* | - | 2.2E-04 | 1.60E-04 | 1.0E-04 | 8.0E-05 | - |

Table Notes:
* From DCD Tier 1, Table 5.0-1 and DCD Tier 2, Table 2-1 (Site Parameters)
- The DCD does not list this value
+ The value is not provided because there is no equivalent DCD value.

The results provided in Table 2.3-220 show that the maximum 0–2-hour X/Q value (2.59E-04) determined by the PAVAN modeling analyses at the Dose Evaluation Periphery is bounded by the 0–2-hour DCD X/Q value of 1.0E-03 as described in DCD Tier 1, Table 5.0-1 and DCD Tier 2, Table 2-1 of the AP1000 DCD. Table 2.3-221 shows that the PAVAN-calculated LPZ boundary X/Q values are all bounded by the corresponding DCD LPZ boundary X/Q values in Tier 1, Table 5.0-1 and DCD Tier 2, Table 2-1.

#### 2.3.4.2.1.2 Onsite Dispersion Estimates

X/Q values were also estimated at the control room HVAC intake and annex building access door for postulated accidental radioactive airborne releases. These two receptors, considered for determination of onsite X/Q values, are identified in Table 15A-7 of DCD Tier 2, Chapter 15, Appendix 15A.

Control room X/Qs were estimated using the ARCON96 dispersion model as described in NUREG/CR-6331 (Reference 232) and considered receptor height, release height, release type, and building area. Three consecutive annual cycles (July 1, 2003–June 30, 2006) of hourly meteorological data collected onsite were used as part of the input for the ARCON96 program. Each of the three years of meteorological data has data recovery rates of more than 90% and are representative of the site dispersion characteristics as described in Subsection 2.3.3.

According to Figure 15A-1 of DCD Tier 2, Chapter 15, Appendix 15A, the receptors may be contaminated from eight sources. Figure 15A-1 shows that among the potential release sources, the containment shell is considered to be a diffuse area source; all other releases are considered to be point sources. Release types used in the ARCON96 modeling analyses for Units 2 and 3 follow those specified in the DCD.

Regulatory Guide 1.194 provides guidance on the use of ARCON96 for determining X/Qs to be used in design basis evaluation of control room radiological habitability. Section 3.2.2 of Regulatory Guide 1.194 specifies that a stack release should be more than 2-1/2 times the height of the adjacent structure. All release height and receptor height information is provided in Table 15A-7 of DCD Tier 2, Chapter 15, Appendix 15A. As stated in Subsection 3.2.3 of Regulatory Guide 1.194, the results from the vent releases mode may not be sufficiently conservative for accident analysis; therefore, the vent release mode should not be used in design basis evaluation. Since the 7.6-meter condenser air removal stack is lower than 2-1/2 times the height of the nearby turbine building, it was considered to be a ground-level source in ARCON96 modeling. Similarly, the 55.7-meter plant vent release was also considered to be a ground-level release because it was lower than the 2-1/2 times the height of the nearby containment shield building.

Control room HVAC intake and annex building access door X/Qs for the 95% time averaging (0–2 hours, 2–8 hours, 8–24 hours, 1–4 days, and 4–30 days) periods obtained from the ARCON96 modeling results are summarized in Tables 2.3-222 and 2.3-223, respectively.

The results provided in Tables 2.3-222 and 2.3-223 show that all of the X/Q values determined by the ARCON96 modeling analyses at the control room HVAC intake and annex building access door for reactor building plant stack releases are bounded by the corresponding DCD X/Q values.

2.3.4.2.2 Hazardous Material Releases

The effect on the Units 2 and 3 control rooms of explosions and postulated accidental releases of chemicals for material stored onsite, offsite, and for toxic or flammable material transported on nearby transport routes are discussed in Subsection 2.2.3.

The concentrations at the control room HVAC intake and annex building access door due to accidental hazardous chemical releases (toxic vapor and flammable cloud) were determined using the guidance specified in Regulatory Guide 1.78.

## 2.3.5 LONG-TERM DIFFUSION ESTIMATES

This subsection of the referenced DCD is incorporated by reference with the following departure(s) and/or supplement(s).

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Insert the following subsections following DCD Subsection 2.3.5.

### 2.3.5.1 Objective

VCS COL 2.3-5 This subsection provides realistic estimates of annual average atmospheric dispersion (X/Q values) and relative deposition (D/Q values) to a distance of 50 miles (80 kilometers) from the site for annual average release limit calculations and person-rem estimates.

The NRC-sponsored XOQDOQ computer program (Reference 231) was used to estimate X/Q values due to routine releases of gaseous effluents to the atmosphere. The XOQDOQ computer code has the primary function of calculating annual average X/Q values and annual average relative deposition (D/Q) values at receptors of interest (*e.g.,* the Dose Evaluation Periphery and the LPZ boundary, the nearest milk animal, residence, garden, meat animal).

The XOQDOQ dispersion model implements the assumptions outlined in Regulatory Guide 1.111(Reference 227). 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.

The following input data and assumptions have been used in the XOQDOQ modeling analysis:

- Meteorological Data: 3-year (July 1, 2003 to June 30, 2006) composite onsite joint frequency distribution of wind speed, wind direction, and atmospheric stability
- Type of release: Ground-level (a default height of 10 meters as suggested by Reference 231 was used)
- Wind sensor height: 10 meters
- Vertical temperature difference: (61 meters – 10 meters)
- Number of wind speed categories: 12 (including calm)
- Minimum building cross-sectional area: 2,636 square meters
- Containment structure height: 69.7 meters

- Distances from the release point to the nearest residence, nearest site boundary (Dose Evaluation Periphery), vegetable garden, meat animal, and milk animal (see Table 2.3-224).

The AP1000 reactor design is used to calculate the minimum building cross-sectional area as called for in NUREG/CR-2919 (Reference 231) for evaluating building downwash effects on dispersion. The shield building is a tapered-shape structure of smaller area at the top. The height of the Unit 2 and Unit 3 shield buildings is about 228 feet 9 inches (69.7 meters). Because of the shape of the shield building, the midpoint between the high point of the building (69.7 meters) and the point at which the building begins to taper (about 170.84 feet or 52.1 meters) was used when determining the building cross-sectional area. This point has a height of 199.8 feet (60.9 meters). The cross-sectional area was determined by multiplying this height by the diameter of the containment (about 142 feet or 43.3 meters). Therefore, based on the cross-sectional area of the reactor structure (2,636 square meters) and assuming the entire structure is rectangular, the equivalent structural height is calculated to be 60.9 meters.

As discussed in Subsection 2.3.4.2, the Dose Evaluation Periphery is defined as a circle that extends 0.5 mile (805 meters) beyond the PBAC. This distance remains constant in all directions. Thus, a constant value was used for the Dose Evaluation Periphery distance in the XOQDOQ analysis. Distances to the sensitive receptors were derived from a land use census table provided in Reference 221. Distances and directions to the sensitive receptors (*i.e.,* nearest residence, meat animal, milk animal, Dose Evaluation Periphery, and vegetable garden) had to be adjusted since the original values provided were based on a source from the existing Unit 1. The adjusted receptor distances based on a release source at the PBAC around Units 2 and 3 used in the XOQDOQ input file are presented in Table 2.3-224. The X/Q and D/Q values were analyzed at Unit 3 with a primary release point at Unit 2. This scenario was evaluated for impact on Unit 3, for that time when Unit 2 is operational and Unit 3 is still under construction.

### 2.3.5.2 Calculations

Table 2.3-225 summarizes the maximum relative concentration and relative deposition (*i.e.,* X/Q and D/Q values) predicted by the XOQDOQ model for identified sensitive receptors in the Units 2 and 3 site area due to routine releases of gaseous effluents. The listed maximum X/Q values reflect several plume depletion scenarios that account for radioactive decay (*i.e.,* no decay, and the default half-life decay periods of 2.26 and 8 days).

The overall maximum annual average X/Q value is 8.5E-06 sec/$m^3$ (no decay, undepleted) and occurs at Unit 3 due to the release from Unit 2. The maximum annual average X/Q values (along with the direction and distance of the receptor locations relative to the Units 2 and 3 site) for the other sensitive receptor types are:

- 4.7E-06 sec/$m^3$ for the Dose Evaluation Periphery occurring in the northeast sector at a distance of 0.5 mile

- 1.0E-06 sec/$m^3$ for the nearest residence occurring in the east sector at a distance of 1.23 miles

- 5.4E-07 sec/$m^3$ for the nearest meat animal occurring in the northeast sector at a distance of 2.14 miles

- 3.5E-08 sec/$m^3$ for the nearest milk animal in the west sector at a receptor distance of 4.74 miles

- 1.0E-06 sec/$m^3$ for the nearest vegetable garden occurring in the east sector at a distance of 1.23 miles

Finally, Table 2.3-226 summarizes annual average X/Q values (for no decay and the default half-life radioactive decay periods of 2.26 and 8 days) and D/Q values at the XOQDOQ model's 22 standard radial distances (between 0.25 and 50 miles) and for the model's 10 distance-segment boundaries (between 0.5 and 50 miles downwind). Although the model is used to predict relative concentration and relative deposition values at the distances, and for the distance-segments indicated above, along each of the 16 standard direction radials (*i.e.,* separated by 22.5°), only the results along the northeast radial are presented in Table 2.3-226. Those values represent the highest X/Q and D/Q values from among all the direction radials modeled.

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## 2.3.6 COMBINED LICENSE INFORMATION

### 2.3.6.1 Regional Climatology

DCD Combined License applicants referencing the AP1000 certified design will address site-specific information related to regional climatology.

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Add the following information to this subsection of the DCD.

VCS SUP 2.3.6-1 Subsection 2.3.1 addresses climatological characteristics of the site area and region. These characteristics include:

- Observed and probabilistic extreme wind conditions (Subsection 2.3.1.3.1)
- Tornadoes and related wind and pressure characteristics (Subsection 2.3.1.3.2)
- Tropical cyclones and related effects (Subsection 2.3.1.3.3)
- Observed and probabilistic precipitation (*i.e.,* rainfall and snowfall) extremes (Subsection 2.3.1.3.4)
- Frequency and magnitude of hail, snowstorms, and ice storms (Subsection 2.3.1.3.5)
- Frequency of thunderstorms and lightning (Subsection 2.3.1.3.6)
- Meteorological data for evaluating ultimate heat sink performance (Subsection 2.3.1.4)
- Design basis dry and wet bulb temperatures (Subsection 2.3.1.5)
- Restrictive dispersion conditions (Subsection 2.3.1.6)
- Climate changes (Subsection 2.3.1.7)

The set of climatological descriptors addressed under Subsection 2.3.1 is based on Regulatory Guide 1.206 (*Combined License Applications for Nuclear Power Plants,* LWR Edition) and NUREG-0800 (S*tandard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants*, LWR Edition) (Reference 239). Many of these site characteristics do not have counterparts among the site parameters and values listed in the DCD.

For those climate-related, design basis site parameters with counterparts, the site characteristic values are addressed in or cross-referenced from Subsections 2.3.1.3.1 (for wind speed), 2.3.1.3.2 (for tornadoes), 2.3.1.3.4 (for snow and rain), and 2.3.1.5 (for air temperatures). Refer to Table 2.0-201 for a comparison between the site parameter values and the corresponding site characteristic values.

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2.3.6.2 Local Meteorology

DCD Combined License applicants referencing the AP1000 certified design will address site-specific local meteorology information.

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Add the following information to this subsection of the DCD.

VCS SUP 2.3.6-2 Subsection 2.3.2 addresses site-specific meteorological characteristics related to atmospheric dispersion, climatological conditions, other related information that both influences and may affect those characteristics, and air quality conditions in the broader site area, including:

- Wind speed and wind direction (Subsection 2.3.2.2.1), wind direction persistence (Subsection 2.3.2.2.2), and atmospheric stability class (Subsection 2.3.2.2.3)
- Normal and period-of-record mean and extreme values of temperature, atmospheric water vapor, precipitation, and the occurrence of heavy fog conditions from nearby climatological observing stations representative of conditions at the Units 2 and 3 site (Subsections 2.3.2.2.4 through 2.3.2.2.7)
- Topographic features within a 50-mile radius and a 5-mile radius of the site (Subsection 2.3.2.3)
- Potential influence of the plant and related facilities on meteorological conditions (Subsection 2.3.2.4)
- Current and projected site air quality conditions (Subsection 2.3.2.5)

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2.3.6.3 Onsite Meteorological Measurements Program

DCD Combined License applicants referencing the AP1000 certified design will address the site-specific onsite meteorological measurements program.

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Add the following information to this subsection of the DCD.

VCS SUP 2.3.6-3 Subsection 2.3.3 addresses site-specific details regarding the onsite meteorological measurements program including:

- Preoperational Monitoring Program (Subsection 2.3.3.2)
- Operational Monitoring Program (Subsection 2.3.3.3)

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### 2.3.6.4 Short-Term Diffusion Estimates

DCD Combined License applicants referencing the AP1000 certified design will address the site-specific X/Q values specified in subsection 2.3.4. For a site selected that exceeds the bounding X/Q values, the Combined License applicant will address how the radiological consequences associated with the controlling design basis accident continue to meet the dose reference values given in 10 CFR Part 50.34 and control room operator dose limits given in General Design Criteria 19 using site-specific X/Q values. The Combined License applicant should consider topographical characteristics in the vicinity of the site for restrictions of horizontal and/or vertical plume spread, channeling or other changes in airflow trajectories, and other unusual conditions affecting atmospheric transport and diffusion between the source and receptors. No further action is required for sites within the bounds of the site parameters for atmospheric dispersion.

With regard to assessment of the postulated impact of an accident on the environment, the COL applicant will provide X/Q values for each cumulative frequency distribution which exceeds the median value (50 percent of the time).

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Add the following information to this subsection of the DCD.

VCS SUP 2.3.6-4 For the AP1000 reactor, the terms “site boundary” and “exclusion area boundary” (or EAB) are used interchangeably. Thus, the X/Q specified for the site boundary applies whenever a discussion in the DCD refers to the exclusion area boundary. Furthermore, in Subsection 2.3.4 the term “Dose Evaluation Periphery” means the same as the term “EAB” for X/Q calculation purposes, as discussed in Subsection 2.3.4.2.

The results of the site-specific, short-term, accident-related dispersion modeling analysis, including X/Q values for the indicated time intervals (*i.e.,* 0 to 2 hours, 0 to 8 hours, 8 to 24 hours, 24 to 96 hours, and 96 to 720 hours) and receptor locations (*i.e.*, the Dose Evaluation Periphery and the low population zone boundary), are discussed in Subsection 2.3.4.2.1.1. Refer to Table 2.0-201 for a comparison between the atmospheric dispersion factor site parameter values, indicated above, and the corresponding site-specific X/Q values.

The results of the site-specific, short-term, accident-related dispersion modeling analysis related to control room habitability, including X/Q values for the indicated time intervals (*i.e.,* 0 to 2 hours, 2 to 8 hours, 8 to 24 hours, 1 to 4 days, and 4 to 30 days) and receptor locations (*i.e.*, the control room HVAC intake and the control room door via the annex building access door), are discussed in Subsection 2.3.4.2.1.2. Refer to Table 2.0-201 for a comparison between the control room atmospheric dispersion factor site parameter values, indicated above, and the corresponding site-specific X/Q values.

Environmental assessment of short-term, accident-related X/Q values is addressed in ER Subsection 2.7.5.2.

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### 2.3.6.5 Long-Term Diffusion Estimates

DCD

Combined License applicants referencing the AP1000 certified design will address long-term diffusion estimates and X/Q values specified in subsection 2.3.5. The Combined License applicant should consider topographical characteristics in the vicinity of the site for restrictions of horizontal and/or vertical plume spread, channeling or other changes in airflow trajectories, and other unusual conditions affecting atmospheric transport and diffusion between the source and receptors. No further action is required for sites within the bounds of the site parameter for atmospheric dispersion.

With regard to environmental assessment, the COL applicant will also provide estimates of annual average X/Q values for 16 radial sectors to a distance of 50 miles from the plant.

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Add the following information to this subsection of the DCD.

VCS SUP 2.3.6-5

For the AP1000 reactor, the terms “site boundary” and “exclusion area boundary” are used interchangeably. Thus, the X/Q specified for the site boundary applies whenever a discussion in the DCD refers to the exclusion area boundary. In Subsection 2.3.5 the term “Dose Evaluation Periphery” means the same as the term “EAB” for X/Q calculation purposes, as explained earlier in Subsection 2.3.4.2. The results of the site-specific, long-term, dispersion modeling analysis, including the maximum annual average, X/Q value at the Dose Evaluation Periphery, are discussed in Subsection 2.3.5.2. Refer to Table 2.0-201 for a comparison between the atmospheric dispersion factor site parameter value, indicated above, and the corresponding site-specific X/Q value.

Environmental assessment of long-term, routine release-related X/Q values is addressed in ER Subsection 2.7.6.2.

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**Table 2.3-201**
**NWS and Cooperative Observing Stations Near the Site for Units 2 and 3**

| Station[a] | County | Climate Division | Approximate Distance (miles) | Direction Relative to Site | Elevation MSL (feet) |
|---|---|---|---|---|---|
| Parr | Fairfield | 3 | 1 | SW | 258 |
| Little Mountain | Newberry | 5 | 8 | SW | 711 |
| Blair | Fairfield | 3 | 10 | NNW | 280 |
| Winnsboro | Fairfield | 3 | 14 | ENE | 560 |
| Newberry | Newberry | 5 | 18 | W | 476 |
| Columbia Metro Airport (WSFO) | Lexington | 6 | 26 | SSE | 213 |
| Santuck | Union | 2 | 26 | NNW | 520 |
| Chester 1NW | Chester | 3 | 30 | N | 520 |
| Saluda | Saluda | 5 | 32 | SW | 480 |
| Camden 3W | Kershaw | 3 | 38 | E | 140 |
| Pelion 4NW | Lexington | 6 | 39 | S | 450 |
| Kershaw 2SW | Lancaster | 3 | 44 | ENE | 500 |
| Catawba | York | 3 | 45 | NNE | 560 |
| Johnston 4SW | Edgefield | 5 | 46 | SW | 620 |

(a) Numeric and letter designators following a station name (e.g., Chester 1NW) indicate the station’s approximate distance in miles (*e.g.,* 1) and direction (*e.g.,* northwest) relative to the place name (*e.g.,* Chester)

## Table 2.3-202
## Local Climatological Data Summary for Columbia, South Carolina

### NORMALS, MEANS, AND EXTREMES

COLUMBIA, SC (CAE)

LATITUDE: 33° 56′ 31″ N | LONGITUDE: 81° 07′ 05″ W | ELEVATION (FT): GRND: 240 BARO: 243 | TIME ZONE: EASTERN (UTC + 5) | WBAN: 13883

| | ELEMENT | POR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | YEAR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TEMPERATURE °F | NORMAL DAILY MAXIMUM | 30 | 55.1 | 59.5 | 67.4 | 75.7 | 83.1 | 89.1 | 92.1 | 90.0 | 84.8 | 75.8 | 66.7 | 57.8 | 74.8 |
| | MEAN DAILY MAXIMUM | 57 | 56.3 | 60.3 | 67.5 | 76.5 | 83.9 | 89.5 | 92.3 | 90.6 | 85.2 | 76.4 | 67.1 | 58.3 | 75.3 |
| | HIGHEST DAILY MAXIMUM | 57 | 84 | 84 | 91 | 94 | 101 | 107 | 107 | 107 | 101 | 101 | 90 | 83 | 107 |
| | YEAR OF OCCURRENCE | | 1975 | 1997 | 1974 | 1986 | 2000 | 1954 | 1952 | 1983 | 1954 | 1954 | 1961 | 1978 | AUG 1983 |
| | MEAN OF EXTREME MAXS. | 57 | 74.2 | 77.3 | 84.0 | 89.8 | 94.0 | 98.7 | 99.7 | 98.5 | 94.7 | 88.2 | 81.5 | 75.6 | 88.0 |
| | NORMAL DAILY MINIMUM | 30 | 34.0 | 36.3 | 43.5 | 50.7 | 60.0 | 67.9 | 71.8 | 70.6 | 64.6 | 51.5 | 42.6 | 36.1 | 52.5 |
| | MEAN DAILY MINIMUM | 57 | 33.6 | 35.8 | 42.3 | 50.2 | 59.3 | 66.8 | 70.7 | 69.6 | 63.6 | 50.8 | 41.4 | 34.9 | 51.6 |
| | LOWEST DAILY MINIMUM | 57 | -1 | 5 | 4 | 26 | 34 | 44 | 54 | 53 | 40 | 23 | 12 | 4 | -1 |
| | YEAR OF OCCURRENCE | | 1985 | 1973 | 1980 | 1983 | 1963 | 1984 | 1951 | 1969 | 1967 | 1952 | 1970 | 1958 | JAN 1985 |
| | MEAN OF EXTREME MINS. | 57 | 16.6 | 19.7 | 25.0 | 33.1 | 43.5 | 54.8 | 62.7 | 60.7 | 49.3 | 33.9 | 24.5 | 18.0 | 36.8 |
| | NORMAL DRY BULB | 30 | 44.6 | 47.9 | 55.4 | 63.2 | 71.6 | 78.5 | 82.0 | 80.3 | 74.7 | 63.7 | 54.7 | 47.0 | 63.6 |
| | MEAN DRY BULB | 57 | 45.0 | 47.9 | 55.0 | 63.5 | 71.7 | 78.1 | 81.5 | 80.2 | 74.5 | 63.8 | 54.3 | 46.6 | 63.5 |
| | MEAN WET BULB | 21 | 40.1 | 43.6 | 49.0 | 55.2 | 63.7 | 70.3 | 73.5 | 72.4 | 67.4 | 57.8 | 49.8 | 41.7 | 57.0 |
| | MEAN DEW POINT | 21 | 33.2 | 36.5 | 41.6 | 47.9 | 58.1 | 66.2 | 69.9 | 69.2 | 63.6 | 53.5 | 44.6 | 35.4 | 51.6 |
| | NORMAL NO. DAYS WITH: | | | | | | | | | | | | | | |
| | MAXIMUM ≥ 90° | 30 | 0.0 | 0.0 | 0.1 | 1.6 | 6.2 | 15.8 | 22.9 | 18.1 | 8.9 | 0.6 | 0.0 | 0.0 | 74.2 |
| | MAXIMUM ≤ 32° | 30 | 0.4 | 0.2 | * | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.7 |
| | MINIMUM ≤ 32° | 30 | 15.5 | 12.0 | 5.7 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 | 7.0 | 13.6 | 55.6 |
| | MINIMUM ≤ 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 |
| H/C | NORMAL HEATING DEG. DAYS | 30 | 628 | 485 | 321 | 131 | 23 | 0 | 0 | 0 | 8 | 121 | 325 | 552 | 2594 |
| | NORMAL COOLING DEG. DAYS | 30 | 2 | 4 | 20 | 69 | 211 | 390 | 519 | 467 | 296 | 76 | 15 | 5 | 2074 |
| RH | NORMAL (PERCENT) | 30 | 70 | 66 | 65 | 62 | 68 | 70 | 72 | 76 | 75 | 73 | 73 | 71 | 70 |
| | HOUR 01 LST | 30 | 78 | 77 | 77 | 77 | 83 | 85 | 86 | 89 | 89 | 88 | 85 | 81 | 83 |
| | HOUR 07 LST | 30 | 83 | 82 | 84 | 84 | 85 | 86 | 88 | 92 | 92 | 90 | 89 | 84 | 87 |
| | HOUR 13 LST | 30 | 55 | 50 | 48 | 43 | 48 | 50 | 53 | 56 | 55 | 50 | 51 | 54 | 51 |
| | HOUR 19 LST | 30 | 65 | 58 | 54 | 50 | 56 | 61 | 65 | 69 | 72 | 73 | 71 | 69 | 64 |
| S | PERCENT POSSIBLE SUNSHINE | 45 | 55 | 59 | 64 | 70 | 68 | 67 | 66 | 66 | 64 | 67 | 63 | 59 | 64 |
| W/O | MEAN NO. DAYS WITH: | | | | | | | | | | | | | | |
| | HEAVY FOG(VISBY≤1/4 MI) | 56 | 2.7 | 2.4 | 1.8 | 1.3 | 1.4 | 1.4 | 1.6 | 2.3 | 2.6 | 2.6 | 2.9 | 2.9 | 25.9 |
| | THUNDERSTORMS | 57 | 0.9 | 1.5 | 2.5 | 3.6 | 6.1 | 9.4 | 12.3 | 9.4 | 3.7 | 1.4 | 0.9 | 0.4 | 52.1 |
| CLOUDINESS | MEAN: | | | | | | | | | | | | | | |
| | SUNRISE-SUNSET (OKTAS) | 1 | | | | | 2.4 | 4.0 | | | | | | | |
| | MIDNIGHT-MIDNIGHT (OKTAS) | | | | | | | | | | | | | | |
| | MEAN NO. DAYS WITH: | | | | | | | | | | | | | | |
| | CLEAR | 1 | 2.0 | 4.0 | 5.0 | | 12.0 | 8.0 | | | | | | | |
| | PARTLY CLOUDY | 1 | | 2.0 | 3.0 | | 5.0 | 8.0 | | | | | | | |
| | CLOUDY | 1 | 5.0 | 3.0 | 8.0 | | 4.0 | 4.0 | | | | | | | |
| PR | MEAN STATION PRESSURE(IN) | 32 | 29.90 | 29.89 | 29.80 | 29.80 | 29.79 | 29.80 | 29.80 | 29.80 | 29.80 | 29.90 | 29.90 | 29.89 | 29.84 |
| | MEAN SEA-LEVEL PRES. (IN) | 19 | 30.13 | 30.12 | 30.06 | 30.00 | 30.00 | 29.99 | 30.03 | 30.02 | 30.03 | 30.10 | 30.13 | 30.15 | 30.06 |
| WINDS | MEAN SPEED (MPH) | 49 | 7.1 | 7.6 | 8.2 | 8.2 | 6.9 | 6.5 | 6.3 | 5.6 | 6.1 | 5.9 | 6.2 | 6.6 | 6.8 |
| | PREVAIL.DIR(TENS OF DEGS) | 33 | 24 | 24 | 25 | 24 | 24 | 24 | 23 | 23 | 03 | 03 | 27 | 25 | 24 |
| | MAXIMUM 2-MINUTE: | | | | | | | | | | | | | | |
| | SPEED (MPH) | 9 | 36 | 38 | 45 | 44 | 47 | 47 | 39 | 48 | 35 | 29 | 33 | 41 | 48 |
| | DIR. (TENS OF DEGS) | | 28 | 28 | 31 | 28 | 28 | 27 | 05 | 30 | 18 | 27 | 27 | 26 | 30 |
| | YEAR OF OCCURRENCE | | 2000 | 2003 | 2000 | 1997 | 1999 | 2001 | 2002 | 2002 | 2004 | 2001 | 2004 | 2000 | AUG 2002 |
| | MAXIMUM 5-SECOND: | | | | | | | | | | | | | | |
| | SPEED (MPH) | 9 | 47 | 45 | 52 | 56 | 71 | 58 | 63 | 64 | 46 | 35 | 43 | 49 | 71 |
| | DIR. (TENS OF DEGS) | | 27 | 27 | 26 | 25 | 36 | 27 | 03 | 29 | 18 | 27 | 33 | 26 | 36 |
| | YEAR OF OCCURRENCE | | 2000 | 1999 | 1999 | 1997 | 1999 | 2000 | 2002 | 2002 | 2004 | 2003 | 1999 | 2000 | MAY 1999 |
| PRECIPITATION | NORMAL (IN) | 30 | 4.66 | 3.84 | 4.59 | 2.98 | 3.17 | 4.99 | 5.54 | 5.41 | 3.94 | 2.89 | 2.88 | 3.38 | 48.27 |
| | MAXIMUM MONTHLY (IN) | 57 | 9.26 | 8.68 | 10.89 | 6.85 | 9.39 | 14.81 | 17.46 | 16.72 | 8.78 | 12.09 | 7.20 | 8.54 | 17.46 |
| | YEAR OF OCCURRENCE | | 1978 | 1961 | 1973 | 1979 | 2002 | 1973 | 1991 | 1949 | 1953 | 1959 | 1957 | 1981 | JUL 1991 |
| | MINIMUM MONTHLY (IN) | 57 | 0.84 | 0.87 | 0.56 | 0.29 | 0.29 | 0.49 | 0.57 | 0.22 | 0.07 | T | 0.41 | 0.32 | T |
| | YEAR OF OCCURRENCE | | 1981 | 1976 | 1985 | 1994 | 1951 | 2002 | 1977 | 1997 | 1985 | 1963 | 1973 | 1955 | OCT 1963 |
| | MAXIMUM IN 24 HOURS (IN) | 57 | 3.15 | 3.69 | 3.59 | 3.66 | 5.57 | 5.44 | 5.81 | 7.66 | 6.23 | 5.46 | 2.60 | 3.18 | 7.66 |
| | YEAR OF OCCURRENCE | | 1993 | 1962 | 1960 | 1956 | 1967 | 1973 | 1959 | 1949 | 1953 | 1964 | 1986 | 1970 | AUG 1949 |
| | NORMAL NO. DAYS WITH: | | | | | | | | | | | | | | |
| | PRECIPITATION ≥ 0.01 | 30 | 11.0 | 9.1 | 10.0 | 7.7 | 8.6 | 10.3 | 11.5 | 10.3 | 8.1 | 6.4 | 7.5 | 9.6 | 110.1 |
| | PRECIPITATION ≥ 1.00 | 30 | 1.3 | 1.2 | 1.3 | 0.8 | 0.8 | 1.4 | 1.9 | 1.9 | 1.4 | 0.9 | 1.0 | 0.9 | 14.8 |
| SNOWFALL | NORMAL (IN) | 30 | 0.6 | 1.1 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.* | 0.1 | 2.1 |
| | MAXIMUM MONTHLY (IN) | 56 | 4.3 | 16.0 | 4.1 | T | T | 0.0 | 0.0 | T | 0.0 | 0.0 | T | 9.1 | 16.0 |
| | YEAR OF OCCURRENCE | | 1988 | 1973 | 1980 | 1992 | 2001 | | | 1993 | | | 1976 | 1958 | FEB 1973 |
| | MAXIMUM IN 24 HOURS (IN) | 56 | 4.3 | 15.7 | 4.1 | T | T | 0.0 | 0.0 | T | 0.0 | 0.0 | T | 8.8 | 15.7 |
| | YEAR OF OCCURRENCE | | 1988 | 1973 | 1980 | 1992 | 2001 | | | 1993 | | | 1976 | 1958 | FEB 1973 |
| | MAXIMUM SNOW DEPTH (IN) | 55 | 4 | 14 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 14 |
| | YEAR OF OCCURRENCE | | 2000 | 1973 | 1980 | | | | | | | | | 1958 | FEB 1973 |
| | NORMAL NO. DAYS WITH: | | | | | | | | | | | | | | |
| | SNOWFALL ≥ 1.0 | 30 | 0.1 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 |

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(Reference 213)

## Table 2.3-203
## Climatological Extremes at Selected NWS and Cooperative Observing Stations in the Units 2 and 3 Site Area

| Station | Maximum Temperature[a] (°F) | Minimum Temperature[a] (°F) | Max 24-Hr Rainfall[a] (inches) | Max Monthly Rainfall[a] (inches) | Max 24-Hr Snowfall[a] (inches) | Max Monthly Snowfall[a] (inches) |
|---|---|---|---|---|---|---|
| Parr | 107[b][c][d] (07/20/86) | –1[b][c] (12/12/62) | 7.08[b][c] (09/04/98) | 12.20[b][e] (06/89) | 7.5[b][c] (02/10/73) | 7.5[b][e][f] (02/73) |
| Little Mountain | 108[b][c][g] (07/24/52) | –2[b][c] (01/21/85) | 6.46[b][c] (08/18/86) | 15.70[b][e] (08/86) | 10.0[c][e] (12/11/58) | 11.0[c][e] (02/69) |
| Blair | NA[h] | NA[h] | 7.14[c][e] (08/23/67) | 12.00[c][e] (03/80) | 12.0[c][e] (02/26/69) | 12.5[c][e] (02/69) |
| Winnsboro | 107[b][c] (06/28/54) | –1[b][c][i] (01/22/85) | 7.77[b][c] (07/10/59) | 14.90[c][e] (08/52) | 12.0[b][c] (02/10/73) | 12.0[b][e] (02/73) |
| Newberry | 108[b][c] (08/21/83) | –1[b][c][j] (01/21/85) | 10.42[b][c] (08/18/86) | 17.04[b][e] (08/86) | 8.0[b][c][e] (01/25/00) | 8.0[b][c][e][k] (01/00) |
| Columbia Metro Airport (WSFO) | 107[b][c][l] (08/21/83) | –1[b][c] (01/21/85) | 5.79[b][c] (07/09/59) | 17.46[b][e] (07/91) | 12.3[b][c] (02/10/73) | 16.0[b][e] (02/73) |
| Santuck | 108[b][c] (07/29/52) | –4[b][c] (01/21/85) | 6.14[b][c] (08/23/67) | 14.76[c][m] (09/04) | 9.5[c][e] (12/29/35) | 12.9[b][e] (01/00) |
| Chester 1NW | 106[b][c] (08/21/83) | –5[b][c] (12/13/62) | 8.40[b][e] (08/23/67) | 15.23[c][e] (08/67) | 7.5[c][e] (02/09/67) | 16.5[c][e] (03/60) |
| Saluda | 109[b][c] (07/14/80) | –2[b][c][n] (01/22/85) | 6.05[b][c] (08/30/64) | 14.96[c][e] (09/59) | 8.0[c][e] (12/11/58) | 10.0[b][c][e][o] (02/73) |
| Camden 3W | 111[b][c] (06/28/54) | –3[b][c] (01/22/85) | 9.62[b][c] (10/11/90) | 16.93[b][e] (10/90) | 9.0[b][c] (02/10/73) | 12.0[b][e] (02/73) |
| Pelion 4NW | 107[b][c][p] (08/01/80) | –2[b][c] (01/21/85) | 7.10[b][c] (09/04/98) | 14.61[c][m] (07/03) | 9.0[b][c] (02/10/73) | 15.5[b][e] (02/73) |
| Kershaw 2SW | 107[b][c] (06/28/54) | –4[b][c][n] (01/22/85) | 10.14[b][e] (09/04/98) | 18.55[c][e] (08/52) | 12.0[c][e] (12/12/58) | 12.0[c][e] (12/58) |
| Catawba | NA[h] | NA[h] | 7.77[c][e] (07/24/97) | 18.26[c][e] (08/67) | 13.5[c][m] (02/27/04) | 14.1[c][m] (02/04) |
| Johnston 4SW | 107[b][c][q] (08/25/02) | –2[b][c][n] (01/22/85) | 6.35[b][c] (08/30/64) | 15.88[c][e] (06/65) | 14.0[b][c] (02/10/73) | 14.0[c][e] (02/73) |

(a) Most recent date of occurrence shown in table
(b) Source: Reference 214
(c) Source: Reference 222
(d) Occurs on multiple dates: 07/20/86; 08/22/83
(e) Source: Reference 211
(f) Occurs for multiple months: 02/73; 12/58
(g) Occurs on multiple dates: 07/24/52; 07/21/52
(h) NA = Temperature measurements not made at this cooperative observing station
(i) Occurs on multiple dates: 01/22/85; 01/21/85; 12/13/62
(j) Occurs on multiple dates: 01/21/85; 03/03/80
(k) Occurs for multiple months: 01/00; 03/60
(l) Occurs on multiple dates: 08/21/83; 07/29/52; 07/24/52; 07/23/52; 06/27/54
(m) Source: Reference 215
(n) Occurs on multiple dates: 01/22/85; 01/21/85
(o) Occurs for multiple months: 02/73; 12/58
(p) Occurs on multiple dates: 08/01/80; 07/13/80
(q) Occurs on multiple dates: 08/25/02; 08/15/99; 07/14/80

## Table 2.3-204
## Morning and Afternoon Mixing Heights, Wind Speeds, and Ventilation Indices for the VCSNS Site Area

| Period | Statistic[a] | Mixing Height (m, Above Ground Level)[b] | | Wind Speed (m/sec) | | Ventilation Index - ($m^2$/sec)[c] | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | AM | PM | AM | PM | AM | Classification | PM | Classification |
| January | Min | 262 | 667 | 3.0 | 2.7 | 773 | P | 1,832 | M |
| | Max | 544 | 1,034 | 4.0 | 4.0 | 2,095 | M | 3,490 | F |
| | Mean | 398 | 844 | 3.3 | 3.3 | 1,359 | M | 2,718 | F |
| February | Min | 252 | 841 | 2.7 | 2.7 | 847 | P | 1,945 | M |
| | Max | 582 | 1,322 | 4.2 | 4.1 | 2,299 | M | 4,821 | G |
| | Mean | 421 | 1,081 | 3.4 | 3.4 | 1537 | M | 3,586 | G |
| March | Min | 322 | 956 | 2.9 | 2.9 | 1,000[d] | P | 3,259 | F |
| | Max | 552 | 1,676 | 3.9 | 3.9 | 2,400[d] | F | 5,922 | G |
| | Mean | 428 | 1,360 | 3.4 | 3.4 | 1,600[d] | M | 5,922 | G |
| April | Min | 269 | 1,414 | 2.7 | 2.9 | 928 | P | 4,193 | G |
| | Max | 546 | 2,078 | 3.8 | 3.7 | 2,249 | M | 6,440 | G |
| | Mean | 401 | 1,665 | 3.3 | 3.2 | 1,488 | M | 5,245 | G |
| May | Min | 211 | 1,383 | 2.4 | 2.6 | 626 | P | 3,734 | G |
| | Max | 570 | 2,243 | 4.0 | 3.5 | 1,992 | M | 7,279 | G |
| | Mean | 393 | 1,745 | 3.0 | 3.0 | 1,302 | M | 5,137 | G |
| June | Min | 281 | 1,439 | 2.5 | 2.4 | 752 | P | 3,679 | G |
| | Max | 480 | 2,105 | 3.4 | 3.4 | 1,681 | M | 5,940 | G |
| | Mean | 389 | 1,725 | 2.9 | 2.8 | 1,177 | M | 4,742 | G |
| July | Min | 265 | 1,369 | 2.5 | 2.3 | 731 | P | 3,466 | F |
| | Max | 619 | 2,153 | 3.4 | 3.2 | 1,846 | M | 6,433 | G |
| | Mean | 398 | 1,673 | 2.8 | 2.8 | 1,183 | M | 4,597 | G |
| August | Min | 207 | 1,392 | 2.3 | 2.1 | 523 | P | 3,294 | F |
| | Max | 594 | 2,012 | 3.4 | 3.0 | 1,799 | M | 5,450 | G |
| | Mean | 386 | 1,592 | 2.7 | 2.6 | 1,099 | P | 4,138 | G |
| September | Min | 251 | 1,044 | 2.3 | 2.2 | 602 | P | 2,974 | F |
| | Max | 621 | 1,654 | 3.4 | 3.3 | 2,237 | M | 4,620 | G |
| | Mean | 370 | 1,431 | 2.9 | 2.7 | 1,144 | P | 3,773 | G |
| October | Min | 193 | 1,047 | 2.4 | 2.3 | 510 | P | 2,722 | F |
| | Max | 435 | 1,676 | 3.5 | 3.2 | 1,644 | M | 5,204 | G |
| | Mean | 313 | 1,265 | 3.0 | 2.8 | 1,020 | P | 3,440 | F |
| November | Min | 210 | 708 | 2.6 | 2.7 | 690 | P | 2,144 | M |
| | Max | 477 | 1,187 | 3.8 | 3.5 | 1,966 | M | 3,673 | G |
| | Mean | 344 | 1,039 | 3.1 | 3.0 | 1,194 | M | 3,054 | F |
| December | Min | 253 | 701 | 2.6 | 2.7 | 785 | P | 2,164 | M |
| | Max | 469 | 945 | 4.0 | 4.3 | 1,807 | M | 3,172 | F |
| | Mean | 374 | 831 | 3.2 | 3.2 | 1,282 | M | 2,678 | F |
| Winter | Mean | 397 | 913 | 3.3 | 3.3 | 1,388 | M | 2,974 | F |
| Spring | Mean | 407 | 1,589 | 3.2 | 3.2 | 1,463 | M | 4,943 | G |
| Summer | Mean | 391 | 1,663 | 2.8 | 2.7 | 1,153 | P | 4,490 | G |
| Autumn | Mean | 342 | 1,245 | 3.0 | 2.8 | 1,118 | P | 3,423 | F |
| Annual | Mean | 384 | 1,355 | 3.1 | 3.0 | 1,280 | M | 3,964 | G |

(a) Monthly minimum, maximum, and mean values are based directly on summaries available from USDA - Forest Service Ventilation Climate Information System (VCIS) (Reference 226). Seasonal and annual mean values represent weighted averages based on the number of days in the appropriate months.

(b) AGL = above ground level

(c) Classifications of ventilation potential from Ventilation Index: P = Poor (0 to 1175 $m^2$/sec); M = Marginal (1176 to 2350 $m^2$/sec); F = Fair (2351 to 3525 $m^2$/sec); G = Good (> 3525 $m^2$/sec);

(d) The mixing height is set to an arbitrary “free height” by VCIS when the mixing height for a given location, as interpolated by the VCIS from observed mixing heights, is mapped to be at or below local ground level elevation.

Source: References 225 and 226

## Table 2.3-205
## Climatological Normals (Means) at Selected NWS and Cooperative Observing Stations in the VCSNS Site Area

| Station | Normal Annual Temperatures (°F)[a] | | | Normal Annual Precipitation | |
|---|---|---|---|---|---|
| | Daily Maximum | Daily Minimum | Daily Mean | Rainfall[a] (inches) | Snowfall[b] (inches) |
| Parr | 74.6 | 48.7 | 61.6 | 45.75 | 2.0 |
| Little Mountain | 72.0 | 50.9 | 61.5 | 48.27 | 2.6 |
| Blair | NA[c] | NA[c] | NA[c] | 43.59 | 2.5[d] |
| Winnsboro | 72.8 | 50.0 | 61.4 | 45.84 | 2.8 |
| Newberry | 74.1 | 48.6 | 61.4 | 49.33 | 2.1 |
| Columbia Metro Airport (WSFO) | 74.8 | 52.5 | 63.6 | 48.27 | 2.1 |
| Santuck | 72.9 | 51.0 | 62.0 | 46.20 | 3.9 |
| Chester 1NW | 72.2 | 48.0 | 60.1 | 47.87 | 3.4 |
| Saluda | 74.3 | 49.5 | 61.9 | 47.79 | 2.8 |
| Camden 3W | 71.8 | 47.9 | 59.9 | 46.65 | 2.4 |
| Pelion 4NW | 75.2 | 51.1 | 63.2 | 51.03 | 1.4 |
| Kershaw 2SW | 73.2 | 48.2 | 60.7 | 47.97 | 1.5 |
| Catawba | NA[c] | NA[c] | NA[c] | 46.51 | 3.7[e] |
| Johnston 4SW | 73.9 | 47.1 | 60.5 | 48.65 | 2.1 |

(a) Reference 208
(b) Reference 214
(c) NA = Temperature measurements not made at this cooperative observing station
(d) Reference 222, based on available Period of Record (1948–1982); represents sum of individual monthly means
(e) Reference 222, based on available Period of Record (1948–2006); represents sum of individual monthly means

# Table 2.3-206
## Seasonal and Annual Mean Wind Speeds for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) and the Columbia, South Carolina NWS Station

| Primary Tower Elevation | Location | Winter | Spring | Summer | Autumn | Annual |
|---|---|---|---|---|---|---|
| Upper Level (61 meters) (m/sec) | Unit 1 Site | 5.0 | 5.1 | 3.8 | 4.7 | 4.6 |
| Lower Level (10 meters) (m/sec) | Unit 1 Site | 3.3 | 3.3 | 2.9 | 3.5 | 3.2 |
| Single Level (6.1 meters) (m/sec) | Columbia Metro Airport WSFO[(a)] | 3.2 | 3.5 | 2.7 | 2.7 | 3.0 |

(a) Reference 213

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

## Table 2.3-207 (Sheet 1 of 2)
## Wind Direction Persistence/Wind Speed Distributions for the Unit 1 Monitoring Program – 10-Meter Level

**Site Name: Summer** **Start Date: 7/1/2003 00:00** **End Date: 6/30/2006 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 | 666 | 1078 | 2039 | 1534 | 939 | 441 | 587 | 1022 | 1206 | 1523 | 1713 | 1552 | 1512 | 524 | 591 | 517 |
| 2 | 248 | 483 | 1214 | 835 | 483 | 161 | 225 | 485 | 611 | 761 | 890 | 736 | 834 | 191 | 250 | 189 |
| 4 | 60 | 163 | 586 | 315 | 177 | 39 | 43 | 150 | 214 | 255 | 287 | 238 | 360 | 38 | 79 | 48 |
| 8 | 7 | 30 | 230 | 68 | 35 | 1 | 5 | 19 | 38 | 37 | 43 | 25 | 113 | 1 | 11 | 4 |
| 12 | 2 | 9 | 114 | 29 | 13 | 0 | 1 | 0 | 9 | 6 | 5 | 3 | 43 | 0 | 0 | 0 |
| 18 | 0 | 0 | 41 | 8 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 13 | 0 | 0 | 0 |
| 24 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 |
| 30 | 0 | 0 | 4 | 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: 10.00 mph**
**Direction**

| Hours | N | NNE | NE | ENE | E | ESE | SE | SSE | S | WSW | SW | WSW | W | WNW | NW | NNW |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 264 | 568 | 1238 | 745 | 200 | 48 | 56 | 85 | 196 | 179 | 130 | 132 | 256 | 47 | 132 | 204 |
| 2 | 110 | 321 | 814 | 421 | 107 | 17 | 18 | 43 | 114 | 94 | 60 | 50 | 151 | 15 | 66 | 109 |
| 4 | 30 | 127 | 442 | 180 | 46 | 3 | 3 | 18 | 50 | 32 | 14 | 10 | 61 | 1 | 26 | 34 |
| 8 | 5 | 24 | 190 | 57 | 12 | 0 | 0 | 1 | 14 | 1 | 0 | 0 | 14 | 0 | 2 | 2 |
| 12 | 1 | 6 | 85 | 29 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 |
| 18 | 0 | 0 | 22 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 4 | 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: 15.00 mph**
**Direction**

| Hours | N | NNE | NE | ENE | E | ESE | SE | SSE | S | WSW | SW | WSW | W | WNW | NW | NNW |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 80 | 223 | 283 | 118 | 21 | 4 | 7 | 12 | 41 | 18 | 0 | 2 | 23 | 2 | 24 | 79 |
| 2 | 32 | 121 | 144 | 63 | 13 | 1 | 4 | 7 | 28 | 8 | 0 | 0 | 8 | 0 | 13 | 44 |
| 4 | 6 | 42 | 60 | 26 | 6 | 0 | 1 | 3 | 16 | 2 | 0 | 0 | 4 | 0 | 5 | 13 |
| 8 | 0 | 5 | 8 | 6 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 0 | 0 | 1 | 2 | 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 2.3-207 (Sheet 2 of 2)
## Wind Direction Persistence/Wind Speed Distributions for the Unit 1 Monitoring Program – 10-Meter Level

**Site Name: Summer** **Start Date: 7/1/2003 00:00** **End Date: 6/30/2006 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 | 16 | 29 | 18 | 6 | 0 | 0 | 0 | 0 | 7 | 1 | 0 | 0 | 1 | 0 | 4 | 14 |
| 2 | 6 | 14 | 4 | 2 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 1 | 6 |
| 4 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 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: 25.00 mph**
**Direction**

| Hours | N | NNE | NE | ENE | E | ESE | SE | SSE | S | WSW | SW | WSW | W | WNW | NW | NNW |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 1 | 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 |

**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 | 1 | 0 | 0 | 0 | 0 | 0 | 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 2.3-208 (Sheet 1 of 2)
## Wind Direction Persistence/Wind Speed Distributions for the Unit 1 Monitoring Program – 61-Meter Level

**Site Name: Summer** **Start Date: 7/1/2003 00:00** **End Date: 6/30/2006 23:00**

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

**Measurement Height, m: 61** **Speed Sensor: 2** **Direction Sensor: 2**

**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 | 620 | 1010 | 1864 | 1999 | 1174 | 734 | 815 | 1087 | 1419 | 1546 | 2702 | 3077 | 1716 | 681 | 677 | 651 |
| 2 | 244 | 472 | 1099 | 1221 | 643 | 356 | 389 | 593 | 780 | 796 | 1636 | 1989 | 976 | 282 | 310 | 290 |
| 4 | 66 | 152 | 497 | 564 | 246 | 131 | 114 | 217 | 298 | 267 | 680 | 936 | 423 | 70 | 97 | 87 |
| 8 | 8 | 29 | 133 | 167 | 59 | 24 | 10 | 46 | 52 | 41 | 138 | 264 | 113 | 3 | 18 | 11 |
| 12 | 0 | 12 | 47 | 54 | 20 | 11 | 0 | 13 | 10 | 2 | 34 | 90 | 32 | 0 | 0 | 0 |
| 18 | 0 | 0 | 8 | 2 | 2 | 4 | 0 | 0 | 1 | 0 | 3 | 13 | 1 | 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: 10.00 mph**
**Direction**

| Hours | N | NNE | NE | ENE | E | ESE | SE | SSE | S | WSW | SW | WSW | W | WNW | NW | NNW |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 291 | 538 | 1230 | 1294 | 601 | 297 | 357 | 646 | 855 | 835 | 1524 | 1999 | 1107 | 191 | 285 | 354 |
| 2 | 126 | 293 | 779 | 823 | 343 | 152 | 161 | 354 | 490 | 430 | 888 | 1312 | 657 | 65 | 134 | 177 |
| 4 | 38 | 111 | 388 | 381 | 150 | 59 | 44 | 130 | 192 | 139 | 355 | 647 | 284 | 19 | 50 | 59 |
| 8 | 4 | 28 | 122 | 121 | 43 | 8 | 4 | 21 | 34 | 16 | 63 | 192 | 78 | 1 | 5 | 8 |
| 12 | 0 | 12 | 41 | 46 | 19 | 0 | 0 | 3 | 8 | 0 | 13 | 70 | 25 | 0 | 0 | 0 |
| 18 | 0 | 0 | 8 | 2 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 9 | 1 | 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: 15.00 mph**
**Direction**

| Hours | N | NNE | NE | ENE | E | ESE | SE | SSE | S | WSW | SW | WSW | W | WNW | NW | NNW |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 94 | 219 | 459 | 395 | 132 | 62 | 61 | 129 | 228 | 176 | 353 | 732 | 356 | 27 | 61 | 125 |
| 2 | 33 | 116 | 269 | 226 | 77 | 26 | 20 | 52 | 112 | 78 | 164 | 462 | 199 | 7 | 23 | 61 |
| 4 | 5 | 45 | 113 | 116 | 41 | 5 | 7 | 16 | 33 | 19 | 41 | 219 | 89 | 1 | 9 | 12 |
| 8 | 0 | 11 | 27 | 43 | 24 | 0 | 1 | 1 | 6 | 0 | 5 | 58 | 19 | 0 | 0 | 0 |
| 12 | 0 | 5 | 6 | 17 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 16 | 6 | 0 | 0 | 0 |
| 18 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 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 2.3-208 (Sheet 2 of 2)
## Wind Direction Persistence/Wind Speed Distributions for the Unit 1 Monitoring Program – 61-Meter Level

**Site Name: Summer** **Start Date: 7/1/2003 00:00** **End Date: 6/30/2006 23:00**

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

**Measurement Height, m: 61** **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 | 25 | 48 | 67 | 38 | 19 | 7 | 10 | 14 | 43 | 21 | 34 | 150 | 95 | 2 | 17 | 38 |
| 2 | 9 | 27 | 34 | 19 | 9 | 2 | 5 | 8 | 28 | 4 | 7 | 66 | 55 | 0 | 7 | 19 |
| 4 | 0 | 10 | 17 | 5 | 2 | 0 | 2 | 4 | 15 | 0 | 0 | 19 | 25 | 0 | 2 | 2 |
| 8 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 10 | 0 | 0 | 0 |
| 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 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 | 4 | 6 | 7 | 6 | 1 | 0 | 0 | 2 | 10 | 1 | 3 | 17 | 24 | 0 | 1 | 1 |
| 2 | 1 | 1 | 3 | 2 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 4 | 10 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 5 | 0 | 0 | 0 |
| 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 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 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 5 | 0 | 1 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 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 2.3-209
## Seasonal and Annual Vertical Stability Class and Mean 10-Meter Level Wind Speed Distributions for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

| Period | Vertical Stability Categories[a] | | | | | | |
|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G |
| **Winter** | | | | | | | |
| Frequency (%) | 4.12 | 4.15 | 8.51 | 37.82 | 24.28 | 10.74 | 10.4 |
| Wind Speed (m/sec) | 4.1 | 4.3 | 4.5 | 4.0 | 2.7 | 2.2 | 1.9 |
| **Spring** | | | | | | | |
| Frequency (%) | 11.39 | 7.4 | 9.2 | 30.05 | 26.12 | 10.7 | 5.15 |
| Wind Speed (m/sec) | 3.9 | 3.9 | 4.0 | 3.9 | 2.7 | 2.2 | 1.9 |
| **Summer** | | | | | | | |
| Frequency (%) | 15.05 | 9.11 | 9.56 | 32.95 | 23.89 | 7.57 | 1.87 |
| Wind Speed (m/sec) | 2.9 | 3.1 | 3.2 | 3.3 | 2.3 | 2.1 | 1.8 |
| **Autumn** | | | | | | | |
| Frequency (%) | 6.58 | 6.44 | 8.74 | 42.30 | 18.19 | 8.64 | 9.10 |
| Wind Speed (m/sec) | 3.5 | 4.0 | 4.4 | 4.2 | 2.5 | 2.1 | 1.7 |
| **Annual** | | | | | | | |
| Frequency (%) | 9.24 | 6.76 | 8.99 | 35.80 | 23.12 | 9.42 | 6.66 |
| Wind Speed (m/sec) | 3.5 | 3.7 | 4.0 | 3.9 | 2.6 | 2.2 | 1.8 |

(a) Vertical stability based on temperature difference ($\Delta T$) between 61-meter and 10-meter measurement levels.

## Table 2.3-210 (Sheet 1 of 8) Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

**Hours at Each Wind Speed and Direction**

**Period of Record:** 07/01/03 0:00 - 06/30/06 23:00 Total Period

**Elevation:** **Speed:** SPD10M **Direction:** DIR10M **Lapse:** DT61M

**Stability Class:** A Delta Temperature Extremely Unstable

| | Wind Speed (m/s) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Wind Direction (from)** | **0.22-0.50** | **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 | 8 | 25 | 37 | 6 | 9 | 2 | 0 | 0 | 0 | 87 |
| **NNE** | 0 | 0 | 0 | 6 | 35 | 37 | 14 | 13 | 4 | 1 | 0 | 0 | 110 |
| **NE** | 0 | 0 | 0 | 5 | 24 | 48 | 29 | 29 | 7 | 1 | 0 | 0 | 143 |
| **ENE** | 0 | 0 | 0 | 3 | 5 | 30 | 45 | 15 | 10 | 0 | 0 | 0 | 108 |
| **E** | 0 | 0 | 0 | 0 | 3 | 16 | 25 | 1 | 0 | 0 | 0 | 0 | 45 |
| **ESE** | 0 | 0 | 0 | 1 | 1 | 10 | 20 | 2 | 0 | 0 | 0 | 0 | 34 |
| **SE** | 0 | 0 | 0 | 0 | 1 | 21 | 20 | 3 | 0 | 0 | 0 | 0 | 45 |
| **SSE** | 0 | 0 | 0 | 1 | 7 | 20 | 31 | 7 | 0 | 0 | 0 | 0 | 66 |
| **S** | 0 | 0 | 0 | 2 | 4 | 13 | 42 | 10 | 5 | 0 | 0 | 0 | 76 |
| **SSW** | 0 | 0 | 0 | 1 | 4 | 61 | 75 | 13 | 1 | 0 | 0 | 0 | 155 |
| **SW** | 0 | 0 | 1 | 8 | 26 | 199 | 134 | 11 | 0 | 0 | 0 | 0 | 379 |
| **WSW** | 0 | 0 | 0 | 5 | 44 | 212 | 263 | 34 | 0 | 0 | 0 | 0 | 558 |
| **W** | 0 | 0 | 1 | 4 | 20 | 46 | 148 | 29 | 1 | 0 | 0 | 0 | 249 |
| **WNW** | 0 | 0 | 0 | 4 | 7 | 35 | 48 | 4 | 0 | 0 | 0 | 0 | 98 |
| **NW** | 0 | 0 | 0 | 5 | 7 | 28 | 53 | 8 | 2 | 0 | 0 | 0 | 103 |
| **NNW** | 0 | 0 | 0 | 2 | 20 | 28 | 15 | 5 | 6 | 1 | 0 | 0 | 77 |
| **Totals** | 0 | 0 | 2 | 55 | 233 | 841 | 968 | 193 | 38 | 3 | 0 | 0 | 2333 |

| | |
|---|---|
| **Number of Calm Hours for this Table** | 0 |
| **Number of Variable Direction Hours for this Table** | 0 |
| **Number of Invalid Hours** | 1066 |
| **Number of Valid Hours for this Table** | 2333 |
| **Total Hours for the Period** | 26304 |

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

## Table 2.3-210 (Sheet 2 of 8)
## Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

**Hours at Each Wind Speed and Direction**

**Period of Record:** 07/01/03 0:00 - 06/30/06 23:00 Total Period

**Elevation:** **Speed:** SPD10M **Direction:** DIR10M **Lapse:** DT61M

**Stability Class:** B Delta Temperature Moderately Unstable

| | Wind Speed (m/s) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Wind Direction (from)** | **0.22-0.50** | **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 | 6 | 19 | 25 | 22 | 12 | 7 | 0 | 0 | 0 | 91 |
| **NNE** | 0 | 0 | 0 | 6 | 10 | 37 | 13 | 24 | 17 | 2 | 0 | 0 | 109 |
| **NE** | 0 | 0 | 0 | 3 | 7 | 37 | 57 | 37 | 18 | 1 | 0 | 0 | 160 |
| **ENE** | 0 | 0 | 0 | 2 | 8 | 23 | 53 | 18 | 8 | 0 | 0 | 0 | 112 |
| **E** | 0 | 0 | 0 | 2 | 3 | 17 | 30 | 11 | 3 | 0 | 0 | 0 | 66 |
| **ESE** | 0 | 0 | 0 | 1 | 2 | 7 | 16 | 5 | 1 | 0 | 0 | 0 | 32 |
| **SE** | 0 | 0 | 0 | 0 | 1 | 17 | 13 | 1 | 0 | 0 | 0 | 0 | 32 |
| **SSE** | 0 | 0 | 1 | 1 | 2 | 14 | 25 | 4 | 1 | 0 | 0 | 0 | 48 |
| **S** | 0 | 0 | 0 | 1 | 1 | 23 | 50 | 15 | 3 | 0 | 0 | 0 | 93 |
| **SSW** | 0 | 0 | 0 | 4 | 8 | 57 | 64 | 13 | 2 | 0 | 0 | 0 | 148 |
| **SW** | 0 | 0 | 0 | 8 | 22 | 85 | 59 | 4 | 0 | 0 | 0 | 0 | 178 |
| **WSW** | 0 | 0 | 0 | 9 | 14 | 90 | 65 | 6 | 0 | 0 | 0 | 0 | 184 |
| **W** | 0 | 0 | 2 | 3 | 17 | 45 | 61 | 35 | 5 | 0 | 0 | 0 | 168 |
| **WNW** | 0 | 0 | 0 | 2 | 8 | 31 | 45 | 4 | 0 | 0 | 0 | 0 | 90 |
| **NW** | 0 | 0 | 0 | 1 | 8 | 34 | 44 | 12 | 9 | 0 | 0 | 0 | 108 |
| **NNW** | 0 | 0 | 0 | 9 | 13 | 23 | 21 | 12 | 7 | 1 | 0 | 0 | 86 |
| **Totals** | 0 | 0 | 3 | 58 | 143 | 565 | 638 | 213 | 81 | 4 | 0 | 0 | 1705 |

| | |
|---|---|
| **Number of Calm Hours for this Table** | 0 |
| **Number of Variable Direction Hours for this Table** | 0 |
| **Number of Invalid Hours** | 1066 |
| **Number of Valid Hours for this Table** | 1705 |
| **Total Hours for the Period** | 26304 |

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

## Table 2.3-210 (Sheet 3 of 8) Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

**Hours at Each Wind Speed and Direction**

**Period of Record:** 07/01/03 0:00 - 06/30/06 23:00 Total Period

**Elevation:** **Speed:** SPD10M **Direction:** DIR10M **Lapse:** DT61M

**Stability Class:** C Delta Temperature Slightly Unstable

| Wind Direction (from) | Wind Speed (m/s) 0.22-0.50 | 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 | 9 | 27 | 47 | 39 | 28 | 15 | 2 | 0 | 0 | 167 |
| NNE | 0 | 1 | 0 | 7 | 17 | 50 | 43 | 67 | 52 | 1 | 1 | 0 | 239 |
| NE | 0 | 0 | 0 | 7 | 22 | 65 | 109 | 142 | 62 | 0 | 0 | 0 | 407 |
| ENE | 0 | 0 | 0 | 4 | 5 | 28 | 79 | 59 | 22 | 0 | 0 | 0 | 197 |
| E | 0 | 0 | 0 | 1 | 5 | 30 | 30 | 16 | 5 | 0 | 0 | 0 | 87 |
| ESE | 0 | 0 | 0 | 1 | 3 | 17 | 24 | 3 | 0 | 0 | 0 | 0 | 48 |
| SE | 0 | 0 | 0 | 0 | 4 | 25 | 19 | 3 | 0 | 0 | 0 | 0 | 51 |
| SSE | 0 | 0 | 0 | 2 | 5 | 26 | 33 | 4 | 2 | 0 | 0 | 0 | 72 |
| S | 0 | 0 | 0 | 1 | 9 | 45 | 50 | 13 | 5 | 0 | 0 | 0 | 123 |
| SSW | 0 | 0 | 0 | 4 | 11 | 49 | 53 | 11 | 0 | 0 | 0 | 0 | 128 |
| SW | 0 | 0 | 0 | 6 | 23 | 71 | 50 | 14 | 0 | 0 | 0 | 0 | 164 |
| WSW | 0 | 0 | 1 | 10 | 34 | 66 | 50 | 7 | 1 | 0 | 0 | 0 | 169 |
| W | 0 | 0 | 0 | 4 | 12 | 45 | 70 | 13 | 0 | 0 | 0 | 0 | 144 |
| WNW | 0 | 0 | 0 | 6 | 14 | 31 | 35 | 4 | 0 | 0 | 0 | 0 | 90 |
| NW | 0 | 0 | 0 | 6 | 8 | 32 | 29 | 14 | 3 | 0 | 0 | 0 | 92 |
| NNW | 0 | 0 | 0 | 10 | 14 | 28 | 20 | 9 | 11 | 0 | 0 | 0 | 92 |
| Totals | 0 | 1 | 1 | 78 | 213 | 655 | 733 | 407 | 178 | 3 | 1 | 0 | 2270 |

| | |
|---|---|
| **Number of Calm Hours for this Table** | 0 |
| **Number of Variable Direction Hours for this Table** | 0 |
| **Number of Invalid Hours** | 1066 |
| **Number of Valid Hours for this Table** | 2270 |
| **Total Hours for the Period** | 26304 |

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

## Table 2.3-210 (Sheet 4 of 8) Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

**Hours at Each Wind Speed and Direction**

**Period of Record:** 07/01/03 0:00 - 06/30/06 23:00 Total Period

**Elevation:** **Speed:** SPD10M **Direction:** DIR10M **Lapse:** DT61M

**Stability Class:** D Delta Temperature Neutral

| | Wind Speed (m/s) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Wind Direction (from)** | **0.22-0.50** | **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 | 7 | 32 | 50 | 107 | 140 | 95 | 34 | 4 | 0 | 0 | 470 |
| **NNE** | 0 | 1 | 2 | 31 | 55 | 136 | 211 | 217 | 89 | 2 | 0 | 0 | 744 |
| **NE** | 1 | 0 | 3 | 19 | 39 | 159 | 508 | 573 | 108 | 3 | 0 | 0 | 1413 |
| **ENE** | 0 | 0 | 1 | 7 | 21 | 157 | 564 | 319 | 49 | 1 | 0 | 0 | 1119 |
| **E** | 0 | 0 | 1 | 8 | 29 | 179 | 310 | 91 | 8 | 0 | 0 | 0 | 626 |
| **ESE** | 0 | 0 | 0 | 5 | 16 | 119 | 118 | 16 | 1 | 0 | 0 | 0 | 275 |
| **SE** | 0 | 0 | 0 | 8 | 26 | 138 | 113 | 16 | 1 | 0 | 0 | 0 | 302 |
| **SSE** | 0 | 1 | 3 | 24 | 32 | 166 | 165 | 21 | 7 | 0 | 0 | 0 | 419 |
| **S** | 0 | 0 | 3 | 28 | 43 | 128 | 184 | 44 | 21 | 0 | 0 | 0 | 451 |
| **SSW** | 0 | 0 | 5 | 30 | 62 | 165 | 198 | 56 | 5 | 1 | 0 | 0 | 522 |
| **SW** | 0 | 2 | 9 | 43 | 70 | 253 | 216 | 29 | 0 | 0 | 0 | 0 | 622 |
| **WSW** | 0 | 5 | 11 | 46 | 84 | 215 | 170 | 18 | 0 | 0 | 0 | 0 | 549 |
| **W** | 0 | 2 | 9 | 54 | 65 | 188 | 232 | 64 | 3 | 0 | 0 | 0 | 617 |
| **WNW** | 0 | 4 | 11 | 37 | 52 | 93 | 61 | 13 | 0 | 0 | 0 | 0 | 271 |
| **NW** | 0 | 1 | 6 | 20 | 35 | 108 | 103 | 33 | 5 | 1 | 0 | 0 | 312 |
| **NNW** | 0 | 3 | 7 | 24 | 18 | 74 | 102 | 58 | 36 | 1 | 0 | 0 | 323 |
| **Totals** | 1 | 20 | 78 | 416 | 697 | 2385 | 3395 | 1663 | 367 | 13 | 0 | 0 | 9035 |

| | |
|---|---|
| **Number of Calm Hours for this Table** | 0 |
| **Number of Variable Direction Hours for this Table** | 0 |
| **Number of Invalid Hours** | 1066 |
| **Number of Valid Hours for this Table** | 9035 |
| **Total Hours for the Period** | 26304 |

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

## Table 2.3-210 (Sheet 5 of 8) Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

**Hours at Each Wind Speed and Direction**

**Period of Record:** 07/01/03 0:00 - 06/30/06 23:00 Total Period

**Elevation:** **Speed:** SPD10M **Direction:** DIR10M **Lapse:** DT61M

**Stability Class:** E Delta Temperature Slightly Stable

| Wind Direction (from) | Wind Speed (m/s) 0.22-0.50 | 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 | 4 | 21 | 23 | 49 | 38 | 5 | 2 | 0 | 0 | 0 | 143 |
| NNE | 0 | 1 | 1 | 16 | 22 | 64 | 28 | 1 | 1 | 0 | 0 | 0 | 134 |
| NE | 0 | 2 | 4 | 15 | 23 | 49 | 31 | 9 | 0 | 0 | 0 | 0 | 133 |
| ENE | 0 | 0 | 2 | 14 | 20 | 41 | 47 | 3 | 0 | 0 | 0 | 0 | 127 |
| E | 0 | 0 | 2 | 10 | 30 | 103 | 88 | 3 | 0 | 0 | 0 | 0 | 236 |
| ESE | 0 | 0 | 2 | 14 | 29 | 75 | 38 | 0 | 0 | 0 | 0 | 0 | 158 |
| SE | 0 | 1 | 2 | 14 | 28 | 126 | 58 | 5 | 2 | 0 | 0 | 0 | 236 |
| SSE | 0 | 0 | 4 | 23 | 91 | 250 | 88 | 3 | 0 | 0 | 0 | 0 | 459 |
| S | 0 | 4 | 10 | 70 | 85 | 259 | 127 | 8 | 2 | 0 | 0 | 0 | 565 |
| SSW | 1 | 2 | 10 | 77 | 129 | 434 | 173 | 7 | 1 | 0 | 0 | 0 | 834 |
| SW | 0 | 2 | 13 | 119 | 213 | 467 | 120 | 2 | 0 | 0 | 0 | 0 | 936 |
| WSW | 1 | 3 | 9 | 99 | 145 | 301 | 104 | 2 | 0 | 0 | 0 | 0 | 664 |
| W | 0 | 2 | 11 | 69 | 90 | 361 | 123 | 7 | 0 | 0 | 0 | 0 | 663 |
| WNW | 1 | 6 | 10 | 54 | 53 | 110 | 15 | 0 | 0 | 0 | 0 | 0 | 249 |
| NW | 0 | 2 | 8 | 26 | 30 | 72 | 29 | 1 | 0 | 0 | 0 | 0 | 168 |
| NNW | 0 | 0 | 6 | 15 | 14 | 49 | 40 | 5 | 2 | 0 | 0 | 0 | 131 |
| Totals | 3 | 26 | 98 | 656 | 1025 | 2810 | 1147 | 61 | 10 | 0 | 0 | 0 | 5836 |

| | |
|---|---|
| **Number of Calm Hours for this Table** | 0 |
| **Number of Variable Direction Hours for this Table** | 0 |
| **Number of Invalid Hours** | 1066 |
| **Number of Valid Hours for this Table** | 5836 |
| **Total Hours for the Period** | 26304 |

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

# Table 2.3-210 (Sheet 6 of 8) Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

**Hours at Each Wind Speed and Direction**

**Period of Record:** 07/01/03 0:00 - 06/30/06 23:00 Total Period

**Elevation:** **Speed:** SPD10M **Direction:** DIR10M **Lapse:** DT61M

**Stability Class:** F Delta Temperature Moderately Stable

| Wind Direction (from) | Wind Speed (m/s) 0.22-0.50 | 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 | 4 | 9 | 15 | 3 | 0 | 0 | 0 | 0 | 0 | 32 |
| NNE | 0 | 0 | 1 | 5 | 6 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 24 |
| NE | 0 | 2 | 0 | 2 | 6 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 22 |
| ENE | 0 | 0 | 0 | 5 | 5 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 17 |
| E | 0 | 0 | 1 | 5 | 7 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 19 |
| ESE | 0 | 1 | 0 | 4 | 4 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 14 |
| SE | 0 | 1 | 1 | 16 | 11 | 41 | 13 | 0 | 0 | 0 | 0 | 0 | 83 |
| SSE | 1 | 1 | 5 | 26 | 57 | 177 | 54 | 0 | 0 | 0 | 0 | 0 | 321 |
| S | 0 | 6 | 7 | 56 | 72 | 195 | 33 | 0 | 0 | 0 | 0 | 0 | 369 |
| SSW | 1 | 0 | 8 | 36 | 71 | 171 | 19 | 0 | 0 | 0 | 0 | 0 | 306 |
| SW | 0 | 5 | 9 | 60 | 119 | 186 | 5 | 0 | 0 | 0 | 0 | 0 | 384 |
| WSW | 0 | 1 | 21 | 49 | 83 | 115 | 2 | 0 | 0 | 0 | 0 | 0 | 271 |
| W | 1 | 4 | 11 | 63 | 52 | 122 | 6 | 0 | 0 | 0 | 0 | 0 | 259 |
| WNW | 0 | 4 | 10 | 46 | 34 | 55 | 3 | 0 | 0 | 0 | 0 | 0 | 152 |
| NW | 0 | 0 | 6 | 14 | 23 | 30 | 2 | 0 | 0 | 0 | 0 | 0 | 75 |
| NNW | 0 | 1 | 2 | 13 | 5 | 6 | 3 | 0 | 0 | 0 | 0 | 0 | 30 |
| **Totals** | 3 | 27 | 82 | 404 | 564 | 1150 | 148 | 0 | 0 | 0 | 0 | 0 | 2378 |

| | |
|---|---|
| **Number of Calm Hours for this Table** | 0 |
| **Number of Variable Direction Hours for this Table** | 0 |
| **Number of Invalid Hours** | 1066 |
| **Number of Valid Hours for this Table** | 2378 |
| **Total Hours for the Period** | 26304 |

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

## Table 2.3-210 (Sheet 7 of 8)
## Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

**Hours at Each Wind Speed and Direction**

**Period of Record:** 07/01/03 0:00 - 06/30/06 23:00 Total Period

**Elevation:** **Speed:** SPD10M **Direction:** DIR10M **Lapse:** DT61M

**Stability Class:** G Delta Temperature Extremely Stable

| Wind Direction (from) | Wind Speed (m/s) 0.22-0.50 | 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 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| NNE | 0 | 0 | 1 | 3 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| NE | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| ENE | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| E | 0 | 0 | 0 | 4 | 0 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 10 |
| ESE | 0 | 1 | 1 | 3 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| SE | 0 | 2 | 3 | 3 | 1 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 16 |
| SSE | 0 | 0 | 2 | 15 | 13 | 58 | 7 | 0 | 0 | 0 | 0 | 0 | 95 |
| S | 0 | 4 | 9 | 51 | 41 | 86 | 4 | 0 | 0 | 0 | 0 | 0 | 195 |
| SSW | 0 | 2 | 9 | 63 | 37 | 83 | 2 | 1 | 0 | 0 | 0 | 0 | 197 |
| SW | 1 | 4 | 23 | 98 | 54 | 101 | 1 | 0 | 0 | 0 | 0 | 0 | 282 |
| WSW | 0 | 2 | 27 | 138 | 82 | 105 | 0 | 0 | 0 | 0 | 0 | 0 | 354 |
| W | 1 | 5 | 17 | 126 | 81 | 92 | 1 | 0 | 0 | 0 | 0 | 0 | 323 |
| WNW | 1 | 1 | 11 | 48 | 25 | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 119 |
| NW | 0 | 1 | 8 | 11 | 10 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 46 |
| NNW | 0 | 0 | 2 | 4 | 1 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| **Totals** | 3 | 22 | 115 | 572 | 350 | 602 | 16 | 1 | 0 | 0 | 0 | 0 | 1681 |

| | |
|---|---|
| **Number of Calm Hours for this Table** | 0 |
| **Number of Variable Direction Hours for this Table** | 0 |
| **Number of Invalid Hours** | 1066 |
| **Number of Valid Hours for this Table** | 1681 |
| **Total Hours for the Period** | 26304 |

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

## Table 2.3-210 (Sheet 8 of 8)
## Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

**Hours at Each Wind Speed and Direction**

**Period of Record:** 07/01/03 0:00 - 06/30/06 23:00 Total Period

**Elevation:** **Speed:** SPD10M **Direction:** DIR10M **Lapse:** DT61M

**Summary of All Stability Classes** Delta Temperature

| | Wind Speed (m/s) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Wind Direction (from)** | **0.22-0.50** | **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 | 3 | 11 | 84 | 153 | 281 | 248 | 149 | 60 | 6 | 0 | 0 | 995 |
| **NNE** | 0 | 3 | 5 | 74 | 146 | 340 | 309 | 322 | 163 | 6 | 1 | 0 | 1369 |
| **NE** | 1 | 4 | 7 | 51 | 122 | 372 | 735 | 790 | 195 | 5 | 0 | 0 | 2282 |
| **ENE** | 0 | 0 | 5 | 36 | 65 | 286 | 788 | 414 | 89 | 1 | 0 | 0 | 1684 |
| **E** | 0 | 0 | 4 | 30 | 77 | 355 | 485 | 122 | 16 | 0 | 0 | 0 | 1089 |
| **ESE** | 0 | 2 | 3 | 29 | 57 | 233 | 219 | 26 | 2 | 0 | 0 | 0 | 571 |
| **SE** | 0 | 4 | 6 | 41 | 72 | 375 | 236 | 28 | 3 | 0 | 0 | 0 | 765 |
| **SSE** | 1 | 2 | 15 | 92 | 207 | 711 | 403 | 39 | 10 | 0 | 0 | 0 | 1480 |
| **S** | 0 | 14 | 29 | 209 | 255 | 749 | 490 | 90 | 36 | 0 | 0 | 0 | 1872 |
| **SSW** | 2 | 4 | 32 | 215 | 322 | 1020 | 584 | 101 | 9 | 1 | 0 | 0 | 2290 |
| **SW** | 1 | 13 | 55 | 342 | 527 | 1362 | 585 | 60 | 0 | 0 | 0 | 0 | 2945 |
| **WSW** | 1 | 11 | 69 | 356 | 486 | 1104 | 654 | 67 | 1 | 0 | 0 | 0 | 2749 |
| **W** | 2 | 13 | 51 | 323 | 337 | 899 | 641 | 148 | 9 | 0 | 0 | 0 | 2423 |
| **WNW** | 2 | 15 | 42 | 197 | 193 | 388 | 207 | 25 | 0 | 0 | 0 | 0 | 1069 |
| **NW** | 0 | 4 | 28 | 83 | 121 | 320 | 260 | 68 | 19 | 1 | 0 | 0 | 904 |
| **NNW** | 0 | 4 | 17 | 77 | 85 | 213 | 201 | 89 | 62 | 3 | 0 | 0 | 751 |
| **Totals** | 10 | 96 | 379 | 2239 | 3225 | 9008 | 7045 | 2538 | 674 | 23 | 1 | 0 | 25238 |

| | |
|---|---|
| **Number of Calm Hours for this Table** | 0 |
| **Number of Variable Direction Hours for this Table** | 0 |
| **Number of Invalid Hours** | 1066 |
| **Number of Valid Hours for this Table** | 25238 |
| **Total Hours for the Period** | 26304 |

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

## Table 2.3-211 (Sheet 1 of 8) Joint Frequency Distribution of Wind Speed and Wind Direction (61-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

**Hours at Each Wind Speed and Direction**

**Period of Record:** 07/01/03 0:00 - 06/30/06 23:00 Total Period

**Elevation:** **Speed:** SPD61M **Direction:** DIR61M **Lapse:** DT61M

**Stability Class:** A Delta Temperature Extremely Unstable

| Wind Direction (from) | Wind Speed (m/s) 0.22-0.50 | 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 | 11 | 22 | 17 | 9 | 5 | 2 | 1 | 0 | 0 | 67 |
| NNE | 0 | 0 | 3 | 14 | 28 | 22 | 12 | 7 | 5 | 2 | 0 | 0 | 93 |
| NE | 0 | 0 | 1 | 22 | 29 | 21 | 20 | 26 | 14 | 1 | 0 | 0 | 134 |
| ENE | 0 | 0 | 0 | 6 | 21 | 25 | 41 | 28 | 10 | 3 | 0 | 0 | 134 |
| E | 0 | 0 | 0 | 5 | 8 | 14 | 29 | 10 | 3 | 1 | 0 | 0 | 70 |
| ESE | 0 | 0 | 0 | 1 | 1 | 11 | 21 | 11 | 0 | 0 | 0 | 0 | 45 |
| SE | 0 | 0 | 0 | 0 | 0 | 20 | 29 | 9 | 2 | 0 | 0 | 0 | 60 |
| SSE | 0 | 0 | 0 | 0 | 5 | 13 | 20 | 19 | 4 | 0 | 0 | 0 | 61 |
| S | 0 | 0 | 0 | 1 | 2 | 13 | 31 | 15 | 9 | 2 | 0 | 0 | 73 |
| SSW | 0 | 0 | 1 | 3 | 6 | 38 | 51 | 20 | 8 | 0 | 0 | 0 | 127 |
| SW | 0 | 0 | 0 | 7 | 14 | 106 | 175 | 65 | 28 | 1 | 0 | 0 | 396 |
| WSW | 0 | 0 | 1 | 4 | 29 | 103 | 214 | 190 | 101 | 21 | 0 | 0 | 663 |
| W | 0 | 0 | 0 | 4 | 8 | 17 | 57 | 65 | 35 | 11 | 1 | 0 | 198 |
| WNW | 0 | 0 | 0 | 5 | 9 | 12 | 42 | 11 | 3 | 0 | 0 | 0 | 82 |
| NW | 0 | 0 | 0 | 3 | 10 | 21 | 38 | 13 | 4 | 0 | 0 | 0 | 89 |
| NNW | 0 | 0 | 0 | 6 | 14 | 12 | 14 | 14 | 3 | 3 | 0 | 0 | 66 |
| Totals | 0 | 0 | 6 | 92 | 206 | 465 | 803 | 508 | 231 | 46 | 1 | 0 | 2358 |

| | |
|---|---|
| **Number of Calm Hours for this Table** | 0 |
| **Number of Variable Direction Hours for this Table** | 0 |
| **Number of Invalid Hours** | 1023 |
| **Number of Valid Hours for this Table** | 2358 |
| **Total Hours for the Period** | 26304 |

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

## Table 2.3-211 (Sheet 2 of 8)
## Joint Frequency Distribution of Wind Speed and Wind Direction (61-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

**Hours at Each Wind Speed and Direction**

**Period of Record:** 07/01/03 0:00 - 06/30/06 23:00 Total Period

**Elevation:** **Speed:** SPD61M **Direction:** DIR61M **Lapse:** DT61M

**Stability Class:** B Delta Temperature Moderately Unstable

| Wind Direction (from) | Wind Speed (m/s) 0.22-0.50 | 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 | 3 | 10 | 13 | 18 | 14 | 15 | 8 | 2 | 0 | 0 | 83 |
| NNE | 0 | 0 | 2 | 7 | 18 | 17 | 11 | 15 | 13 | 3 | 0 | 0 | 86 |
| NE | 0 | 0 | 1 | 14 | 7 | 26 | 52 | 29 | 30 | 3 | 0 | 0 | 162 |
| ENE | 0 | 0 | 0 | 2 | 5 | 14 | 46 | 37 | 17 | 0 | 0 | 0 | 121 |
| E | 0 | 0 | 0 | 1 | 6 | 17 | 33 | 23 | 8 | 2 | 0 | 0 | 90 |
| ESE | 0 | 0 | 1 | 0 | 0 | 7 | 19 | 9 | 1 | 0 | 0 | 0 | 37 |
| SE | 0 | 0 | 0 | 0 | 3 | 8 | 16 | 5 | 0 | 0 | 0 | 0 | 32 |
| SSE | 0 | 0 | 1 | 2 | 2 | 11 | 28 | 9 | 3 | 1 | 0 | 0 | 57 |
| S | 0 | 0 | 0 | 1 | 2 | 18 | 32 | 23 | 10 | 2 | 0 | 0 | 88 |
| SSW | 0 | 0 | 0 | 1 | 8 | 19 | 54 | 26 | 9 | 1 | 0 | 0 | 118 |
| SW | 0 | 0 | 0 | 4 | 10 | 58 | 84 | 32 | 8 | 0 | 0 | 0 | 196 |
| WSW | 0 | 0 | 0 | 8 | 19 | 45 | 73 | 45 | 43 | 4 | 0 | 0 | 237 |
| W | 0 | 0 | 0 | 5 | 12 | 21 | 35 | 32 | 29 | 10 | 4 | 0 | 148 |
| WNW | 0 | 0 | 1 | 0 | 6 | 18 | 42 | 15 | 1 | 0 | 0 | 0 | 83 |
| NW | 0 | 0 | 1 | 3 | 8 | 19 | 32 | 20 | 15 | 1 | 0 | 0 | 99 |
| NNW | 0 | 0 | 1 | 8 | 10 | 12 | 12 | 13 | 7 | 3 | 0 | 0 | 66 |
| **Totals** | 0 | 0 | 11 | 66 | 129 | 328 | 583 | 348 | 202 | 32 | 4 | 0 | 1703 |

| | |
|---|---|
| **Number of Calm Hours for this Table** | 0 |
| **Number of Variable Direction Hours for this Table** | 0 |
| **Number of Invalid Hours** | 1023 |
| **Number of Valid Hours for this Table** | 1703 |
| **Total Hours for the Period** | 26304 |

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

## Table 2.3-211 (Sheet 3 of 8) Joint Frequency Distribution of Wind Speed and Wind Direction (61-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

**Hours at Each Wind Speed and Direction**

**Period of Record:** 07/01/03 0:00 - 06/30/06 23:00 Total Period

**Elevation:** **Speed:** SPD61M **Direction:** DIR61M **Lapse:** DT61M

**Stability Class:** C Delta Temperature Slightly Unstable

| | Wind Speed (m/s) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wind Direction (from) | 0.22-0.50 | 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 | 13 | 20 | 15 | 32 | 20 | 16 | 1 | 0 | 0 | 118 |
| NNE | 0 | 0 | 0 | 14 | 35 | 36 | 43 | 39 | 45 | 5 | 1 | 0 | 218 |
| NE | 0 | 0 | 1 | 14 | 23 | 38 | 78 | 119 | 89 | 4 | 0 | 0 | 366 |
| ENE | 0 | 0 | 0 | 7 | 16 | 22 | 98 | 90 | 58 | 1 | 0 | 0 | 292 |
| E | 0 | 0 | 0 | 6 | 7 | 30 | 28 | 19 | 9 | 0 | 0 | 0 | 99 |
| ESE | 0 | 0 | 1 | 1 | 5 | 13 | 36 | 10 | 3 | 0 | 0 | 0 | 69 |
| SE | 0 | 0 | 0 | 1 | 2 | 13 | 22 | 7 | 2 | 0 | 0 | 0 | 47 |
| SSE | 0 | 0 | 0 | 3 | 12 | 19 | 35 | 12 | 2 | 1 | 0 | 0 | 84 |
| S | 0 | 0 | 0 | 0 | 7 | 27 | 41 | 22 | 11 | 2 | 1 | 0 | 111 |
| SSW | 0 | 0 | 1 | 5 | 4 | 30 | 45 | 14 | 11 | 0 | 0 | 0 | 110 |
| SW | 0 | 0 | 0 | 9 | 11 | 41 | 60 | 35 | 19 | 1 | 0 | 0 | 176 |
| WSW | 0 | 0 | 0 | 5 | 15 | 48 | 69 | 40 | 40 | 3 | 0 | 0 | 220 |
| W | 0 | 0 | 0 | 3 | 7 | 17 | 31 | 32 | 17 | 5 | 0 | 0 | 112 |
| WNW | 0 | 0 | 0 | 5 | 15 | 21 | 30 | 11 | 2 | 0 | 0 | 0 | 84 |
| NW | 0 | 0 | 1 | 4 | 12 | 21 | 20 | 13 | 5 | 2 | 0 | 0 | 78 |
| NNW | 0 | 0 | 0 | 8 | 8 | 10 | 20 | 13 | 17 | 1 | 0 | 0 | 77 |
| Totals | 0 | 0 | 5 | 98 | 199 | 401 | 688 | 496 | 346 | 26 | 2 | 0 | 2261 |

| | |
|---|---|
| **Number of Calm Hours for this Table** | 1 |
| **Number of Variable Direction Hours for this Table** | 0 |
| **Number of Invalid Hours** | 1023 |
| **Number of Valid Hours for this Table** | 2261 |
| **Total Hours for the Period** | 26304 |

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

## Table 2.3-211 (Sheet 4 of 8)
## Joint Frequency Distribution of Wind Speed and Wind Direction (61-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

**Hours at Each Wind Speed and Direction**

**Period of Record:** 07/01/03 0:00 - 06/30/06 23:00 Total Period

**Elevation:** **Speed:** SPD61M **Direction:** DIR61M **Lapse:** DT61M

**Stability Class:** D Delta Temperature Neutral

| | Wind Speed (m/s) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wind Direction (from) | 0.22-0.50 | 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 | 11 | 27 | 40 | 46 | 96 | 87 | 33 | 8 | 0 | 0 | 349 |
| NNE | 0 | 4 | 10 | 40 | 55 | 74 | 168 | 175 | 96 | 7 | 0 | 0 | 629 |
| NE | 0 | 5 | 8 | 41 | 37 | 105 | 350 | 490 | 203 | 11 | 1 | 0 | 1251 |
| ENE | 0 | 2 | 6 | 17 | 25 | 109 | 463 | 552 | 188 | 12 | 0 | 0 | 1374 |
| E | 0 | 0 | 3 | 9 | 32 | 87 | 318 | 239 | 71 | 3 | 0 | 0 | 762 |
| ESE | 0 | 0 | 2 | 6 | 19 | 78 | 152 | 79 | 31 | 0 | 0 | 0 | 367 |
| SE | 0 | 0 | 2 | 10 | 19 | 69 | 158 | 78 | 15 | 2 | 0 | 0 | 353 |
| SSE | 0 | 0 | 3 | 13 | 18 | 41 | 140 | 108 | 23 | 8 | 0 | 0 | 354 |
| S | 0 | 2 | 4 | 13 | 16 | 64 | 143 | 126 | 48 | 17 | 0 | 0 | 433 |
| SSW | 0 | 4 | 4 | 22 | 28 | 56 | 139 | 91 | 63 | 2 | 1 | 0 | 410 |
| SW | 0 | 0 | 9 | 18 | 28 | 79 | 227 | 179 | 99 | 4 | 0 | 0 | 643 |
| WSW | 0 | 2 | 9 | 30 | 32 | 83 | 208 | 182 | 169 | 22 | 0 | 0 | 737 |
| W | 0 | 4 | 9 | 15 | 28 | 60 | 139 | 145 | 105 | 21 | 1 | 0 | 527 |
| WNW | 0 | 4 | 7 | 27 | 44 | 51 | 68 | 23 | 11 | 0 | 0 | 0 | 235 |
| NW | 0 | 1 | 12 | 23 | 24 | 45 | 79 | 51 | 20 | 0 | 1 | 0 | 256 |
| NNW | 1 | 2 | 11 | 30 | 17 | 32 | 91 | 75 | 56 | 6 | 0 | 0 | 321 |
| Totals | 1 | 31 | 110 | 341 | 462 | 1079 | 2939 | 2680 | 1231 | 123 | 4 | 0 | 9001 |

| | |
|---|---|
| **Number of Calm Hours for this Table** | 0 |
| **Number of Variable Direction Hours for this Table** | 0 |
| **Number of Invalid Hours** | 1023 |
| **Number of Valid Hours for this Table** | 9001 |
| **Total Hours for the Period** | 26304 |

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

## Table 2.3-211 (Sheet 5 of 8) Joint Frequency Distribution of Wind Speed and Wind Direction (61-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

**Hours at Each Wind Speed and Direction**

**Period of Record:** 07/01/03 0:00 - 06/30/06 23:00 Total Period

**Elevation:** **Speed:** SPD61M **Direction:** DIR61M **Lapse:** DT61M

**Stability Class:** E Delta Temperature Slightly Stable

| Wind Direction (from) | Wind Speed (m/s) 0.22-0.50 | 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 | 3 | 6 | 11 | 19 | 25 | 38 | 20 | 4 | 0 | 0 | 0 | 127 |
| NNE | 0 | 1 | 11 | 15 | 17 | 30 | 55 | 24 | 2 | 0 | 0 | 0 | 155 |
| NE | 0 | 3 | 3 | 20 | 19 | 27 | 35 | 12 | 2 | 0 | 0 | 0 | 121 |
| ENE | 1 | 2 | 5 | 18 | 17 | 30 | 67 | 44 | 4 | 0 | 0 | 0 | 188 |
| E | 0 | 2 | 1 | 19 | 20 | 26 | 87 | 75 | 5 | 0 | 0 | 0 | 235 |
| ESE | 0 | 3 | 3 | 7 | 14 | 39 | 84 | 66 | 10 | 0 | 0 | 0 | 226 |
| SE | 0 | 0 | 4 | 14 | 14 | 46 | 86 | 90 | 12 | 1 | 0 | 0 | 267 |
| SSE | 0 | 2 | 0 | 12 | 18 | 38 | 123 | 154 | 22 | 1 | 0 | 0 | 370 |
| S | 1 | 2 | 2 | 9 | 22 | 48 | 156 | 179 | 41 | 2 | 0 | 0 | 462 |
| SSW | 0 | 4 | 7 | 17 | 13 | 56 | 244 | 212 | 23 | 2 | 0 | 0 | 578 |
| SW | 0 | 1 | 8 | 15 | 26 | 67 | 407 | 366 | 68 | 1 | 0 | 0 | 959 |
| WSW | 2 | 4 | 5 | 13 | 19 | 59 | 358 | 372 | 169 | 4 | 0 | 0 | 1005 |
| W | 2 | 2 | 10 | 23 | 18 | 62 | 206 | 231 | 39 | 2 | 0 | 0 | 595 |
| WNW | 1 | 3 | 8 | 22 | 17 | 56 | 104 | 25 | 1 | 0 | 0 | 0 | 237 |
| NW | 1 | 3 | 4 | 16 | 21 | 39 | 65 | 32 | 4 | 0 | 0 | 0 | 185 |
| NNW | 1 | 3 | 4 | 13 | 8 | 19 | 49 | 46 | 8 | 0 | 0 | 0 | 151 |
| **Totals** | 10 | 38 | 81 | 244 | 282 | 667 | 2164 | 1948 | 414 | 13 | 0 | 0 | 5861 |

| | |
|---|---|
| **Number of Calm Hours for this Table** | 0 |
| **Number of Variable Direction Hours for this Table** | 0 |
| **Number of Invalid Hours** | 1023 |
| **Number of Valid Hours for this Table** | 5861 |
| **Total Hours for the Period** | 26304 |

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

## Table 2.3-211 (Sheet 6 of 8) Joint Frequency Distribution of Wind Speed and Wind Direction (61-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

**Hours at Each Wind Speed and Direction**

**Period of Record:** 07/01/03 0:00 - 06/30/06 23:00 Total Period

**Elevation:** **Speed:** SPD61M **Direction:** DIR61M **Lapse:** DT61M

**Stability Class:** F Delta Temperature Moderately Stable

| Wind Direction (from) | Wind Speed (m/s) 0.22-0.50 | 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 | 2 | 1 | 2 | 23 | 30 | 4 | 1 | 0 | 0 | 0 | 63 |
| NNE | 0 | 3 | 3 | 3 | 6 | 19 | 29 | 5 | 0 | 0 | 0 | 0 | 68 |
| NE | 0 | 1 | 3 | 14 | 7 | 22 | 20 | 1 | 0 | 0 | 0 | 0 | 68 |
| ENE | 0 | 2 | 6 | 11 | 14 | 20 | 8 | 4 | 0 | 0 | 0 | 0 | 65 |
| E | 2 | 4 | 2 | 6 | 9 | 16 | 12 | 3 | 0 | 0 | 0 | 0 | 54 |
| ESE | 0 | 0 | 2 | 5 | 5 | 20 | 20 | 5 | 0 | 0 | 0 | 0 | 57 |
| SE | 1 | 1 | 2 | 5 | 9 | 16 | 39 | 29 | 6 | 0 | 0 | 0 | 108 |
| SSE | 1 | 0 | 3 | 2 | 3 | 26 | 66 | 91 | 18 | 0 | 0 | 0 | 210 |
| S | 0 | 1 | 2 | 2 | 11 | 23 | 85 | 99 | 23 | 0 | 0 | 0 | 246 |
| SSW | 0 | 1 | 1 | 8 | 4 | 24 | 89 | 105 | 5 | 0 | 0 | 0 | 237 |
| SW | 1 | 2 | 2 | 6 | 9 | 25 | 139 | 171 | 20 | 0 | 0 | 0 | 375 |
| WSW | 1 | 0 | 2 | 0 | 5 | 31 | 104 | 148 | 12 | 0 | 0 | 0 | 303 |
| W | 0 | 1 | 1 | 5 | 9 | 28 | 88 | 82 | 6 | 0 | 0 | 0 | 220 |
| WNW | 0 | 1 | 3 | 7 | 7 | 22 | 65 | 10 | 0 | 0 | 0 | 0 | 115 |
| NW | 0 | 1 | 1 | 7 | 7 | 28 | 50 | 21 | 0 | 0 | 0 | 0 | 115 |
| NNW | 0 | 2 | 0 | 4 | 7 | 9 | 49 | 15 | 1 | 0 | 0 | 0 | 87 |
| **Totals** | 6 | 20 | 35 | 86 | 114 | 352 | 893 | 793 | 92 | 0 | 0 | 0 | 2391 |

| | |
|---|---|
| **Number of Calm Hours for this Table** | 0 |
| **Number of Variable Direction Hours for this Table** | 0 |
| **Number of Invalid Hours** | 1023 |
| **Number of Valid Hours for this Table** | 2391 |
| **Total Hours for the Period** | 26304 |

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

## Table 2.3-211 (Sheet 7 of 8) Joint Frequency Distribution of Wind Speed and Wind Direction (61-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

**Hours at Each Wind Speed and Direction**

**Period of Record:** 07/01/03 0:00 - 06/30/06 23:00 Total Period

**Elevation:** **Speed:** SPD61M **Direction:** DIR61M **Lapse:** DT61M

**Stability Class:** G Delta Temperature Extremely Stable

| | Wind Speed (m/s) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Wind Direction (from)** | **0.22-0.50** | **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 | 12 | 8 | 23 | 35 | 5 | 0 | 0 | 0 | 0 | 87 |
| **NNE** | 1 | 0 | 5 | 5 | 14 | 38 | 52 | 1 | 1 | 0 | 0 | 0 | 117 |
| **NE** | 0 | 2 | 5 | 10 | 14 | 41 | 37 | 0 | 1 | 0 | 0 | 0 | 110 |
| **ENE** | 0 | 0 | 1 | 10 | 15 | 19 | 7 | 0 | 0 | 0 | 0 | 0 | 52 |
| **E** | 0 | 3 | 5 | 5 | 8 | 23 | 3 | 0 | 1 | 0 | 0 | 0 | 48 |
| **ESE** | 2 | 0 | 3 | 4 | 10 | 13 | 15 | 3 | 0 | 0 | 0 | 0 | 50 |
| **SE** | 0 | 5 | 1 | 7 | 7 | 21 | 32 | 6 | 2 | 0 | 0 | 0 | 81 |
| **SSE** | 1 | 1 | 6 | 7 | 2 | 12 | 36 | 13 | 9 | 0 | 0 | 0 | 87 |
| **S** | 0 | 3 | 3 | 3 | 9 | 21 | 47 | 61 | 5 | 0 | 0 | 0 | 152 |
| **SSW** | 2 | 1 | 4 | 3 | 10 | 17 | 63 | 33 | 3 | 1 | 0 | 0 | 137 |
| **SW** | 1 | 0 | 0 | 6 | 11 | 30 | 71 | 62 | 4 | 0 | 0 | 0 | 185 |
| **WSW** | 1 | 2 | 2 | 1 | 11 | 18 | 74 | 73 | 7 | 0 | 0 | 0 | 189 |
| **W** | 1 | 0 | 0 | 3 | 9 | 29 | 64 | 34 | 3 | 0 | 0 | 0 | 143 |
| **WNW** | 3 | 0 | 2 | 5 | 11 | 23 | 40 | 4 | 3 | 0 | 0 | 0 | 91 |
| **NW** | 1 | 1 | 3 | 9 | 9 | 22 | 41 | 4 | 2 | 0 | 0 | 0 | 92 |
| **NNW** | 1 | 1 | 4 | 4 | 6 | 23 | 37 | 6 | 2 | 0 | 0 | 0 | 84 |
| **Totals** | 14 | 20 | 47 | 94 | 154 | 373 | 654 | 305 | 43 | 1 | 0 | 0 | 1705 |

| | |
|---|---|
| **Number of Calm Hours for this Table** | 0 |
| **Number of Variable Direction Hours for this Table** | 0 |
| **Number of Invalid Hours** | 1023 |
| **Number of Valid Hours for this Table** | 1705 |
| **Total Hours for the Period** | 26304 |

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

## Table 2.3-211 (Sheet 8 of 8)
## Joint Frequency Distribution of Wind Speed and Wind Direction (61-Meter Level) by Atmospheric Stability Class for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006)

**Hours at Each Wind Speed and Direction**

**Period of Record:** 07/01/03 0:00 - 06/30/06 23:00 Total Period

**Elevation:** **Speed:** SPD61M **Direction:** DIR61M **Lapse:** DT61M

**Summary of All Stability Classes** Delta Temperature

| | Wind Speed (m/s) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Wind Direction (from)** | **0.22-0.50** | **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 | 5 | 26 | 85 | 124 | 167 | 254 | 156 | 64 | 12 | 0 | 0 | 894 |
| **NNE** | 1 | 8 | 34 | 98 | 173 | 236 | 370 | 266 | 162 | 17 | 1 | 0 | 1366 |
| **NE** | 0 | 11 | 22 | 135 | 136 | 280 | 592 | 677 | 339 | 19 | 1 | 0 | 2212 |
| **ENE** | 1 | 6 | 18 | 71 | 113 | 239 | 730 | 755 | 277 | 16 | 0 | 0 | 2226 |
| **E** | 2 | 9 | 11 | 51 | 90 | 213 | 510 | 369 | 97 | 6 | 0 | 0 | 1358 |
| **ESE** | 2 | 3 | 12 | 24 | 54 | 181 | 347 | 183 | 45 | 0 | 0 | 0 | 851 |
| **SE** | 1 | 6 | 9 | 37 | 54 | 193 | 382 | 224 | 39 | 3 | 0 | 0 | 948 |
| **SSE** | 2 | 3 | 13 | 39 | 60 | 160 | 448 | 406 | 81 | 11 | 0 | 0 | 1223 |
| **S** | 1 | 8 | 11 | 29 | 69 | 214 | 535 | 525 | 147 | 25 | 1 | 0 | 1565 |
| **SSW** | 2 | 10 | 18 | 59 | 73 | 240 | 685 | 501 | 122 | 6 | 1 | 0 | 1717 |
| **SW** | 2 | 3 | 19 | 65 | 109 | 406 | 1163 | 910 | 246 | 7 | 0 | 0 | 2930 |
| **WSW** | 4 | 8 | 19 | 61 | 130 | 387 | 1100 | 1050 | 541 | 54 | 0 | 0 | 3354 |
| **W** | 3 | 7 | 20 | 58 | 91 | 234 | 620 | 621 | 234 | 49 | 6 | 0 | 1943 |
| **WNW** | 4 | 8 | 21 | 71 | 109 | 203 | 391 | 99 | 21 | 0 | 0 | 0 | 927 |
| **NW** | 2 | 6 | 22 | 65 | 91 | 195 | 325 | 154 | 50 | 3 | 1 | 0 | 914 |
| **NNW** | 3 | 8 | 20 | 73 | 70 | 117 | 272 | 182 | 94 | 13 | 0 | 0 | 852 |
| **Totals** | 31 | 109 | 295 | 1021 | 1546 | 3665 | 8724 | 7078 | 2559 | 241 | 11 | 0 | 25280 |

| | |
|---|---|
| **Number of Calm Hours for this Table** | 1 |
| **Number of Variable Direction Hours for this Table** | 0 |
| **Number of Invalid Hours** | 1023 |
| **Number of Valid Hours for this Table** | 25280 |
| **Total Hours for the Period** | 26304 |

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 61-m and 10-m measurement levels.

## Table 2.3-212
## Unit 1 Meteorological Tower Siting Conformance

| Regulatory Guide 1.23 Criteria | Conformance Status | Remarks |
|---|---|---|
| **Tower Siting:**<br>The meteorological tower sites and the Units 2 and 3 location have similar meteorological exposure. | Yes | The site area is generally gently rolling terrain. |
| The base of the tower is at approximately the same elevation as the finished plant grade of the units. | Yes | Unit 1 tower base having similar elevation (small difference that has minimal impacts on the tower measurements) as the design finished grade:<br>• Tower elevation: 437 feet (NGVD29)<br>• Finished plant grade: 400 feet (NAVD 88) |
| Location of the tower is not directly downwind of the existing and plant cooling systems (*i.e.*, Monticello Reservoir and the Units 2 and 3 cooling towers) under the southwest prevailing downwind wind direction. | Yes | • VCSNS site prevailing wind: southwest<br>• Monticello Reservoir –188 feet north of the Unit 1 meteorological towers<br>• Unit 1 does not use cooling 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.<br>• Both the retired and current Unit 1 towers are located on open fields with a mixture of grassy dirt and gravel surface underlying the towers. |
| Tower is not located near large body of water | Meet the intent | • Dew point data from Columbia NWS was used to predict cooling tower plume impacts.<br>• Additional information (*i.e.*, relative humidity and temperature) are being collected at the Units 2 and 3 tower for dew point calculation. |

## Table 2.3-213
## Unit 1 Meteorological Instrument Siting Conformance

| Regulatory Guide 1.23 Criteria | Conformance Status | Remarks |
|---|---|---|
| **Sensor Siting:** | | |
| Wind sensors are located at 10 obstruction heights away from such obstructions (including the existing and unit complex, trees, and nearby terrain) to minimize any airflow modification (*i.e.*, turbulent wake effects). | Meet the intent | • Trees are trimmed to meet the 10 obstruction height requirements.<br>• NRC site inspection (in 2006), determined that the current Unit 1 meteorological monitoring tower siting is acceptable (Reference 235). |
| Wind sensors are located at heights that avoid airflow modifications by nearby obstructions with heights exceeding one-half of the wind measurement. | Yes | • Instrument shelter height was 10 feet, which is less than half of the lower level sensor height at 33 feet (10 meters). |
| Wind sensors are located to reduce airflow modification and turbulence induced by the supporting structure itself. | Yes | • Tower booms (8 feet long for current tower and 10 feet for the retired tower) 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 heat and moisture sources, such as ventilation systems, water bodies, or the influence of large parking lots or other paved surfaces. | Yes | • No large ventilation systems and large parking lots within 650 feet of the tower.<br>• The ground surface at the base of the towers has been kept natural (*i.e.*, a mixture of grasses, dirt, and gravel).<br>• 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 2.3-214
## Meteorological System Accuracies (Retired Unit 1 System)

| Sensed Parameter | Sensor Type | Manufacturer/ Model | Range | System Accuracy[c] | System Accuracy (per Reg. Guide 1.23) | System Accuracy (per ANSI/ANS-3.11-2005) | Starting Threshold | Starting Threshold (per R.G. 1.23) | Measurement Resolution | Measurement Resolution (per R.G. 1.23) | Measurement Resolution (per ANSI/ ANS-3.11-2005) | Elevation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wind Speed | Ultrasonic | Handar WS425 | 0 mph to 144 mph | ±0.122 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 mph | 0.1 m/s or 0.1 mph | 0.1 m/s | 61m, 10m |
| Wind Direction | Ultrasonic | Handar WS425 | 0° to 359° | ±0.695° | ±5° | 5°azimuth | Virtually zero | < 0.45 m/s (1 mph) | 1.0° | 1.0° | 1.0° azimuth | 61m, 10m |
| Ambient Temperature | PT-200 type RTD element | Rosemount T-200 | –20°F to 120°F | ±0.0698°F | ±0.5°C (±0.9°F) | 0.5°C | — | — | 0.08°C | 0.1°C or 0.1°F | 0.1°C | 61m, 41m, 10m |
| Differential Temperature[a] | N/A | N/A | –7°F to 25°F | ±0.0521°F | ±0.1°C (±0.18°F) | 0.1°C | — | — | 0.001°C | 0.01°C or 0.01°F | 0.01°C | 61m–10m<br>41m–10m |
| Dew Point | Lithium Chloride Chill Mirror (optical) Dew Point Hygrometer | General Eastern M1 | –15°F to 85°F | ±0.32°F | ±1.5°C (±2.7°F) | 1.5°C | — | — | 0.1°C | 0.1°C or 0.1°F | 0.1°C | 9m or 30 ft[b] |
| Precipitation[d] | Tipping Bucket | Weather Measure Corp. P511E | Bucket capacity (10 ml) | ±2.6%[d] | ±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 | — | — | 0.25 mm or 0.01 in | 0.25 mm or 0.01 in | 0.25 mm | Near base of tower |

(a) The differential temperature is a calculated value based on the ambient temperature measurements.
(b) The dew point sensor was located 20 feet west of the tower on a separate 30-foot pole.
(c) Each system accuracy is based on a 15-minute average, unless otherwise noted.
(d) The system accuracy for the precipitation instrument is instantaneous.

## Table 2.3-215
## Meteorological System Accuracies (Current Unit 1 System)

| Sensed Parameter | Sensor Type | Manufacturer/ Model | Range | System Accuracy[c] | System Accuracy (per Reg. Guide 1.23) | System Accuracy (per ANSI/ ANS-3.11-2005) | Starting Threshold | Starting Threshold (per R.G. 1.23) | Measurement Resolution | Measurement Resolution (per R.G. 1.23) | Measurement Resolution (per ANSI/ANS-3.11-2005) | Elevation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wind Speed | Ultrasonic | Vaisala WS425 | 0 mph to 144 mph | ±0.010mph @ 0-5mph ±0.010mph @ 0-10mph ±0.015mph @ 0-15mph ±0.021mph @ 0-20mph ±0.051mph @ 0-50mph ±0.077mph @ 0-75mph ±0.103mph @ 0-100mph | ±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 mph | 0.1 m/s or 0.1 mph | 0.1 m/s | 61m, 10m |
| Wind Direction | Ultrasonic | Vaisala WS425 | 0° to 360° | ±0.149° | ±5° | 5°azimuth | Virtually zero | < 0.45 m/s (1 mph) | 1° | 1.0° | 1.0° azimuth | 61m, 10m |
| Ambient Temperature | PT-100 type RTD element | Vaisala QMT102 | –122°F to 140°F | ±0.023°F | ±0.5°C (±0.9°F) | 0.5°C | — | — | 0.01°F | 0.1°C or 0.1°F | 0.1°C | 61m, 40m, 10m |
| Differential Temperature[a]) | N/A | N/A | N/A | ±0.025°F | ±0.1°C (±0.18°F) | 0.1°C | — | — | 0.001°F | 0.01°C or 0.01°F | 0.01°C | 10m–61m |
| Relative Humidity/ Temperature[b] (for Dew Point calculation) | Capacitive Polymer Humidity and Temperature Device | Vaisala QMH102 | Temperature: –40°C to 60°C RH: 0% to 100% | ±0.087°F | ±4% | 4% | — | — | 0.1% | 0.1% | 0.1% | 1 to 2 m above grade |
| Precipitation[d] | Tipping Bucket/Reed Switch | Vaisala QMR102 | Bucket capacity (10 ml) | 8.00% based on volume equivalent to 1/128 inches or 0.008 inches of rain for rainfall less than 4.724 in/hr[d] | ±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 | — | — | 0.2 mm | 0.25 mm or 0.01 in | 0.25 mm | Near base of tower |
| Barometric Pressure | — | Vaisala PMT16A | 600 hPa to 1100 hPa | — | — | 3 hPa | — | — | — | ----- | 0.1 hPa | 1 to 2 m above grade |

(a) The differential temperature is a calculated value based on the ambient temperature measurements at two specified levels.
(b) The dew point is a calculated value based on relative humidity and ambient temperature.
(c) Each system accuracy is based on a 15-minute average, unless otherwise noted.
(d) The system accuracy listed for the precipitation instrument is instantaneous.

## Table 2.3-216
## Meteorological System Accuracies (Current Units 2 and 3 System)

| Sensed Parameter | Sensor Type | Manufacturer/ Model | Range | System Accuracy[c] | System Accuracy (per Reg. Guide 1.23) | System Accuracy (per ANSI/ANS-3.11-2005) | Starting Threshold | Starting Threshold (per R.G. 1.23) | Measurement Resolution | Measurement Resolution (per R.G. 1.23) | Measurement Resolution (per ANSI/ANS-3.11-2005) | Elevation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wind Speed | Ultrasonic | Vaisala WS425 | 0 mph to 144 mph | ±0.011mph @ 0-5mph ±0.11% @ 50mph ±0.11% @ 100mph | ±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 mph | 0.1 m/s or 0.1 mph | 0.1 m/s | 60m, 30m, 10m |
| Wind Direction | Ultrasonic | Vaisala WS425 | 0° to 360° | ±0.22° | ±5° | 5° azimuth | Virtually zero | <0.45 m/s (1 mph) | 1° | 1.0° | 1.0° azimuth | 60m, 30m, 10m |
| Ambient Temperature | PT-100 type RTD element | Vaisala HMP45D | –40°F to 140°F | (for -0.6°F to 107.7°F) 0.48°F | ±0.5°C (±0.9°F) | 0.5°C | — | — | 0.1°F | 0.1°C or 0.1°F | 0.1°C | 60m, 30m, 10m |
| Differential Temperature[a] | N/A | N/A | N/A | (for -0.6°F to 107.7°F) 0.17°F | ±0.1°C (±0.18°F) | 0.1°C | — | — | 0.001°F | 0.01°C or 0.01°F | 0.01°C | |
| Relative Humidity/ Temperature[b] (for calculation of dew point temperature) | Capacitive Polymer Humidity and Temperature Device | Vaisala HMP45D | 0.8% to 100% | RH: 0.96% DEW POINT: (for -0.6°F to 107.7°F) 0.98°F | ±1.5°C (±2.7°F) | 4% | — | — | Temp: 0.1°F R.H.: 0.1% | 0.1°C or 0.1°F | 0.1% | 60m, 30m, 10m |
| Precipitation[d] | Tipping Bucket/ Reed Switch | Vaisala QMR102 | Bucket capacity (10 ml) | 8.0% for rainfall greater than 2 in/hr | ±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 | — | — | 0.2 mm | 0.25 mm or 0.01 in | 0.25 mm | Near base of tower |
| Barometric Pressure | — | Vaisala PMT16A | 600 hPa to 1100 hPa | — | — | 3 hPa | — | — | — | — | 0.1 hPa | 1 to 2 m above grade |

(a) The differential temperature is a calculated value based on the ambient temperature measurements between two specified levels.
(b) The dew point is a calculated value based on relative humidity and ambient temperature.
(c) The system accuracy is based on a 15-minute average as noted.
(d) The system accuracy listed for the precipitation instrument is instantaneous.

**Table 2.3-217**
**Annual Data Recovery Rates (in percent) for Unit 1 Meteorological Monitoring System (July 1, 2003–June 30, 2006)**

| Parameter | 7/03-6/04 | 7/04-6/05 | 7/05-6/06 | 3-Year Composite |
|---|---|---|---|---|
| Wind Speed (10 meters) | 97.7 | 96.0 | 98.2 | 97.3 |
| Wind Speed (61 meters) | 98.3 | 95.0 | 99.8 | 97.7 |
| Wind Direction (10 meters) | 95.7 | 95.8 | 97.9 | 96.5 |
| Wind Direction (61 meters) | 97.6 | 94.9 | 99.8 | 97.4 |
| $\Delta$T (61 meters – 10 meters)[a] | 96.0 | 95.6 | 98.9 | 96.9 |
| Ambient Temperature (10 meters) | 97.8 | 95.8 | 99.9 | 97.8 |
| **Composite Parameters** | | | | |
| WS/WD (10 meters), $\Delta$T (61 meters–10 meters)[a] | 95.2 | 95.1 | 97.6 | 95.9 |
| WS/WD (61meters), $\Delta$T (61 meters-10 meters)[a] | 95.6 | 93.7 | 99.0 | 96.1 |

(a) Temperature difference ($\Delta$T) between 61-meter and 10-meter levels.

## Table 2.3-218
## Comparison of Onsite Data with Long-Term Climatological Data

**Wind Frequency Distribution (%)**

| Wind Direction | VCSNS Onsite Data 3 years (7/2003–6/2006) | Columbia NWS 10 years (1951–1960) | Columbia NWS 20 years (1956–1975) |
|---|---|---|---|
| N | 3.8 | 4.9 | 6.8 |
| NNE | 5.2 | 6.5 | 6.5 |
| **NE** | **9.0** | **8.1** | **7.9** |
| ENE | 6.6 | 5.3 | 7.0 |
| E | 4.1 | 3.7 | 6.3 |
| ESE | 2.2 | 3.1 | 4.4 |
| SE | 2.9 | 3.1 | 3.3 |
| SSE | 5.6 | 3.0 | 2.6 |
| S | 7.1 | 4.5 | 6.3 |
| SSW | 9.0 | 7.4 | 6.4 |
| **SW** | **11.6** | **10.1** | **10.7** |
| WSW | 10.5 | 7.4 | 9.8 |
| W | 9.2 | 5.4 | 8.4 |
| WNW | 4.1 | 4.7 | 5.5 |
| NW | 3.4 | 4.3 | 4.2 |
| NNW | 2.8 | 4.1 | 4.0 |

| Annual Percentage by Stability Class (%) | | | | | | |
|---|---|---|---|---|---|---|
| | A | B | C | D | E | F&G |
| 1975 | 3.6 | 2.0 | 5.4 | 35.0 | 31.8 | 22.4 |
| (2003–2006) | 8.8 | 6.5 | 8.6 | 34.3 | 22.2 | 15.3 |

## Table 2.3-219
## Distances from Power Block Area Circle

| Directional Sector | To LPZ (feet) | To LPZ (meters) |
|---|---|---|
| S | 10,270 | 3,130 |
| SSW | 10,028 | 3,057 |
| SW | 10,326 | 3,147 |
| WSW | 11,165 | 3,403 |
| W | 12,542 | 3,823 |
| WNW | 14,365 | 4,378 |
| NW | 16,431 | 5,008 |
| NNW | 18,356 | 5,595 |
| N | 19,702 | 6,005 |
| NNE | 20,151 | 6,142 |
| NE | 19,592 | 5,972 |
| ENE | 18,163 | 5,536 |
| E | 16,208 | 4,940 |
| ESE | 14,155 | 4,315 |
| SE | 12,363 | 3,768 |
| SSE | 11,050 | 3,368 |

## Table 2.3-220
## Units 2 & 3 Ground-Level Release PAVAN Output — X/Q Values at the Dose Evaluation Periphery

| Downwind Sector | Distance (Meters) | 0–-2 Hours | 0–8 Hours | 8–24 Hours | 1–4 Days | 4–30 Days | Annual Average | Hours per Year Maximum 0–2 Hour X/Q Exceeded in Sector |
|---|---|---|---|---|---|---|---|---|
| S | 805 | 7.86E-05 | 5.03E-05 | 4.03E-05 | 2.48E-05 | 1.24E-05 | 5.29E-06 | 0.8 |
| SSW | 805 | 7.64E-05 | 5.02E-05 | 4.07E-05 | 2.58E-05 | 1.34E-05 | 6.03E-06 | 162.8 |
| SW | 805 | 7.26E-05 | 5.05E-05 | 4.21E-05 | 2.84E-05 | 1.62E-05 | 8.10E-06 | 1.1 |
| WSW | 805 | 6.78E-05 | 4.60E-05 | 3.79E-05 | 2.49E-05 | 1.36E-05 | 6.49E-06 | 1.3 |
| W | 805 | 7.69E-05 | 5.02E-05 | 4.05E-05 | 2.55E-05 | 1.31E-05 | 5.82E-06 | 1.0 |
| WNW | 805 | 7.00E-05 | 4.32E-05 | 3.40E-05 | 2.01E-05 | 9.48E-06 | 3.78E-06 | 1.9 |
| NW | 805 | 1.06E-04 | 6.60E-05 | 5.20E-05 | 3.11E-05 | 1.48E-05 | 5.99E-06 | 3.6 |
| NNW | 805 | 1.90E-04 | 1.24E-04 | 1.00E-04 | 6.30E-05 | 3.24E-05 | 1.44E-05 | 11.6 |
| N | 805 | 2.31E-04 | 1.55E-04 | 1.27E-04 | 8.29E-05 | 4.47E-05 | 2.10E-05 | 25.7 |
| NNE | 805 | 2.30E-04 | 1.58E-04 | 1.30E-04 | 8.62E-05 | 4.77E-05 | 2.31E-05 | 24.6 |
| NE | 805 | 2.55E-04 | 1.80E-04 | 1.52E-04 | 1.04E-04 | 6.08E-05 | 3.14E-05 | 41.3 |
| ENE | 805 | 2.57E-04 | 1.80E-04 | 1.50E-04 | 1.02E-04 | 5.83E-05 | 2.95E-05 | 42.4 |
| E | 805 | 2.59E-04 | 1.78E-04 | 1.48E-04 | 9.89E-05 | 5.54E-05 | 2.73E-05 | 43.7 |
| ESE | 805 | 1.98E-04 | 1.26E-04 | 1.01E-04 | 6.23E-05 | 3.11E-05 | 1.33E-05 | 20.0 |
| SE | 805 | 1.14E-04 | 7.26E-05 | 5.78E-05 | 3.53E-05 | 1.73E-05 | 7.28E-06 | 7.9 |
| SSE | 805 | 7.99E-05 | 4.97E-05 | 3.91E-05 | 2.34E-05 | 1.11E-05 | 4.50E-06 | 2.3 |
| Max 0-2 hr X/Q | | 2.59E-04 | Total Hours Entire Site Max 0-2 hr X/Q Exceeded | | | | | 392.0 |
| Site Limit | | 2.18E-04 | 1.58E-04 | 1.35E-04 | 9.53E-05 | 5.79E-05 | 3.14E-05 | |

## Table 2.3-221
## Units 2 & 3 Ground-Level Release PAVAN Output – X/Q Values at the Low Population Zone Boundary

| Downwind Sector | Distance (Meters) | 0–2 Hours | 0–8 Hours | 8–24 Hours | 1–4 Days | 4–30 Days | Annual Average | Hours per Year Maximum 0–2 Hour X/Q Exceeded in Sector |
|---|---|---|---|---|---|---|---|---|
| S | 3,130 | 1.40E-05 | 7.16E-06 | 5.13E-06 | 2.49E-06 | 8.79E-07 | 2.46E-07 | 3.6 |
| SSW | 3,057 | 1.41E-05 | 7.42E-06 | 5.40E-06 | 2.70E-06 | 9.99E-07 | 2.96E-07 | 3.8 |
| SW | 3,147 | 1.23E-05 | 6.89E-06 | 5.16E-06 | 2.75E-06 | 1.11E-06 | 3.69E-07 | 2.3 |
| WSW | 3,403 | 1.08E-05 | 5.78E-06 | 4.24E-06 | 2.16E-06 | 8.21E-07 | 2.51E-07 | 2.4 |
| W | 3,823 | 1.15E-05 | 5.79E-06 | 4.10E-06 | 1.94E-06 | 6.63E-07 | 1.78E-07 | 2.2 |
| WNW | 4,378 | 8.87E-06 | 4.14E-06 | 2.83E-06 | 1.24E-06 | 3.77E-07 | 8.82E-08 | 2.3 |
| NW | 5,008 | 1.19E-05 | 5.47E-06 | 3.71E-06 | 1.60E-06 | 4.76E-07 | 1.08E-07 | 3.4 |
| NNW | 5,595 | 2.45E-05 | 1.12E-05 | 7.56E-06 | 3.23E-06 | 9.52E-07 | 2.14E-07 | 3.4 |
| N | 6,005 | 3.18E-05 | 1.45E-05 | 9.80E-06 | 4.18E-06 | 1.23E-06 | 2.77E-07 | 10.6 |
| NNE | 6,142 | 3.15E-05 | 1.45E-05 | 9.83E-06 | 4.23E-06 | 1.26E-06 | 2.88E-07 | 9.3 |
| NE | 5,972 | 3.98E-05 | 1.87E-05 | 1.28E-05 | 5.67E-06 | 1.75E-06 | 4.16E-07 | 20.8 |
| ENE | 5,536 | 4.51E-05 | 2.11E-05 | 1.44E-05 | 6.31E-06 | 1.93E-06 | 4.52E-07 | 31.7 |
| E | 4,940 | 4.87E-05 | 2.30E-05 | 1.58E-05 | 7.02E-06 | 2.18E-06 | 5.23E-07 | 43.7 |
| ESE | 4,315 | 3.81E-05 | 1.74E-05 | 1.17E-05 | 5.01E-06 | 1.48E-06 | 3.31E-07 | 25.7 |
| SE | 3,768 | 2.12E-05 | 1.01E-05 | 6.95E-06 | 3.10E-06 | 9.72E-07 | 2.35E-07 | 13.1 |
| SSE | 3,368 | 1.20E-05 | 5.97E-06 | 4.22E-06 | 1.99E-06 | 6.76E-07 | 1.80E-07 | 4.9 |
| Max 0-2 hr X/Q | | 4.87E-05 | Total Hours Entire Site Max 0–2 hr X/Q Exceeded | | | | | 183.3 |
| Site Limit | | 7.34E-05 | 3.87E-05 | 2.81E-05 | 1.40E-05 | 5.30E-06 | 1.62E-06 | |

## Table 2.3-222
## ARCON96 X/Q Values at the Control Room HVAC Intake

| Release Point and DCD Site Parameter X/Q Values[(a)] | 0 – 2 hours | 2 – 8 hours | 8 – 24 hours | 1 – 4 days | 4 – 30 days |
|---|---|---|---|---|---|
| Plant Vent | 1.71E-03 | 1.23E-03 | 4.52E-04 | 3.00E-04 | 2.13E-04 |
| DCD | 3.0E-03 | 2.5E-03 | 1.0E-03 | 8.0E-04 | 6.0E-04 |
| | | | | | |
| PCS Air Diffuser | 1.58E-03 | 1.14E-03 | 4.17E-04 | 3.01E-04 | 2.12E-04 |
| DCD | 3.0E-03 | 2.5E-03 | 1.0E-03 | 8.0E-04 | 6.0E-04 |
| | | | | | |
| Fuel Building Blowout Panel | 1.44E-03 | 9.58E-04 | 3.90E-04 | 2.74E-04 | 1.88E-04 |
| DCD | 6.0E-03 | 4.0E-03 | 2.0E-03 | 1.5E-03 | 1.0E-03 |
| | | | | | |
| Fuel Building Truck Bay Door | 1.15E-03 | 8.05E-04 | 3.49E-04 | 2.42E-04 | 1.82E-04 |
| DCD | 6.0E-03 | 4.0E-03 | 2.0E-03 | 1.5E-03 | 1.0E-03 |
| | | | | | |
| Steam Line Break | 1.69E-02 | 1.39E-02 | 5.59E-03 | 5.17E-03 | 3.81E-03 |
| DCD | 2.4E-02 | 2.0E-02 | 7.5E-03 | 5.5E-03 | 5.0E-03 |
| | | | | | |
| PORV & Safety Valves | 1.44E-02 | 1.23E-02 | 4.99E-03 | 4.60E-03 | 3.36E-03 |
| DCD | 2.0E-02 | 1.8E-02 | 7.0E-03 | 5.0E-03 | 4.5E-03 |
| | | | | | |
| Condenser Air Removal Stack | 1.52E-03 | 1.03E-03 | 4.16E-04 | 2.75E-04 | 2.13E-04 |
| DCD | 2.0E-02 | 1.8E-02 | 7.0E-03 | 5.0E-03 | 4.5E-03 |
| | | | | | |
| Containment Shell (As Diffuse Area Source) | 1.96E-03 | 1.32E-03 | 5.34E-04 | 3.97E-04 | 2.76E-04 |
| DCD | 6.0E-03 | 4.5E-03 | 2.0E-03 | 1.8E-03 | 1.5E-03 |

(a) DCD site parameter values are from DCD Tier 2, Chapter 15, Appendix 15A, Table 15A-6.

## Table 2.3-223
## ARCON96 X/Q Values at the Annex Building Access Door

| Release Point and DCD Site Parameter X/Q Values[a] | 0 – 2 hours | 2 – 8 hours | 8 – 24 hours | 1 – 4 days | 4 – 30 days |
|---|---|---|---|---|---|
| Plant Vent | 3.85E-04 | 2.75E-04 | 1.01E-04 | 6.81E-05 | 4.82E-05 |
| DCD | 1.0E-03 | 7.5E-04 | 3.5E-04 | 2.8E-04 | 2.5E-04 |
| | | | | | |
| PCS Air Diffuser | 3.93E-04 | 2.83E-04 | 1.05E-04 | 7.11E-05 | 4.91E-05 |
| DCD | 1.0E-03 | 7.5E-04 | 3.5E-04 | 2.8E-04 | 2.5E-04 |
| | | | | | |
| Fuel Building Blowout Panel | 3.61E-04 | 2.49E-04 | 8.99E-05 | 6.00E-05 | 4.27E-05 |
| DCD | 6.0E-03 | 4.0E-03 | 2.0E-03 | 1.5E-03 | 1.0E-03 |
| | | | | | |
| Fuel Building Truck Bay Door | 3.51E-04 | 2.33E-04 | 8.77E-05 | 6.09E-05 | 4.25E-05 |
| DCD | 6.0E-03 | 4.0E-03 | 2.0E-03 | 1.5E-03 | 1.0E-03 |
| | | | | | |
| Steam Line Break | 9.59E-04 | 6.98E-04 | 2.41E-04 | 1.75E-04 | 1.15E-04 |
| DCD | 4.0E-03 | 3.2E-03 | 1.2E-03 | 1.0E-03 | 8.0E-04 |
| | | | | | |
| PORV & Safety Valves | 1.02E-03 | 7.29E-04 | 2.47E-04 | 1.84E-04 | 1.24E-04 |
| DCD | 4.0E-03 | 3.2E-03 | 1.2E-03 | 1.0E-03 | 8.0E-04 |
| | | | | | |
| Condenser Air Removal Stack | 3.80E-03 | 2.95E-03 | 1.05E-03 | 8.96E-04 | 5.97E-04 |
| DCD | 4.0E-03 | 3.2E-03 | 1.2E-03 | 1.0E-03 | 8.0E-04 |
| | | | | | |
| Containment Shell (As Diffuse Area Source) | 3.79E-04 | 2.57E-04 | 9.71E-05 | 6.34E-05 | 4.36E-05 |
| DCD | 1.0E-03 | 7.5E-04 | 3.5E-04 | 2.8E-04 | 2.5E-04 |

(a) DCD site parameter values are from DCD Tier 2, Chapter 15, Appendix 15A, Table 15A-6.

## Table 2.3-224
## Shortest Distances Between the Units 2 and 3 Power Block Area Circle and Receptors of Interest by Downwind Direction Sector[a]

| Downwind Direction Sector[b] | Meat Animal | Milk Animal | Residence | Vegetable Garden | Dose Evaluation Periphery | Unit 3 Reactor |
|---|---|---|---|---|---|---|
| N | 6,756 | ----- | 7,264 | ----- | 805 | ----- |
| NNE | 9,313 | ----- | 5,980 | 6,480 | 805 | ----- |
| NE | 3,436 | ----- | 3,436 | 3,703 | 805 | ----- |
| ENE | ----- | ----- | 2,094 | 2,647 | 805 | ----- |
| E | ----- | ----- | 1,978 | 1,978 | 805 | ----- |
| ESE | ----- | ----- | ----- | 7,931 | 805 | ----- |
| SE | 6,855 | ----- | 2,703 | 2,703 | 805 | ----- |
| SSE | ----- | ----- | ----- | ----- | 805 | ----- |
| S | 6,403 | ----- | 4,099 | 4,099 | 805 | 274 |
| SSW | 5,793 | ----- | 3,234 | 4,296 | 805 | 274 |
| SW | 5,955 | ----- | 3,719 | 3,719 | 805 | 274 |
| WSW | 6,570 | ----- | ----- | ----- | 805 | ----- |
| W | ----- | 7,625 | 3,541 | 3,696 | 805 | ----- |
| WNW | 2,795 | ----- | 3,597 | 3,973 | 805 | ----- |
| NW | 7,682 | ----- | 6,801 | 7,682 | 805 | ----- |
| NNW | 5,656 | ----- | 5,656 | 5,656 | 805 | ----- |

(a) Distances shown are in meters.
(b) Not all direction sectors included receptors of interest.

**Table 2.3-225**
**XOQDOQ-Predicted Maximum X/Q and D/Q Values at Sensitive Receptors of Interest**

| Type of Sensitive Receptor Location | Direction from Site | Distance (miles) | X/Q (sec/$m^3$) (No Decay) |
|---|---|---|---|
| Residence | E | 1.23 | 1.0E-06 |
| Meat Animal | NE | 2.14 | 5.4E-07 |
| Milk Animal | W | 4.74 | 3.5E-08 |
| Vegetable Garden | E | 1.23 | 1.0E-06 |
| Dose Evaluation Periphery | NE | 0.50 | 4.7E-06 |
| Unit 3 Reactor | SW | 0.17 | 8.5E-06 |

| Type of Sensitive Receptor Location | Direction from Site | Distance (miles) | X/Q (sec/$m^3$) (2.26-Day Decay) |
|---|---|---|---|
| Residence | ENE<br>E | 1.30<br>1.23 | 9.9E-07 |
| Meat Animal | NE | 2.14 | 5.4E-07 |
| Milk Animal | W | 4.74 | 3.5E-08 |
| Vegetable Garden | E | 1.23 | 9.9E-07 |
| Dose Evaluation Periphery | NE | 0.50 | 4.7E-06 |
| Unit 3 Reactor | SW | 0.17 | 8.5E-06 |

| Type of Sensitive Receptor Location | Direction from Site | Distance (miles) | X/Q (sec/$m^3$) (8-Day Decay) |
|---|---|---|---|
| Residence | E | 1.23 | 8.6E-07 |
| Meat Animal | NE | 2.14 | 4.4E-07 |
| Milk Animal | W | 4.74 | 2.6E-08 |
| Vegetable Garden | E | 1.23 | 8.6E-07 |
| Dose Evaluation Periphery | NE | 0.50 | 4.3E-06 |
| Unit 3 Reactor | SW | 0.17 | 8.1E-06 |

| Type of Sensitive Receptor Location | Direction from Site | Distance (miles) | D/Q (1/$m^3$) |
|---|---|---|---|
| Residence | ENE | 1.30 | 4.3E-09 |
| Meat Animal | NE | 2.14 | 1.9E-09 |
| Milk Animal | W | 4.74 | 1.7E-10 |
| Vegetable Garden | E | 1.23 | 4.2E-09 |
| Dose Evaluation Periphery | NE | 0.50 | 2.3E-08 |
| Unit 3 Reactor | SW | 0.17 | 9.2E-08 |

## Table 2.3-226 (Sheet 1 of 2)
## XOQDOQ-Predicted Maximum Annual Average X/Q and D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

| **No Decay Undepleted** | **DISTANCE IN MILES FROM THE SITE** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NE | 0.25 | 0.5 | 0.75 | 1.00 | 1.50 | 2.00 | 2.50 | 3.00 | 3.50 | 4.00 | 4.50 |
| X/Q (s/$m^3$) | 1.592E-5 | 4.733E-6 | 2.450E-6 | 1.576E-6 | 8.873E-7 | 5.925E-7 | 4.352E-7 | 3.418E-7 | 2.788E-7 | 2.337E-7 | 2.001E-7 |
| | **DISTANCE IN MILES FROM THE SITE** | | | | | | | | | | |
| NE | 5.00 | 7.50 | 10.00 | 15.00 | 20.00 | 25.00 | 30.00 | 35.00 | 40.00 | 45.00 | 50.00 |
| X/Q (s/$m^3$) | 1.742E-7 | 1.025E-7 | 7.058E-8 | 4.186E-8 | 2.900E-8 | 2.185E-8 | 1.735E-8 | 1.429E-8 | 1.208E-8 | 1.042E-8 | 9.139E-9 |
| | **SEGMENT BOUNDARIES IN MILES FROM THE SITE** | | | | | | | | | | |
| NE | 0.5 - 1 | 1 - 2 | 2 - 3 | 3 - 4 | 4 - 5 | 5 - 10 | 10 - 20 | 20 - 30 | 30 - 40 | 40 - 50 | |
| X/Q (s/$m^3$) | 2.569E-6 | 9.094E-7 | 4.398E-7 | 2.796E-7 | 2.004E-7 | 1.043E-7 | 4.253E-8 | 2.196E-8 | 1.432E-8 | 1.044E-8 | |
| | | | | | | | | | | | |
| **2.26-Day Decay, Undepleted** | **DISTANCE IN MILES FROM THE SITE** | | | | | | | | | | |
| NE | 0.25 | 0.5 | 0.75 | 1.00 | 1.50 | 2.00 | 2.50 | 3.00 | 3.50 | 4.00 | 4.50 |
| X/Q (s/$m^3$) | 1.590E-5 | 4.725E-6 | 2.443E-6 | 1.571E-6 | 8.827E-7 | 5.884E-7 | 4.314E-7 | 3.382E-7 | 2.753E-7 | 2.304E-7 | 1.969E-7 |
| | **DISTANCE IN MILES FROM THE SITE** | | | | | | | | | | |
| NE | 5.00 | 7.50 | 10.00 | 15.00 | 20.00 | 25.00 | 30.00 | 35.00 | 40.00 | 45.00 | 50.00 |
| X/Q (s/$m^3$) | 1.711E-7 | 9.982E-8 | 6.808E-8 | 3.965E-8 | 2.697E-8 | 1.995E-8 | 1.556E-8 | 1.258E-8 | 1.044E-8 | 8.850E-9 | 7.619E-9 |
| | **SEGMENT BOUNDARIES IN MILES FROM THE SITE** | | | | | | | | | | |
| NE | 0.5 - 1 | 1 - 2 | 2 - 3 | 3 - 4 | 4 - 5 | 5 - 10 | 10 - 20 | 20 - 30 | 30 - 40 | 40 - 50 | |
| X/Q (s/$m^3$) | 2.563E-6 | 9.048E-7 | 4.360E-7 | 2.762E-7 | 1.973E-7 | 1.016E-7 | 4.033E-8 | 2.006E-8 | 1.262E-8 | 8.867E-9 | |

## Table 2.3-226 (Sheet 2 of 2)
## XOQDOQ-Predicted Maximum Annual Average X/Q and D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

| **8.0-Day Decay, Depleted** | **DISTANCE IN MILES FROM THE SITE** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NE | 0.25 | 0.50 | 0.75 | 1.00 | 1.50 | 2.00 | 2.50 | 3.00 | 3.50 | 4.00 | 4.50 |
| X/Q (s/$m^3$) | 1.506E-5 | 4.320E-6 | 2.181E-6 | 1.379E-6 | 7.525E-7 | 4.897E-7 | 3.517E-7 | 2.707E-7 | 2.168E-7 | 1.787E-7 | 1.506E-7 |
| | **DISTANCE IN MILES FROM THE SITE** | | | | | | | | | | |
| NE | 5.00 | 7.50 | 10.00 | 15.00 | 20.00 | 25.00 | 30.00 | 35.00 | 40.00 | 45.00 | 50.00 |
| X/Q (s/$m^3$) | 1.292E-7 | 7.174E-8 | 4.694E-8 | 2.563E-8 | 1.659E-8 | 1.178E-8 | 8.870E-9 | 6.956E-9 | 5.620E-9 | 4.645E-9 | 3.909E-9 |
| | **SEGMENT BOUNDARIES IN MILES FROM THE SITE** | | | | | | | | | | |
| NE | 0.5 - 1 | 1 - 2 | 2 - 3 | 3 - 4 | 4 - 5 | 5 - 10 | 10 - 20 | 20 - 30 | 30 - 40 | 40 - 50 | |
| X/Q (s/$m^3$) | 2.300E-6 | 7.748E-7 | 3.561E-7 | 2.177E-7 | 1.510E-7 | 7.348E-8 | 2.635E-8 | 1.190E-8 | 6.994E-9 | 4.662E-9 | |
| | | | | | | | | | | | |
| **Relative Deposition/Area** | **DISTANCE IN MILES FROM THE SITE** | | | | | | | | | | |
| NE | 0.25 | 0.50 | 0.75 | 1.00 | 1.50 | 2.00 | 2.50 | 3.00 | 3.50 | 4.00 | 4.50 |
| D/Q (1/$m^2$) | 6.756E-8 | 2.285E-8 | 1.173E-8 | 7.203E-9 | 3.591E-9 | 2.178E-9 | 1.473E-9 | 1.067E-9 | 8.114E-10 | 6.392E-10 | 5.175E-10 |
| | **DISTANCE IN MILES FROM THE SITE** | | | | | | | | | | |
| NE | 5.00 | 7.50 | 10.00 | 15.00 | 20.00 | 25.00 | 30.00 | 35.00 | 40.00 | 45.00 | 50.00 |
| D/Q (1/$m^2$) | 4.281E-10 | 2.098E-10 | 1.316E-10 | 6.653E-11 | 4.027E-11 | 2.700E-11 | 1.935E-11 | 1.453E-11 | 1.129E-11 | 9.022E-12 | 7.364E-12 |
| | **SEGMENT BOUNDARIES IN MILES FROM THE SITE** | | | | | | | | | | |
| NE | 0.5 - 1 | 1 - 2 | 2 - 3 | 3 - 4 | 4 - 5 | 5 - 10 | 10 - 20 | 20 - 30 | 30 - 40 | 40 - 50 | |
| D/Q (1/$m^2$) | 1.219E-08 | 3.766E-09 | 1.498E-09 | 8.189E-10 | 5.205E-10 | 2.236E-10 | 6.932E-11 | 2.748E-11 | 1.467E-11 | 9.081E-12 | |

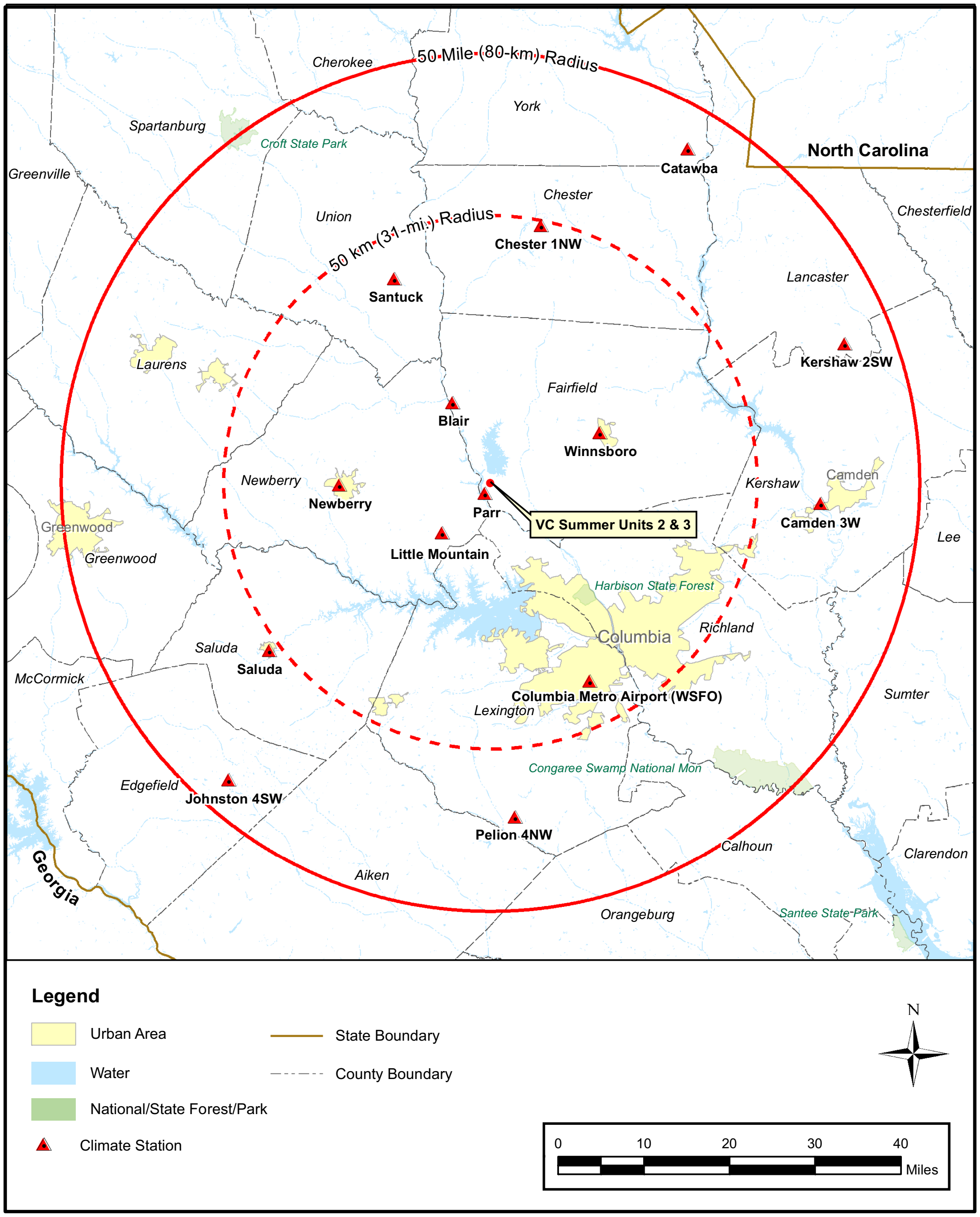



Figure 2.3-201. Climatological Observing Stations Near the VCSNS Site

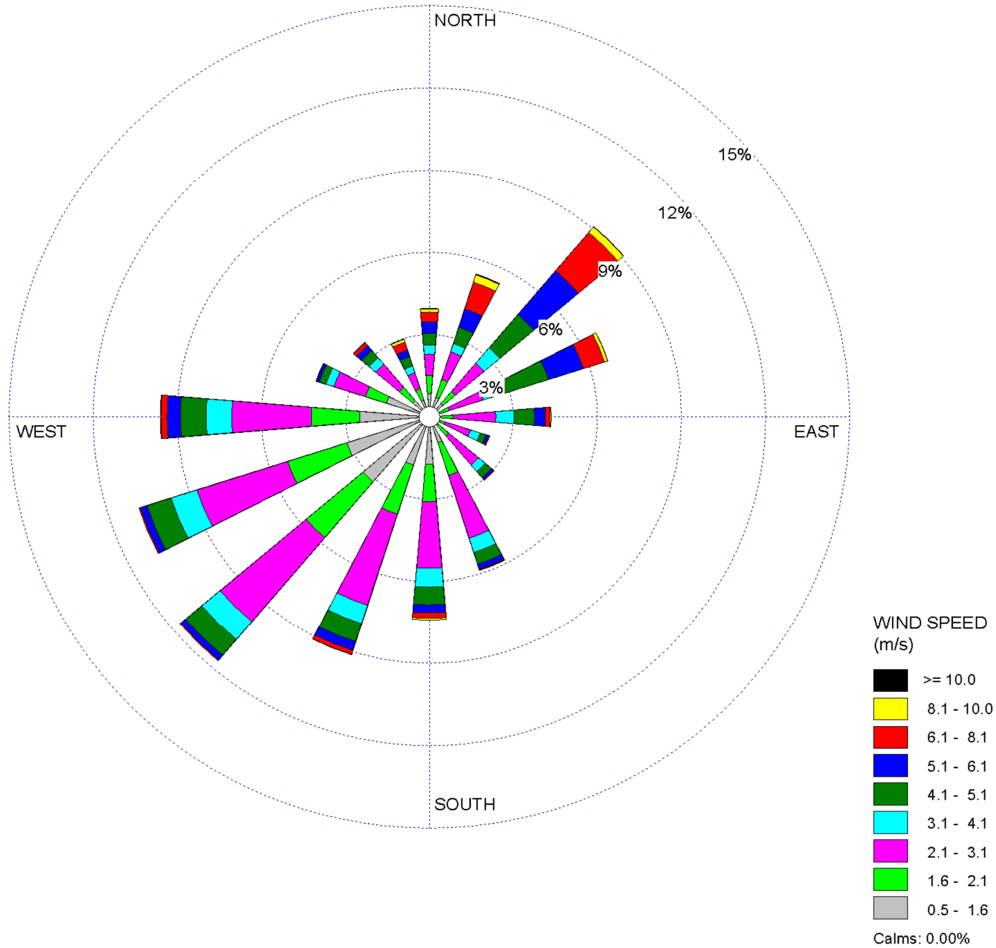



**Figure 2.3-202. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — Annual**

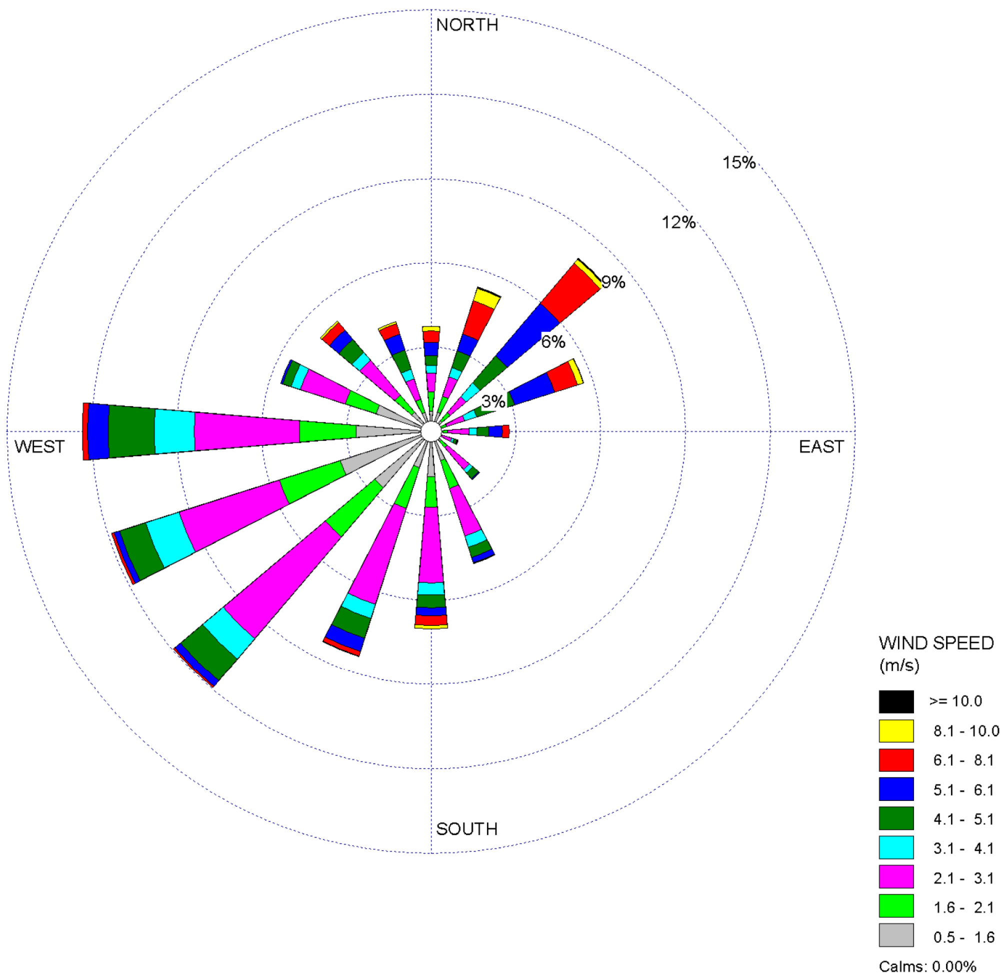



**Figure 2.3-203. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — Winter**

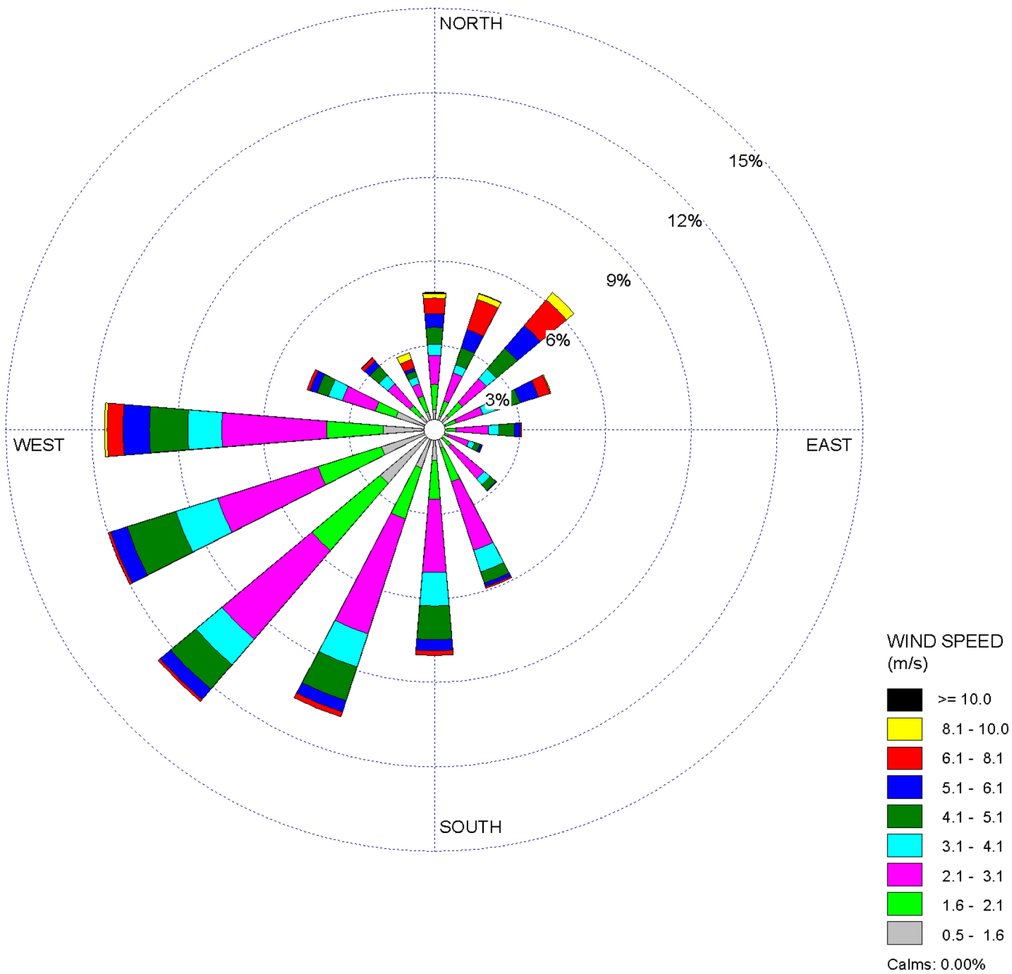



**Figure 2.3-204. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — Spring**

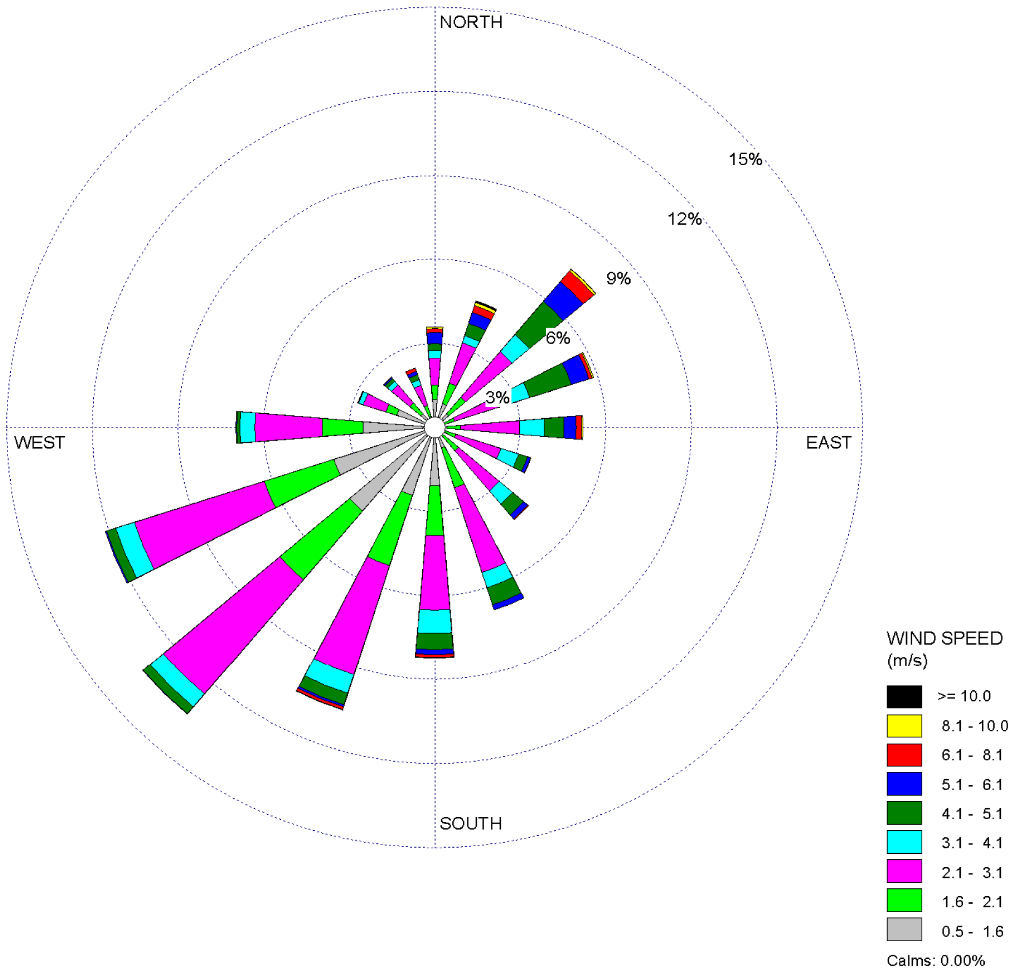



**Figure 2.3-205. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — Summer**

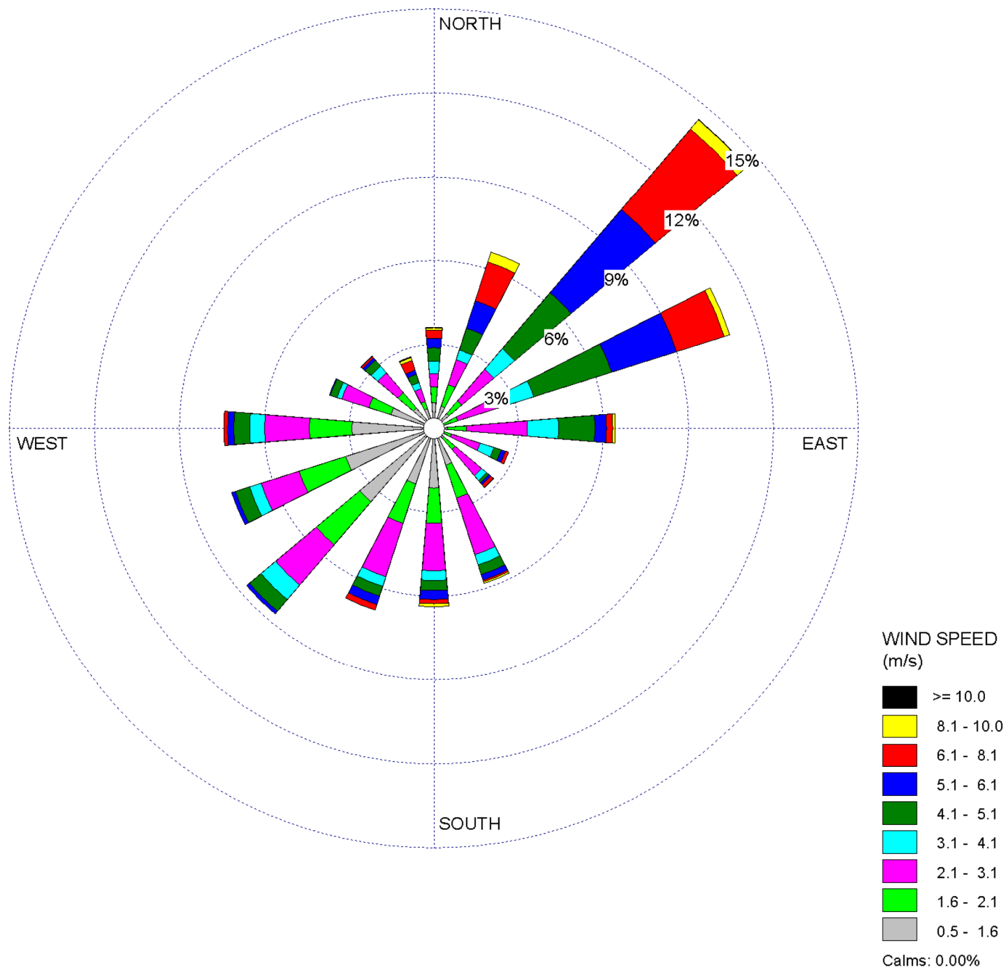



**Figure 2.3-206. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — Autumn**

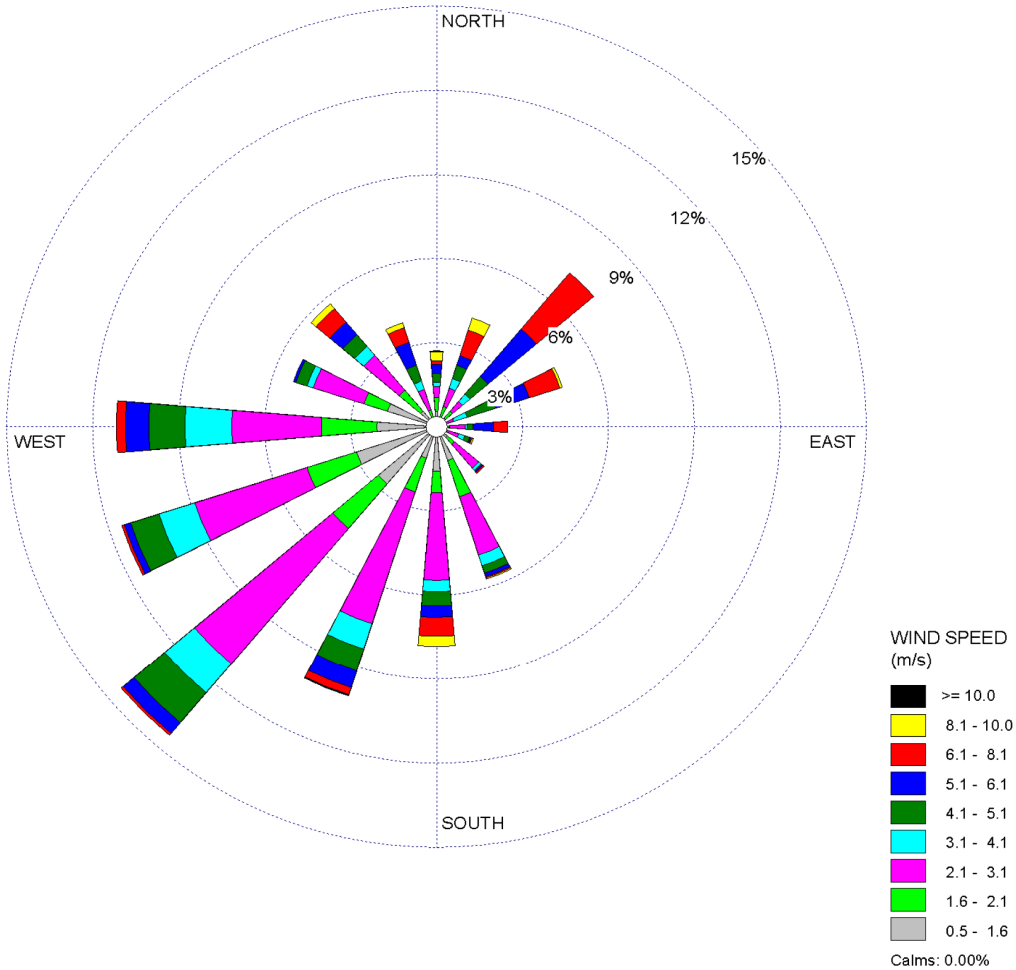



**Figure 2.3-207. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — January (Sheet 1 of 12)**

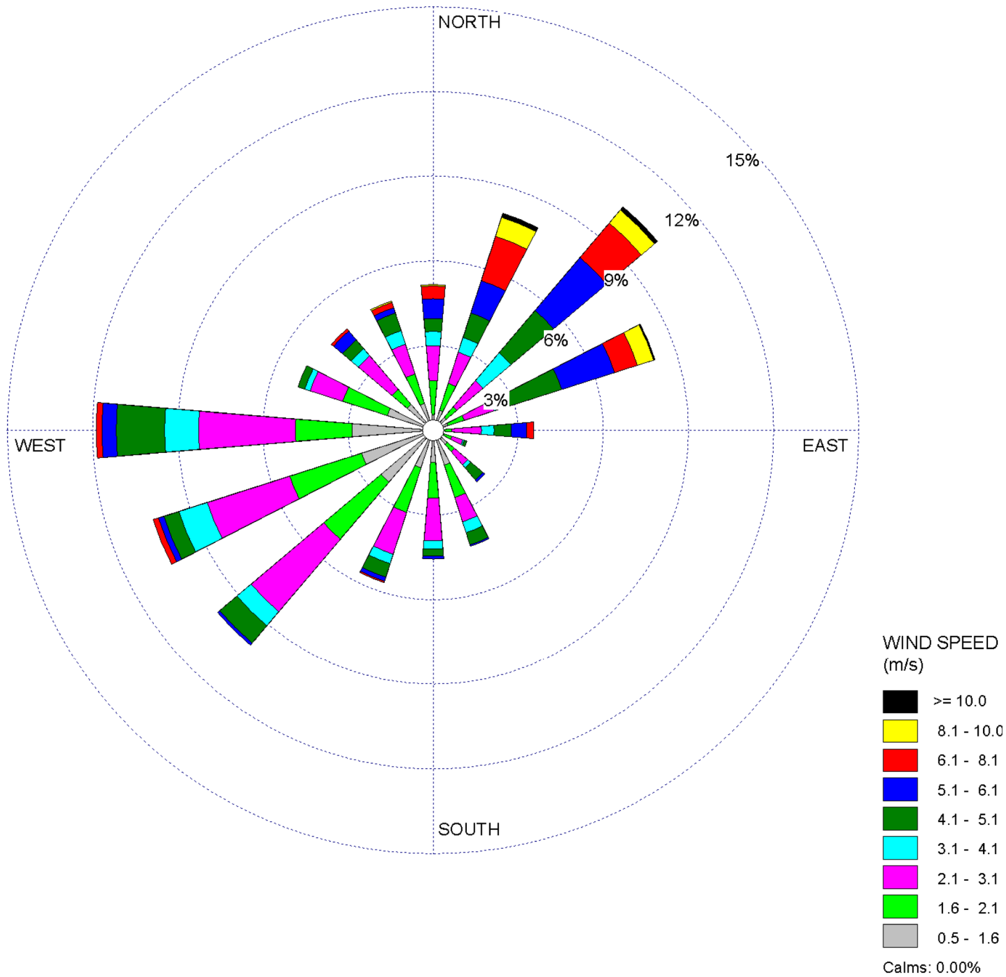



**Figure 2.3-207. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — February (Sheet 2 of 12)**

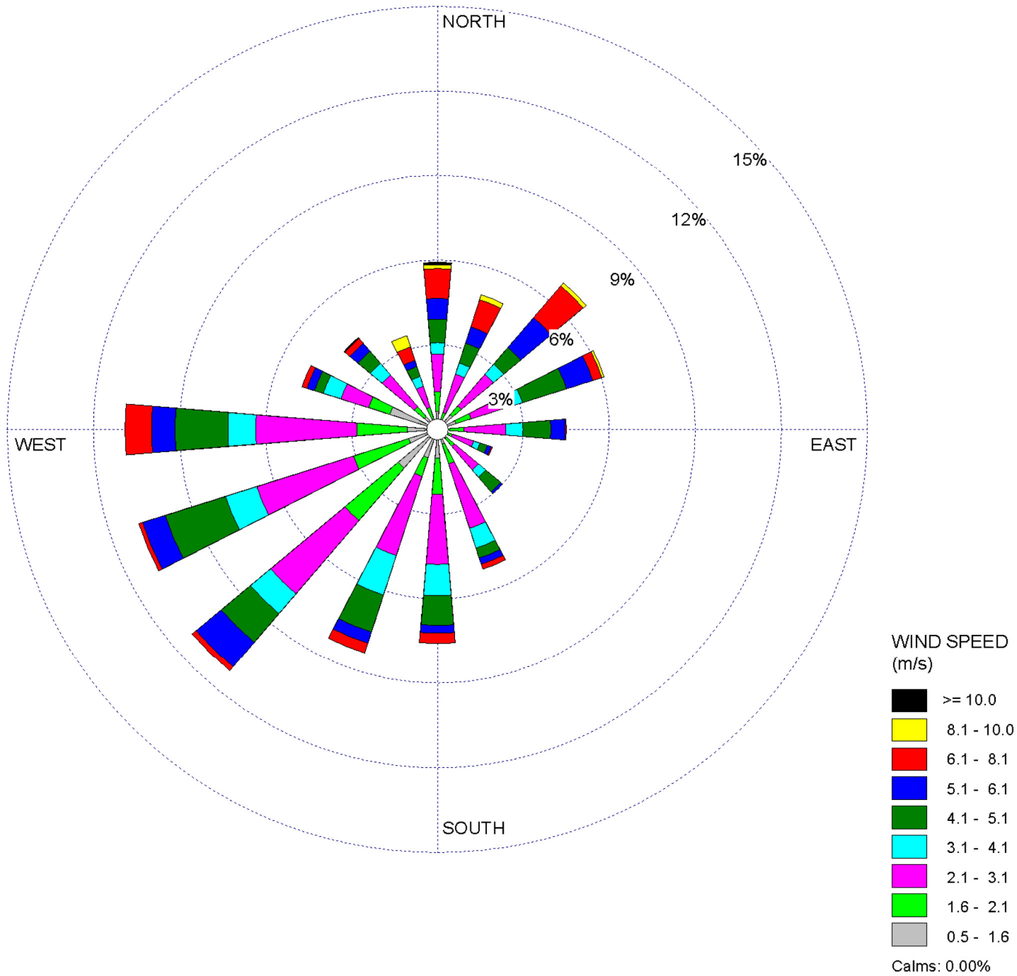



**Figure 2.3-207. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — March (Sheet 3 of 12)**

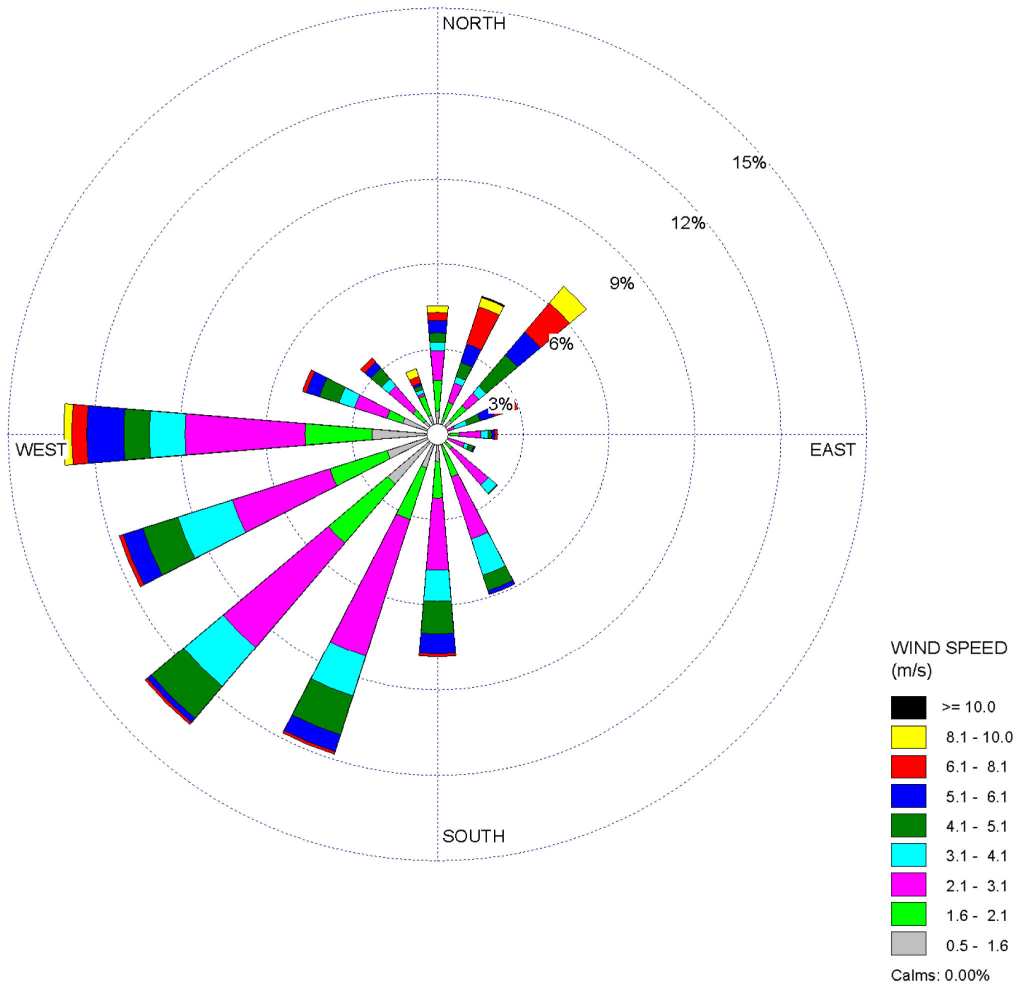



**Figure 2.3-207. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — April (Sheet 4 of 12)**

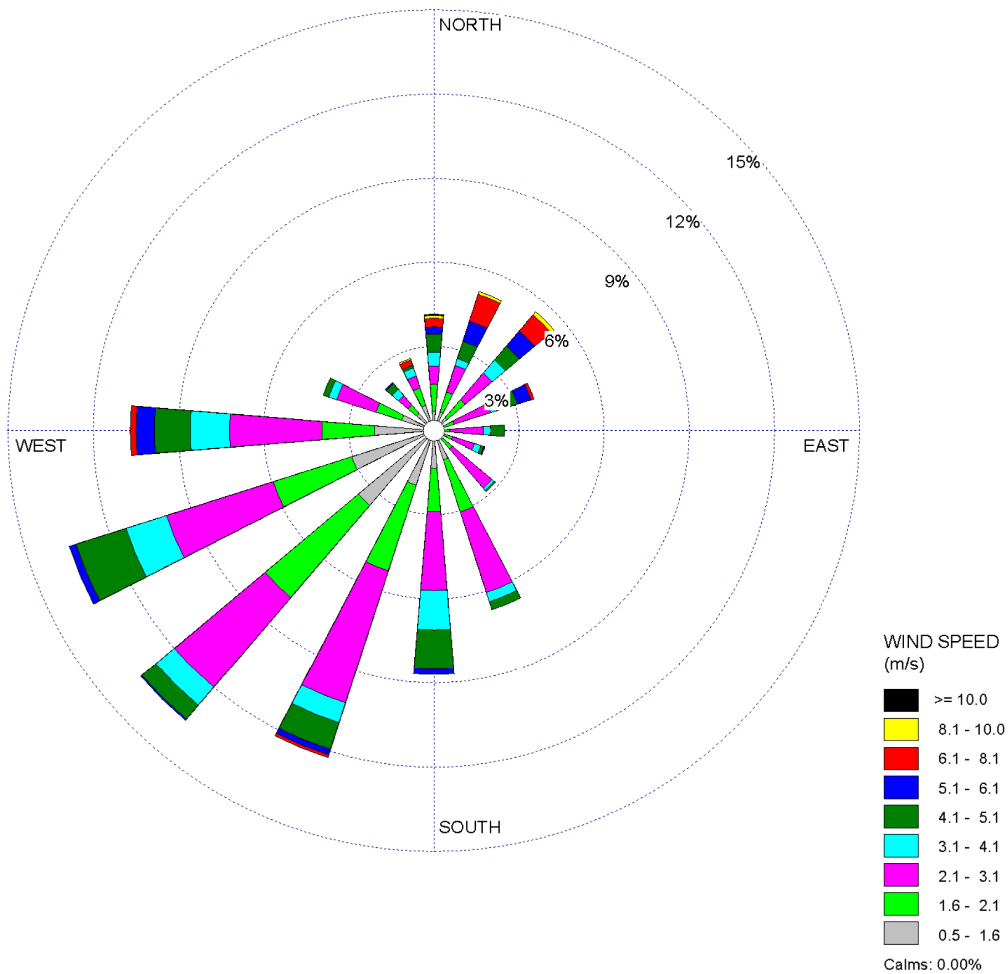



**Figure 2.3-207. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — May (Sheet 5 of 12)**

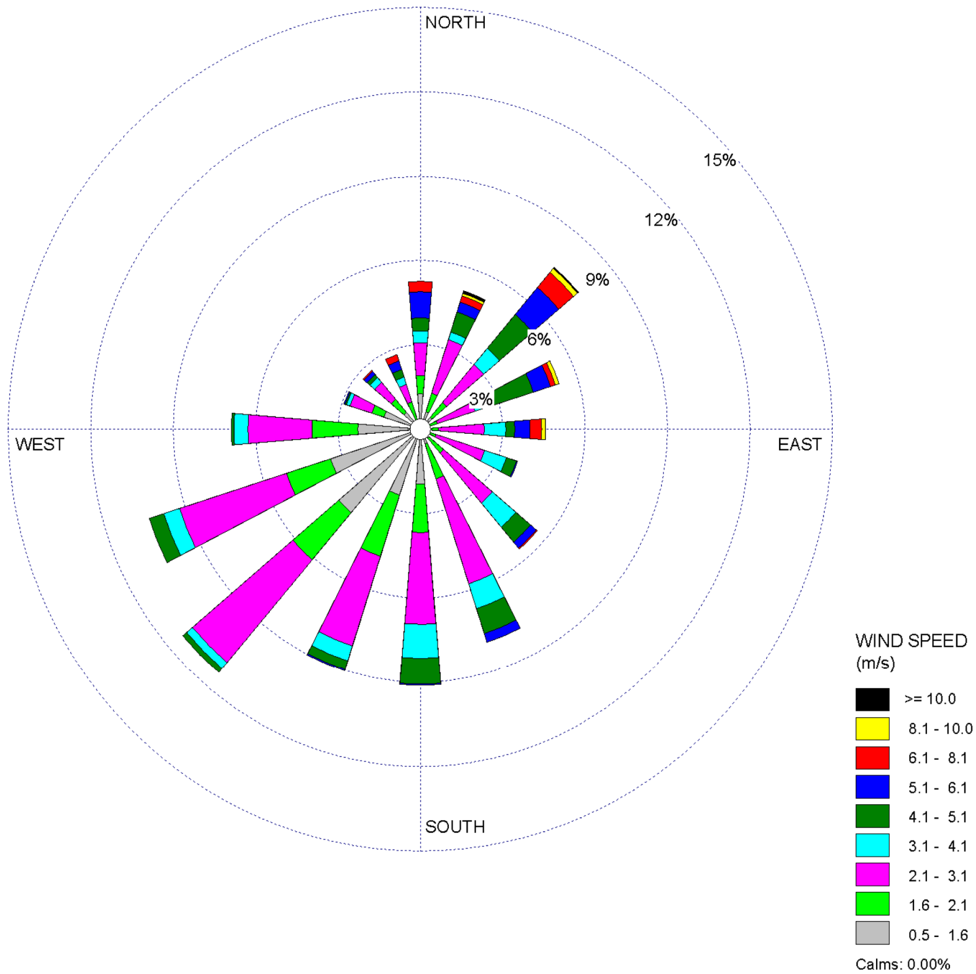



**Figure 2.3-207. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — June (Sheet 6 of 12)**

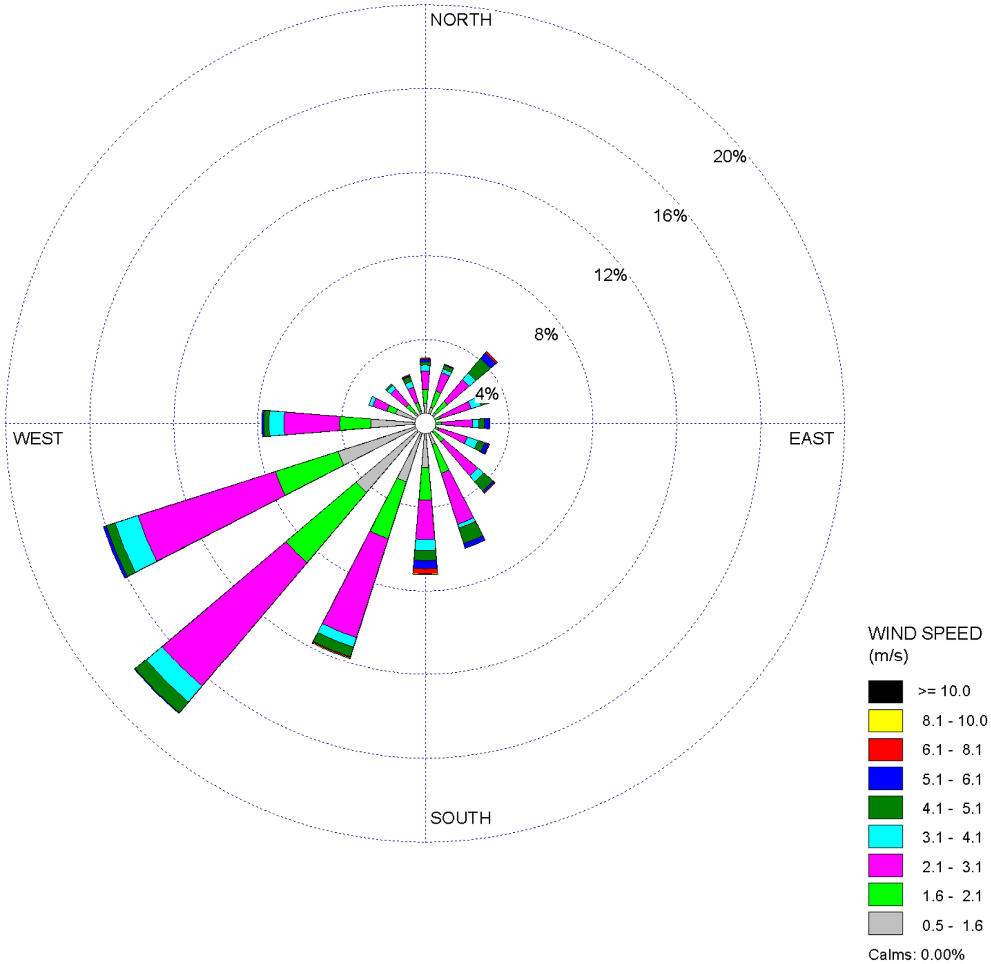



**Figure 2.3-207. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — July (Sheet 7 of 12)**

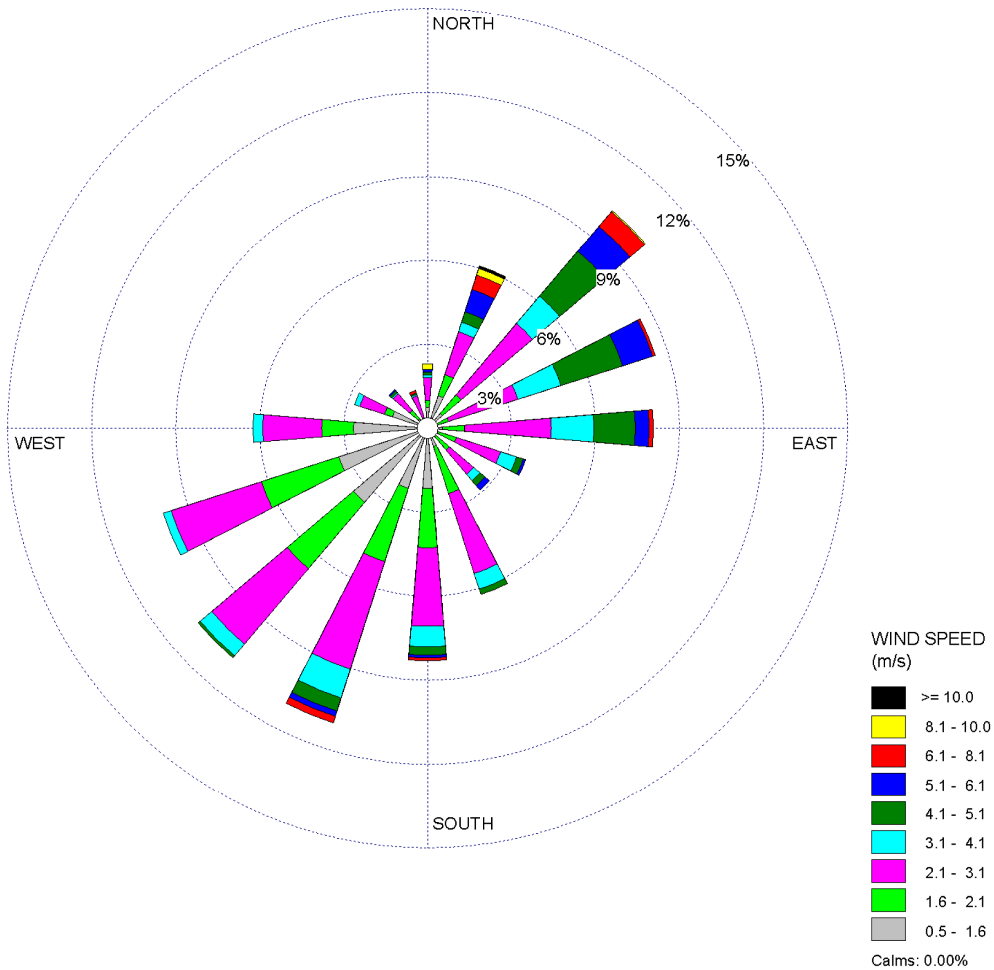



**Figure 2.3-207. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — August (Sheet 8 of 12)**

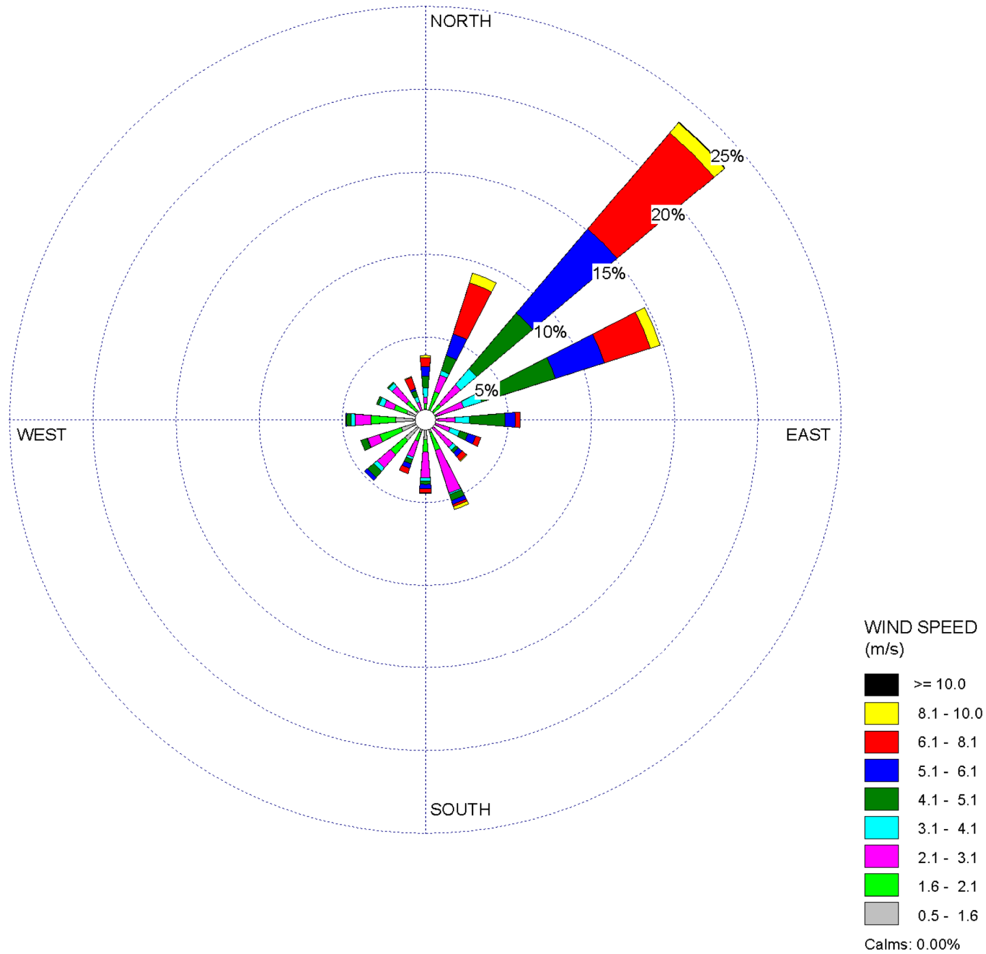



**Figure 2.3-207. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — September (Sheet 9 of 12)**

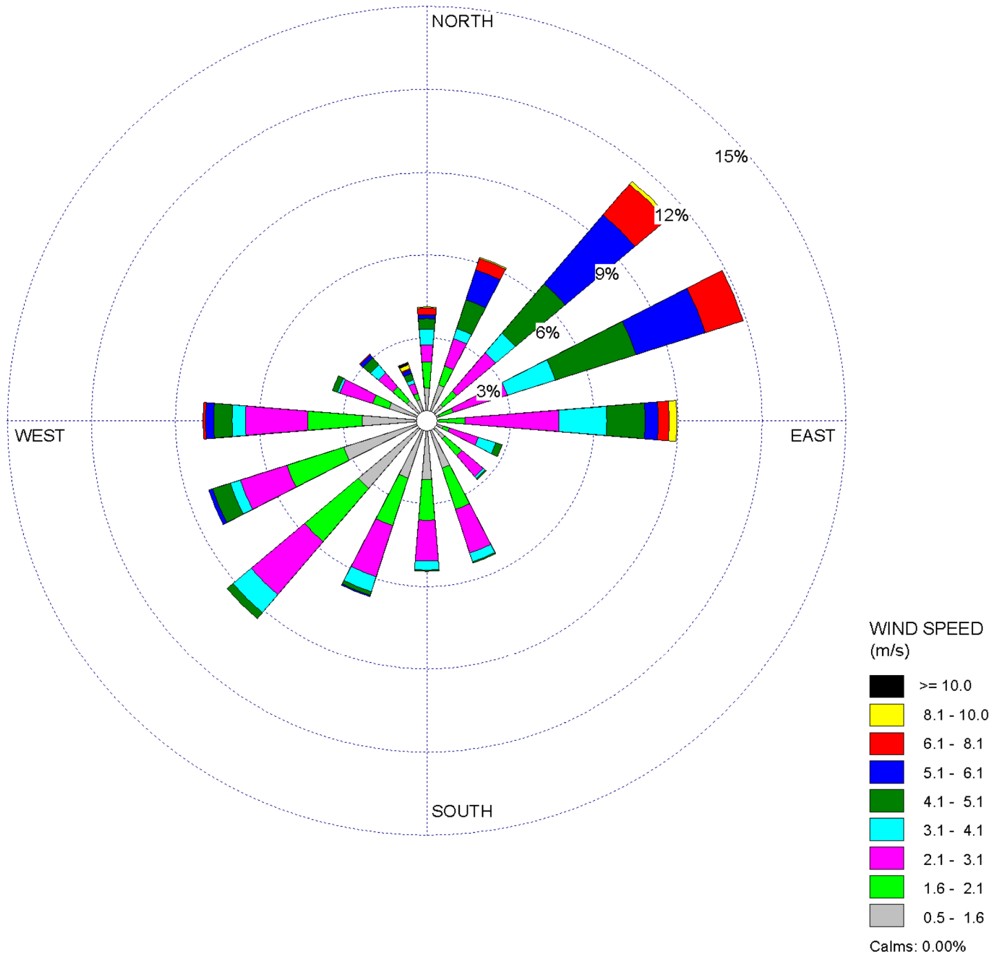



**Figure 2.3-207. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — October (Sheet 10 of 12)**

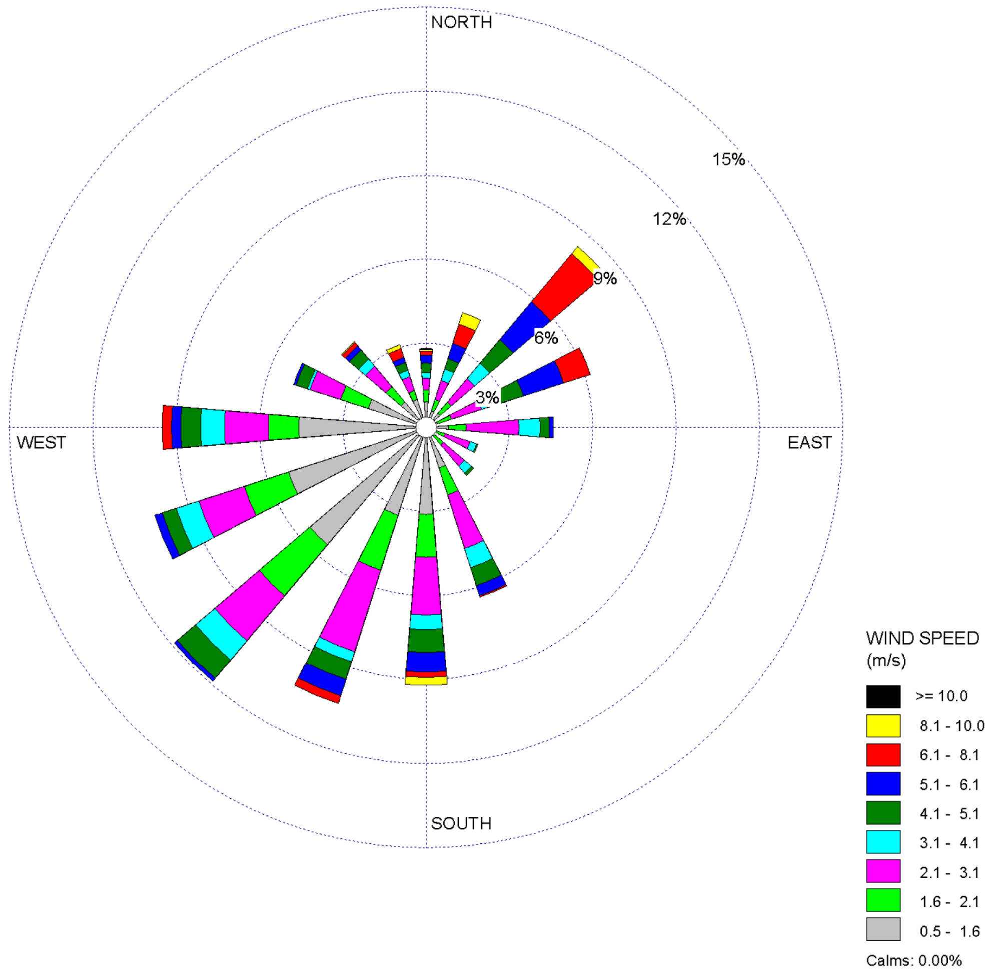



**Figure 2.3-207. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — November (Sheet 11 of 12)**

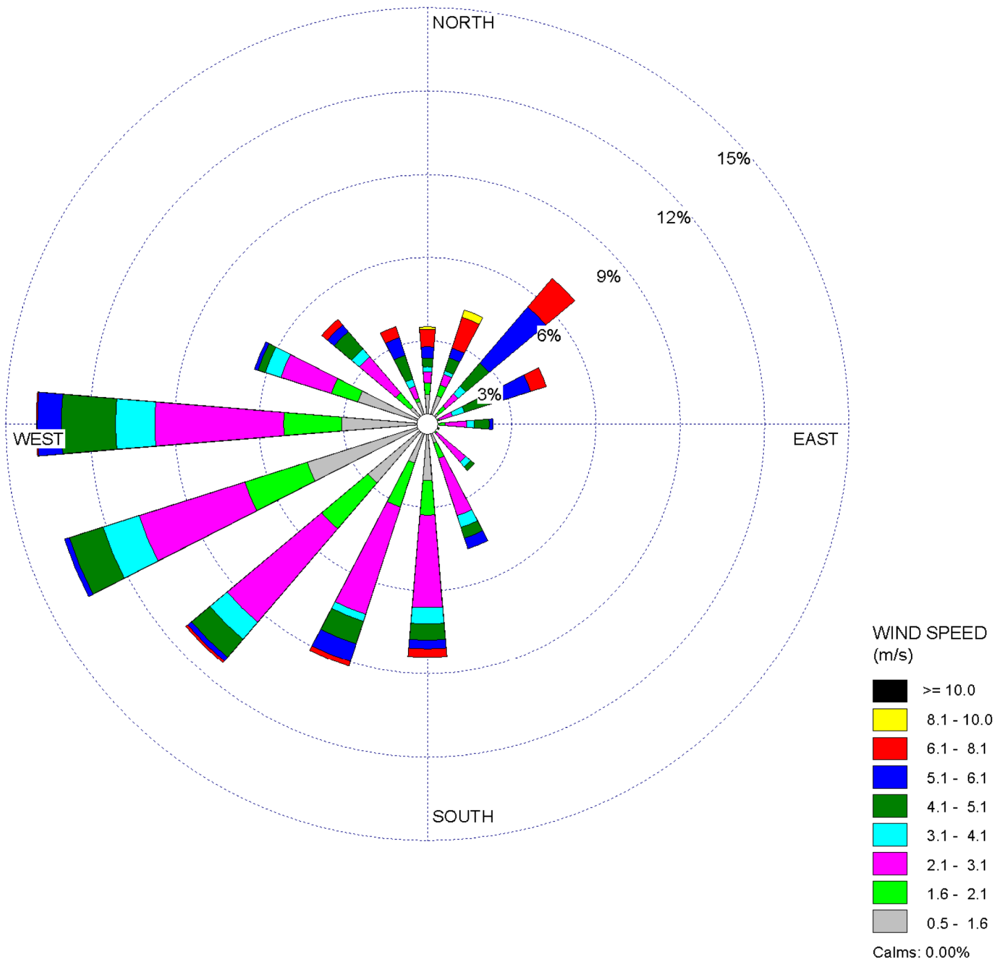



**Figure 2.3-207. 10-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — December (Sheet 12 of 12)**

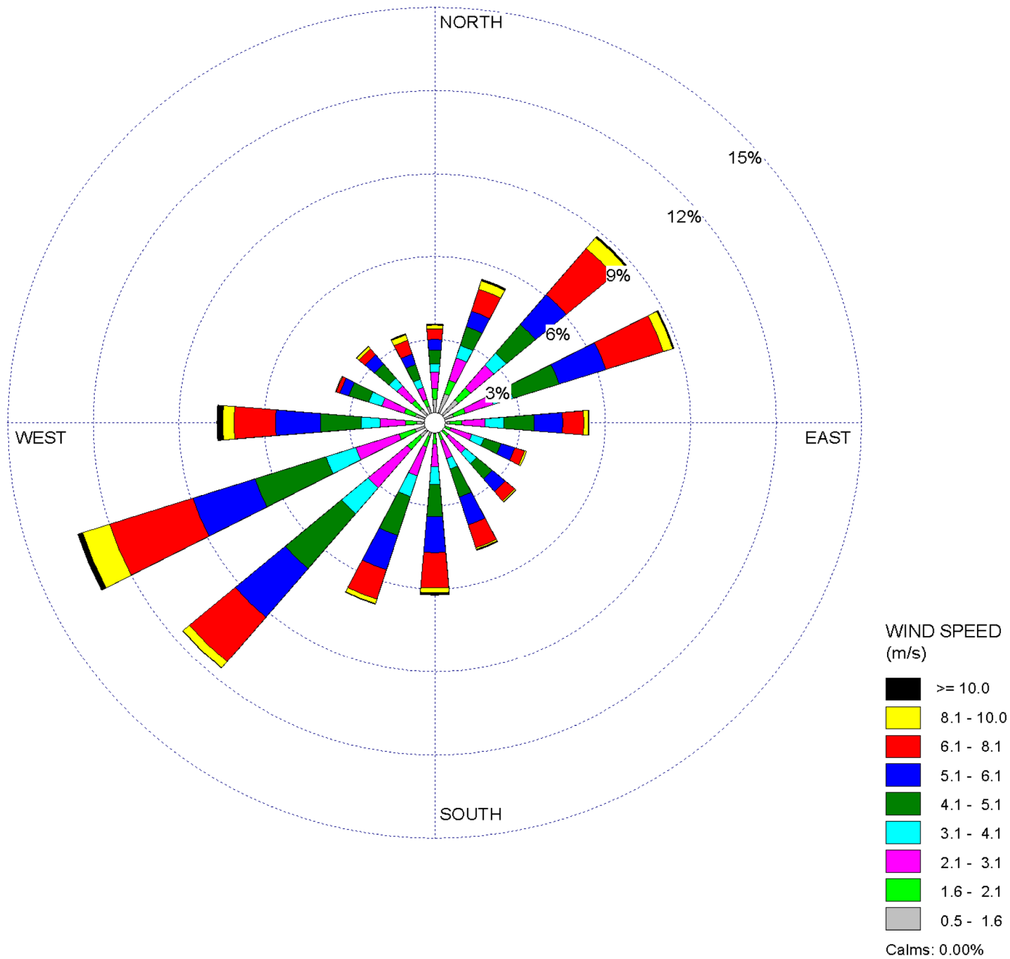



**Figure 2.3-208. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — Annual**

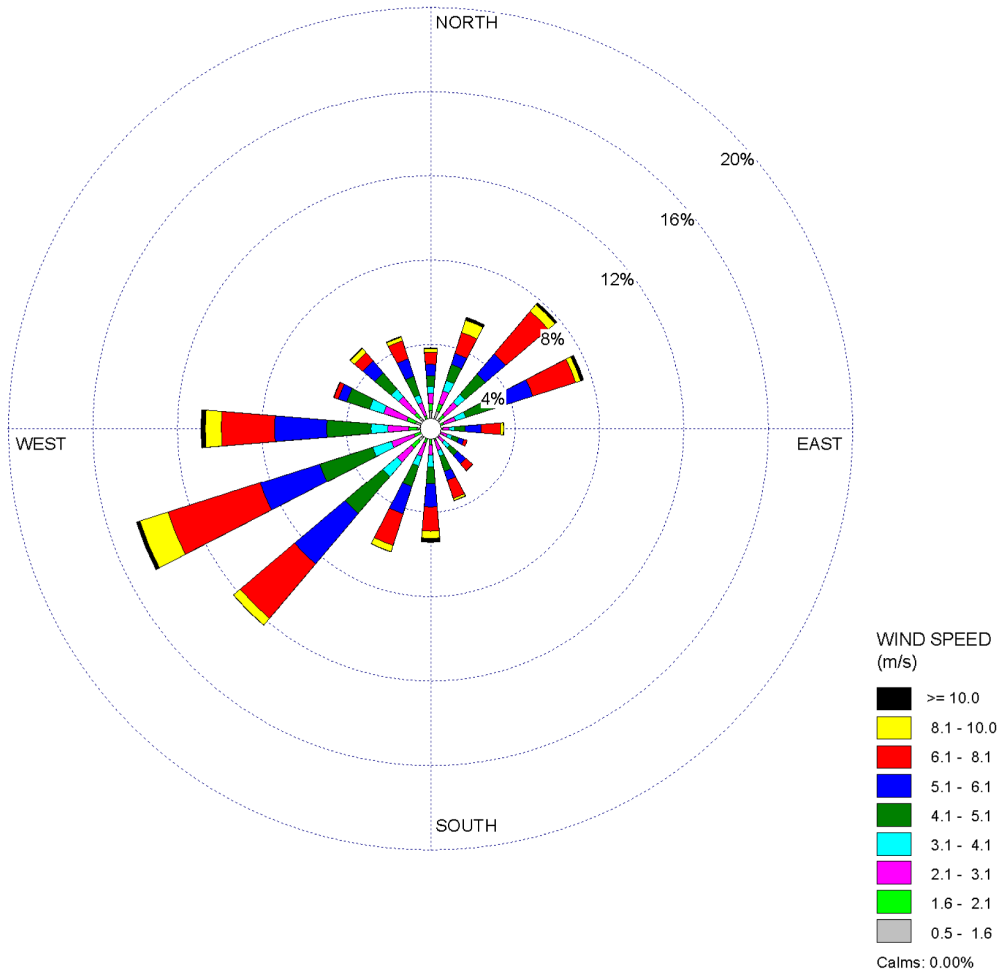



**Figure 2.3-209. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — Winter**

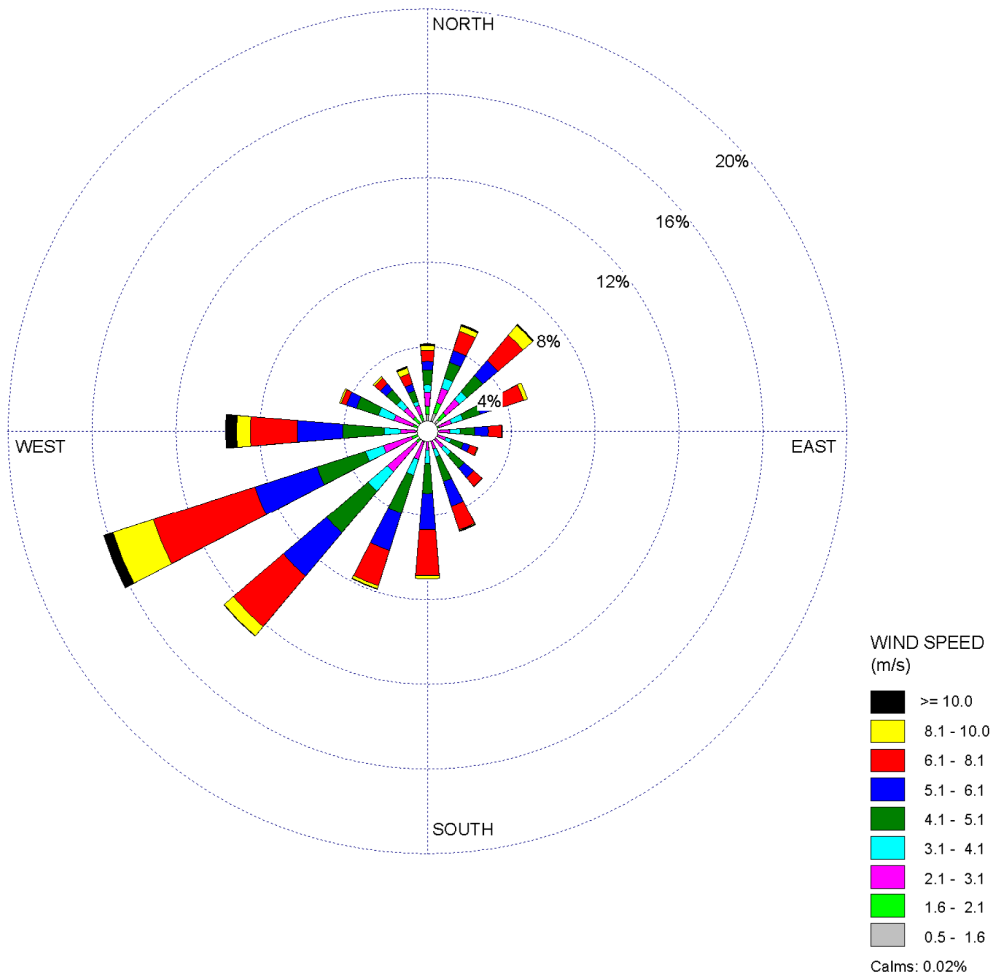



Figure 2.3-210. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — Spring

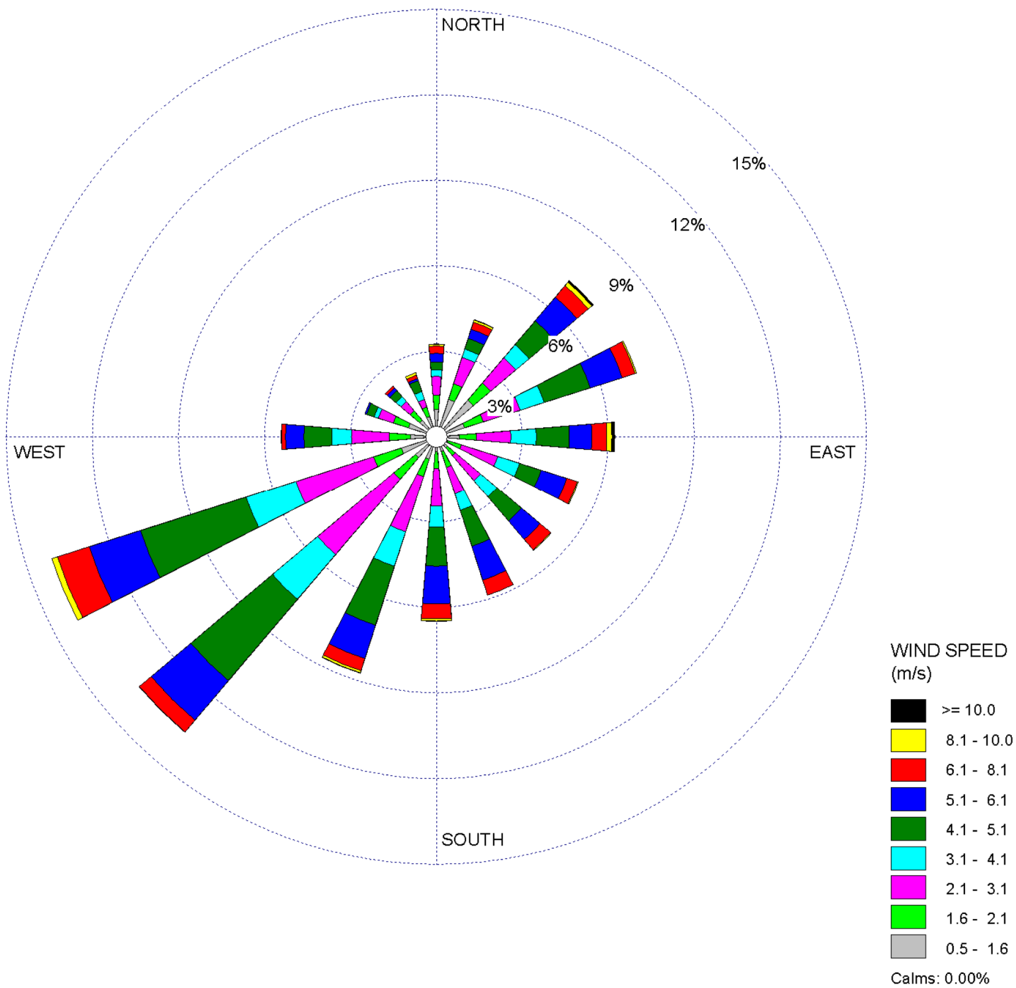



**Figure 2.3-211. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — Summer**

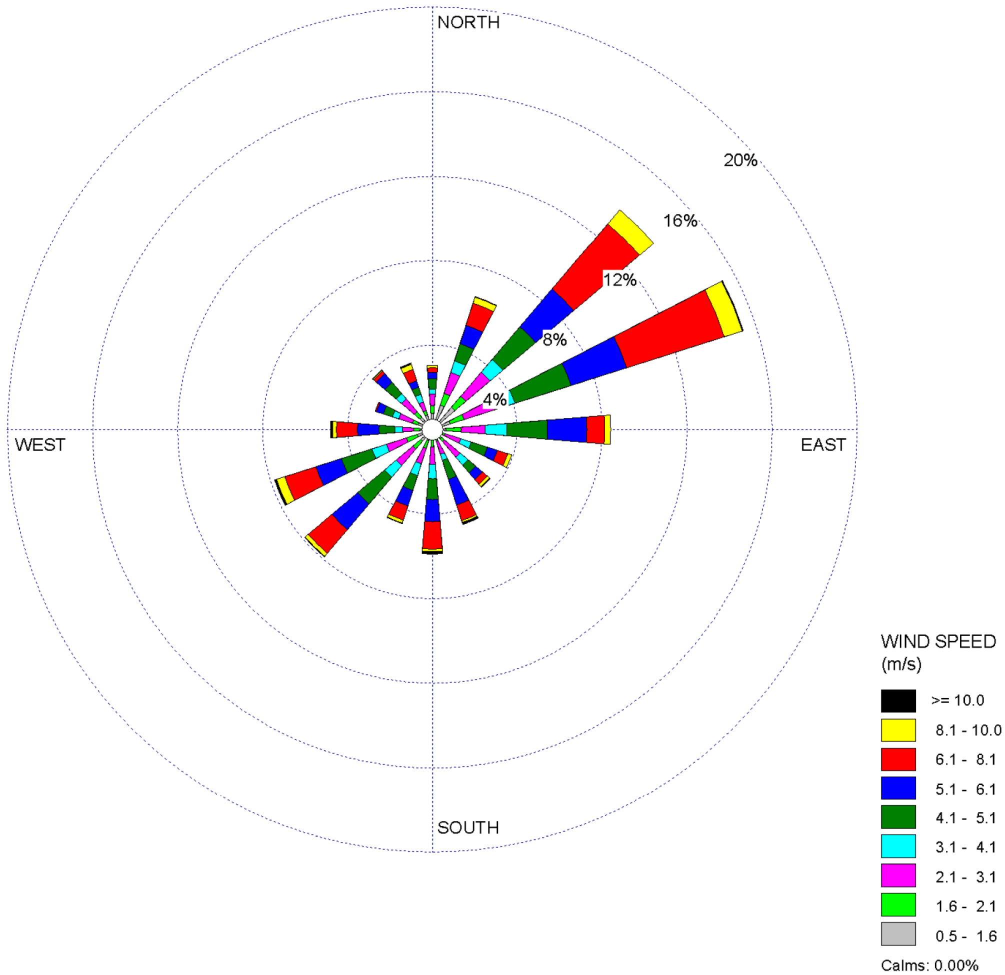



**Figure 2.3-212. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — Autumn**

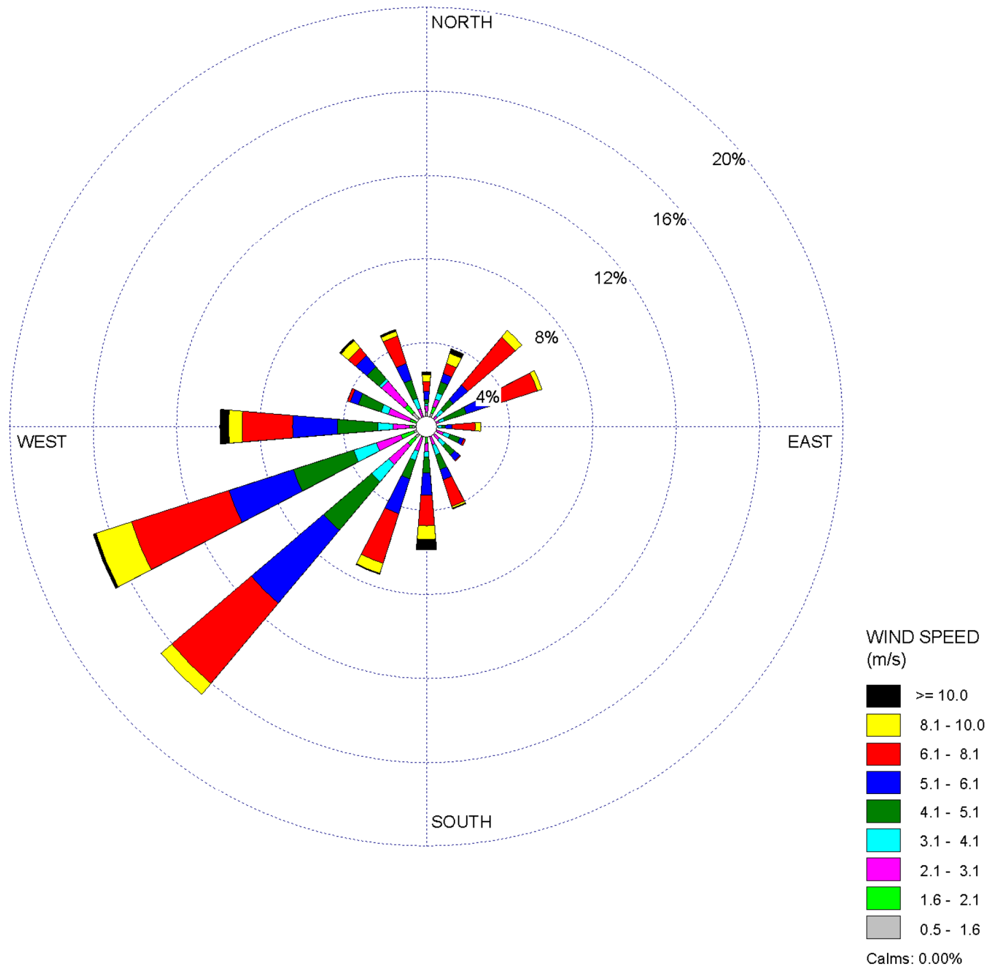



**Figure 2.3-213. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — January (Sheet 1 of 12)**

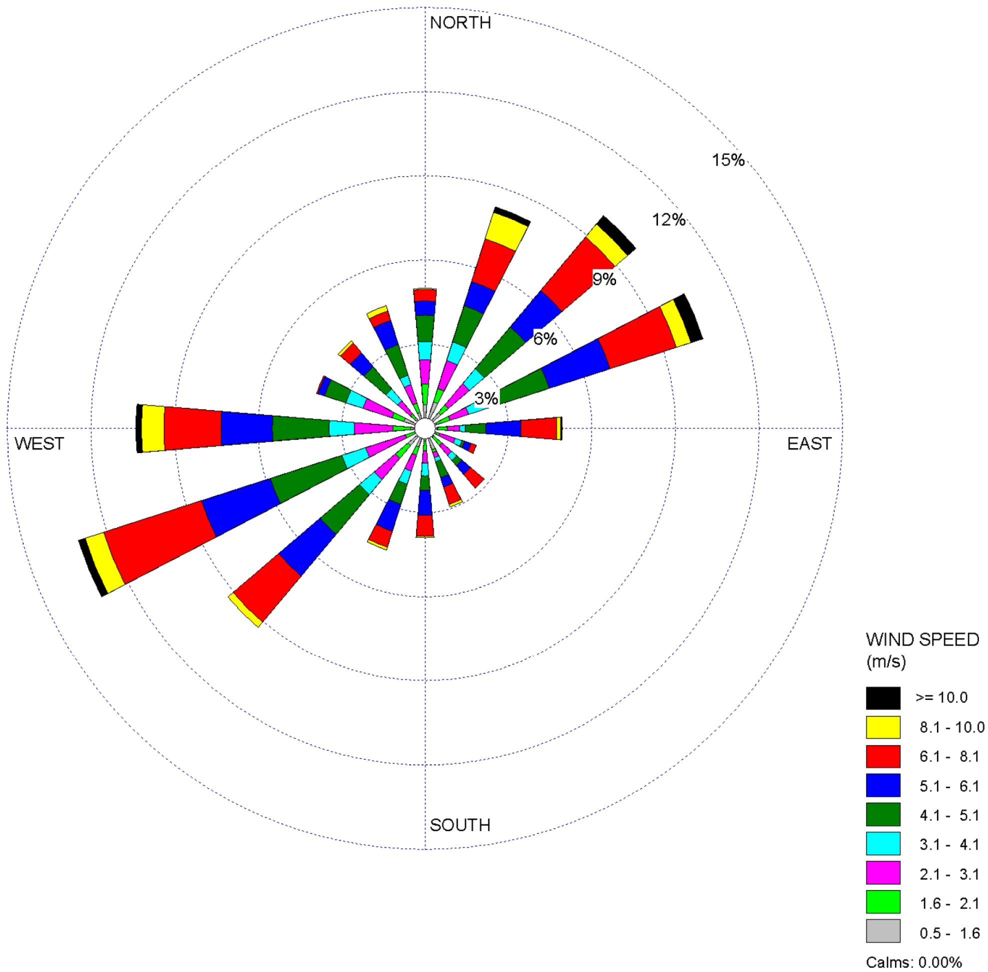



**Figure 2.3-213. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — February (Sheet 2 of 12)**

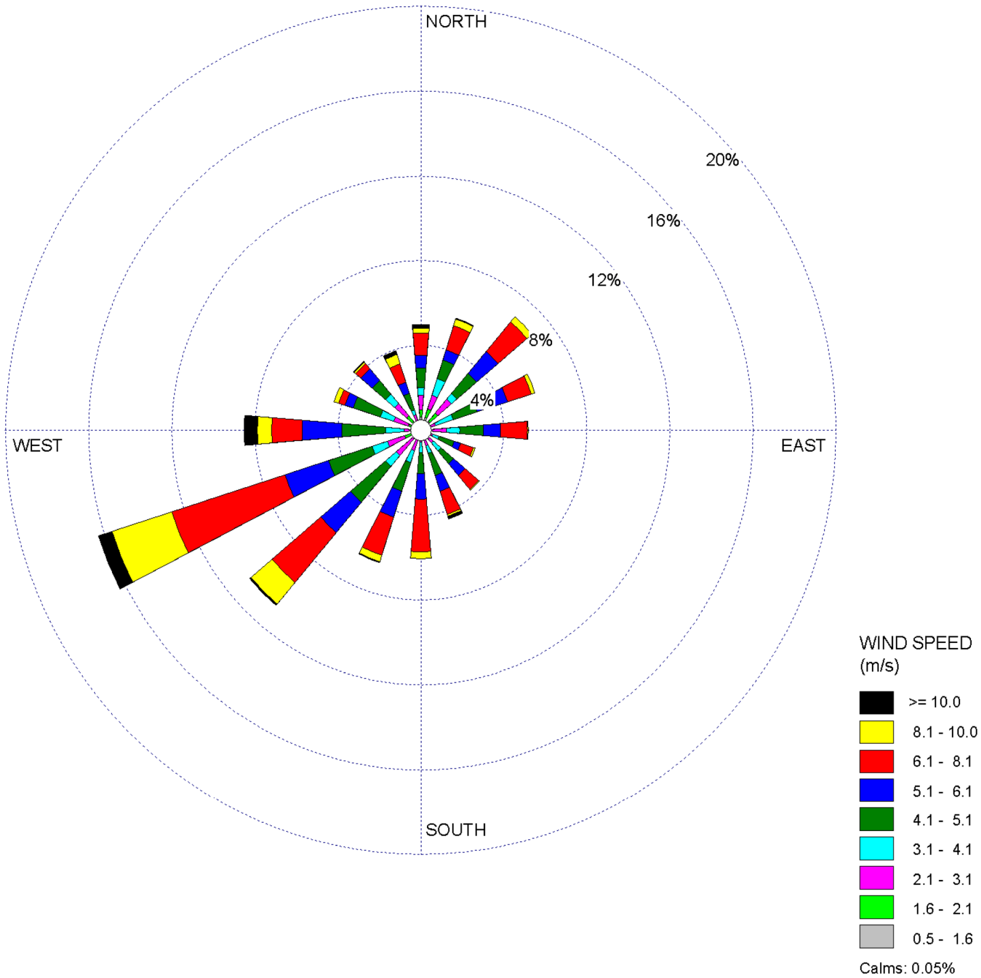



**Figure 2.3-213. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — March (Sheet 3 of 12)**

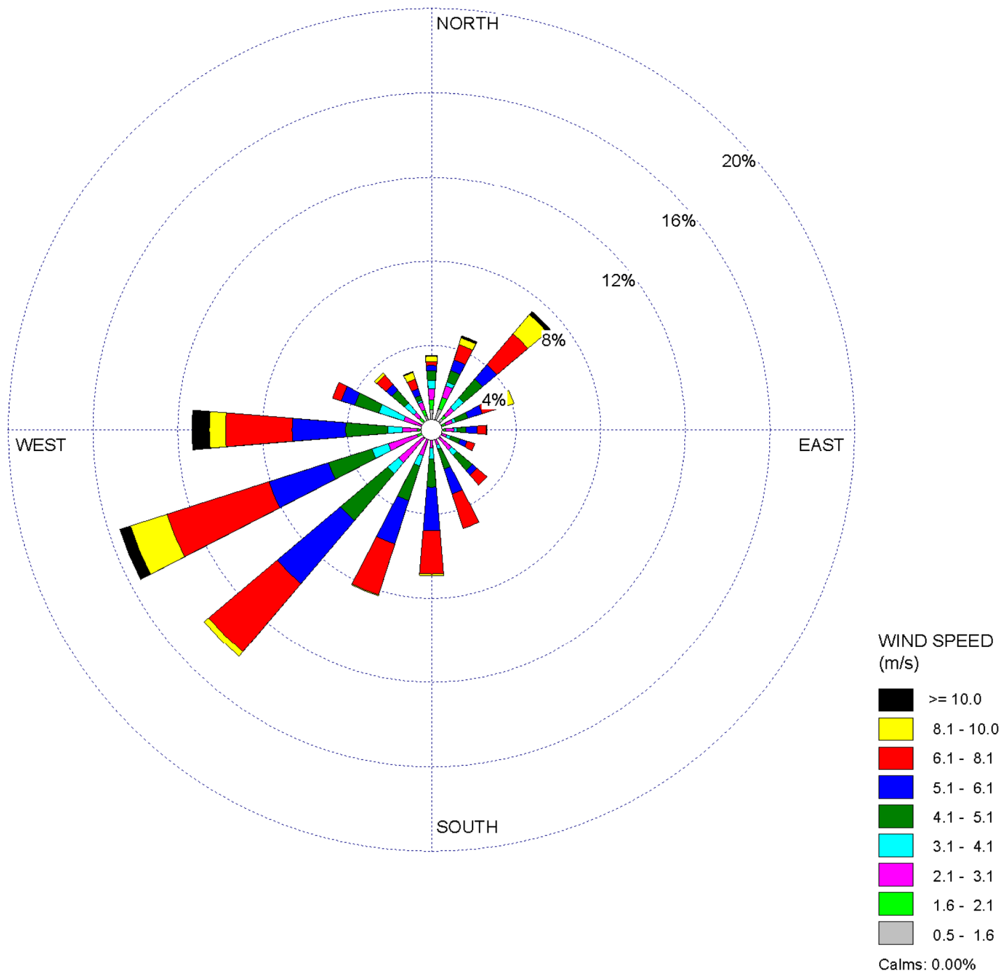



**Figure 2.3-213. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — April (Sheet 4 of 12)**

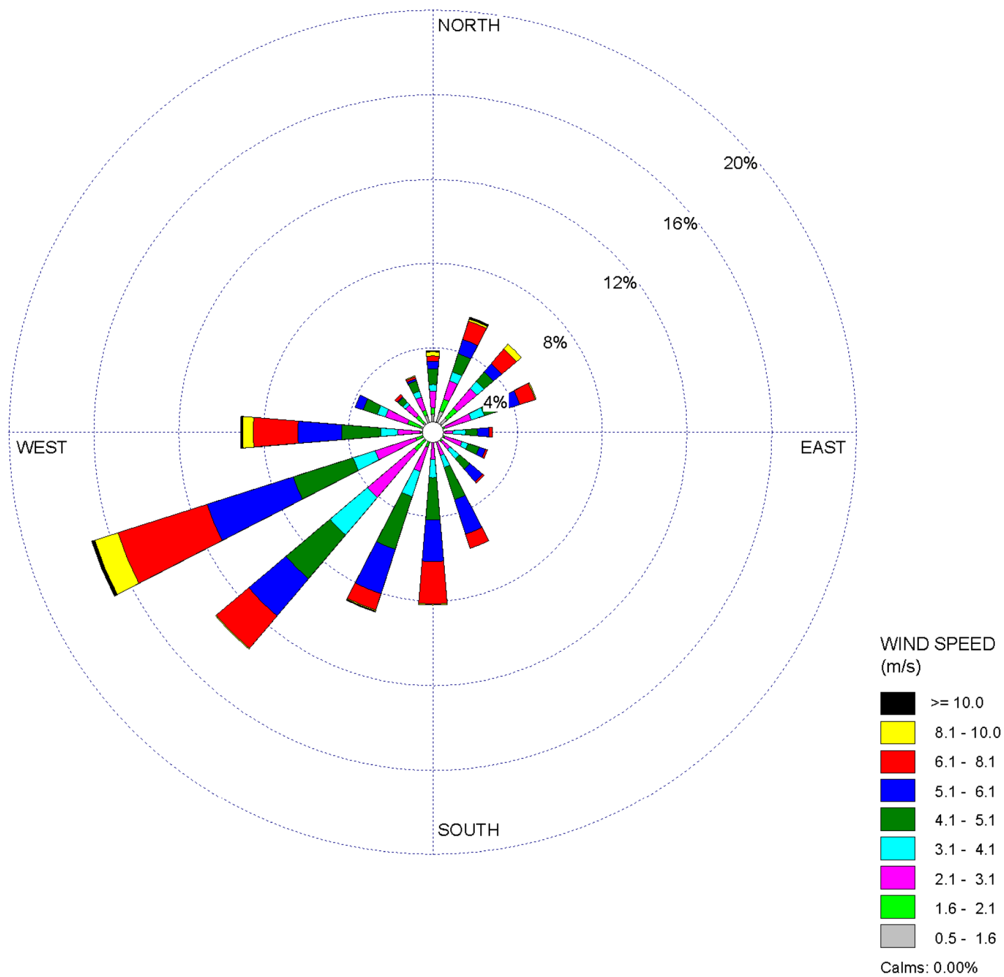



**Figure 2.3-213. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — May (Sheet 5 of 12)**

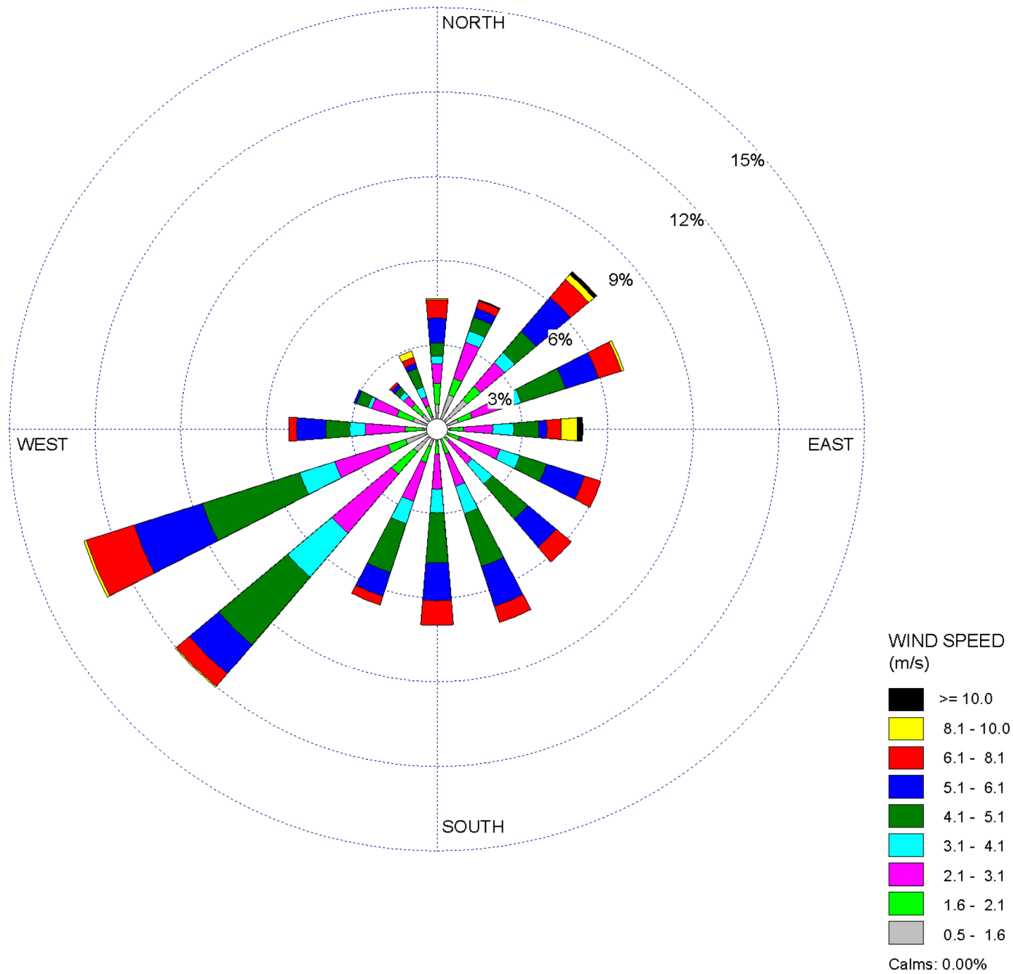



**Figure 2.3-213. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — June (Sheet 6 of 12)**

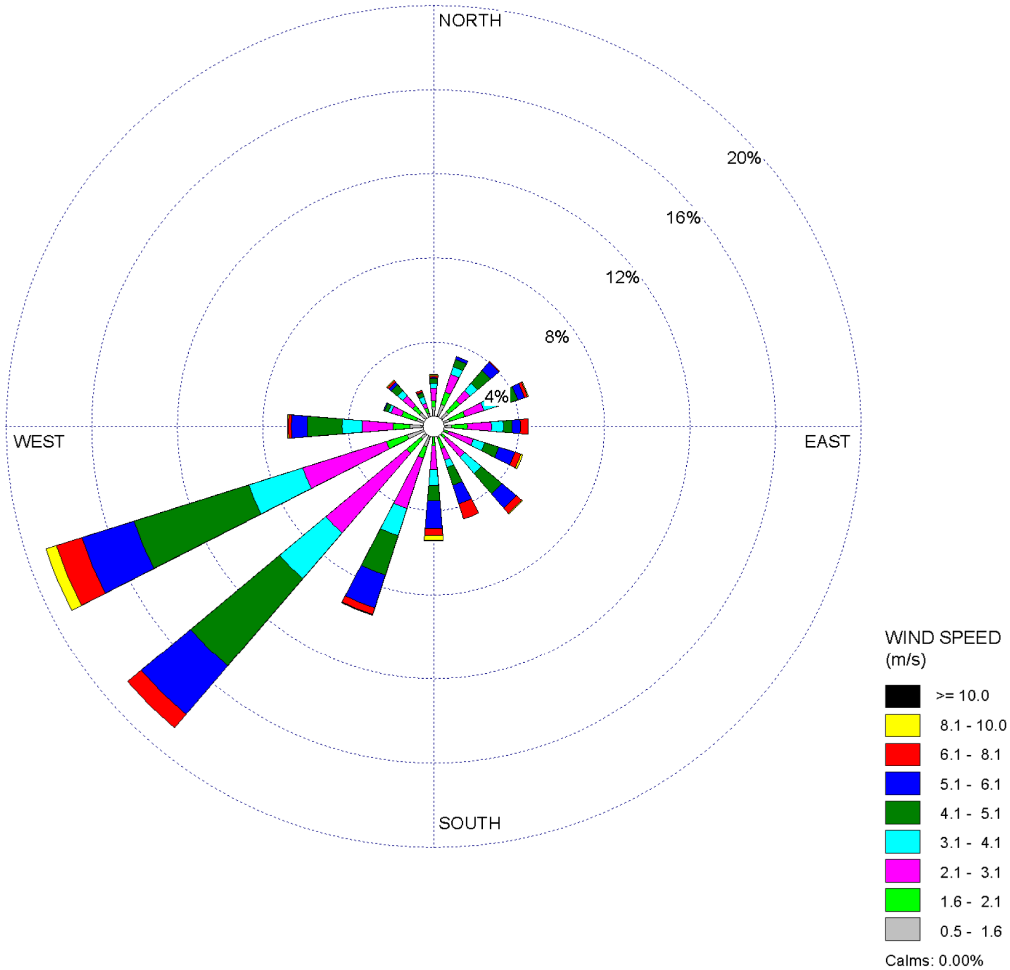



**Figure 2.3-213. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — July (Sheet 7 of 12)**

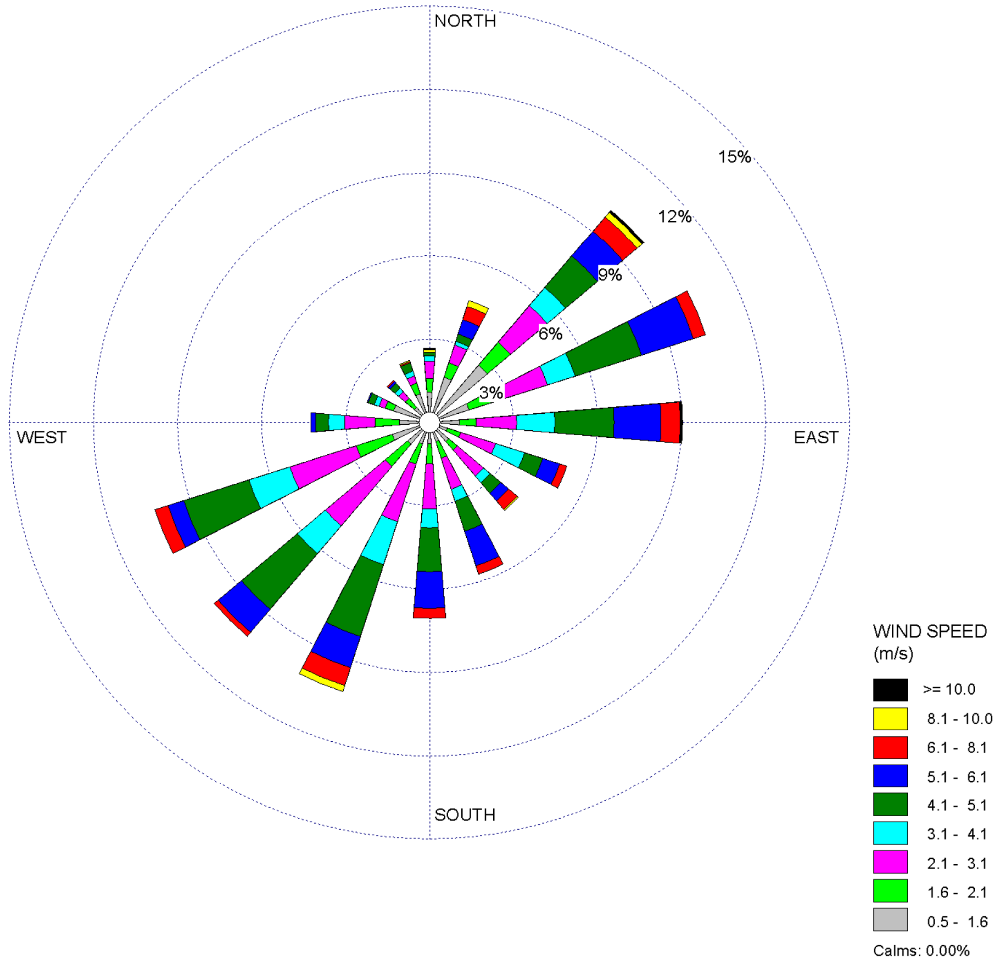



**Figure 2.3-213. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — August (Sheet 8 of 12)**

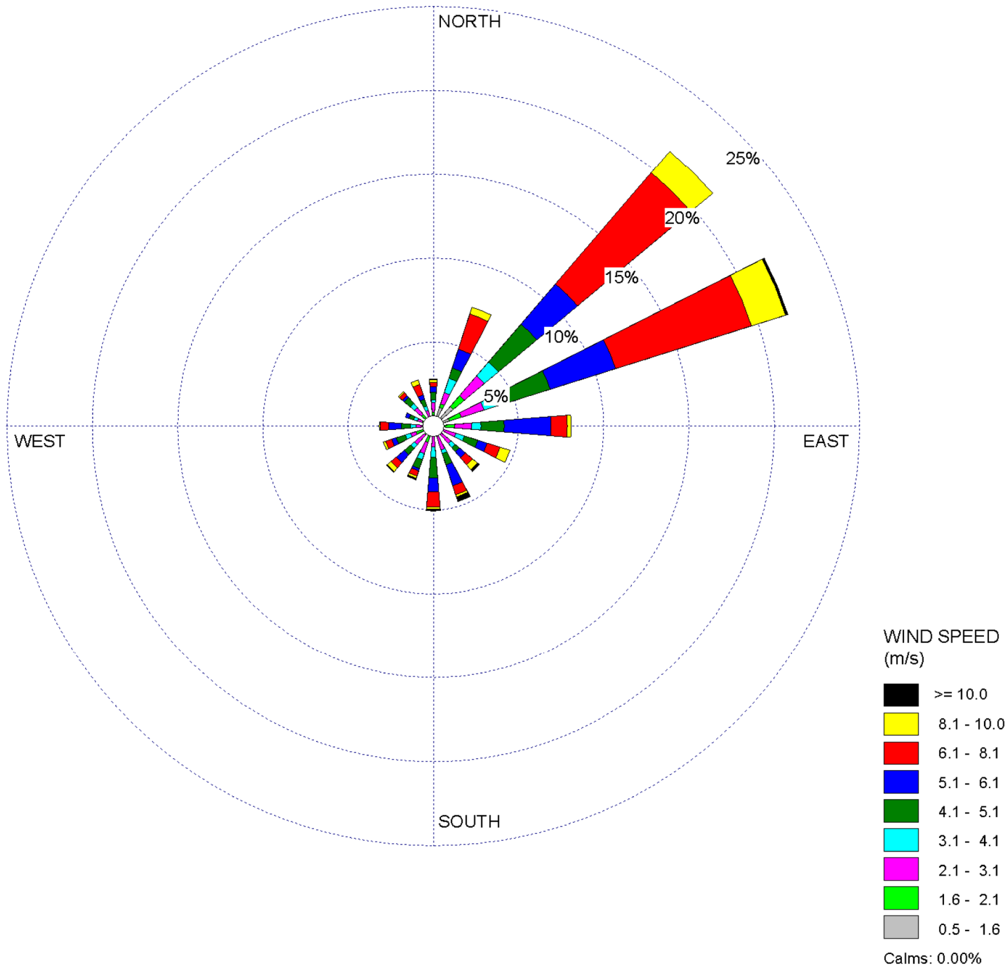



**Figure 2.3-213. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — September (Sheet 9 of 12)**

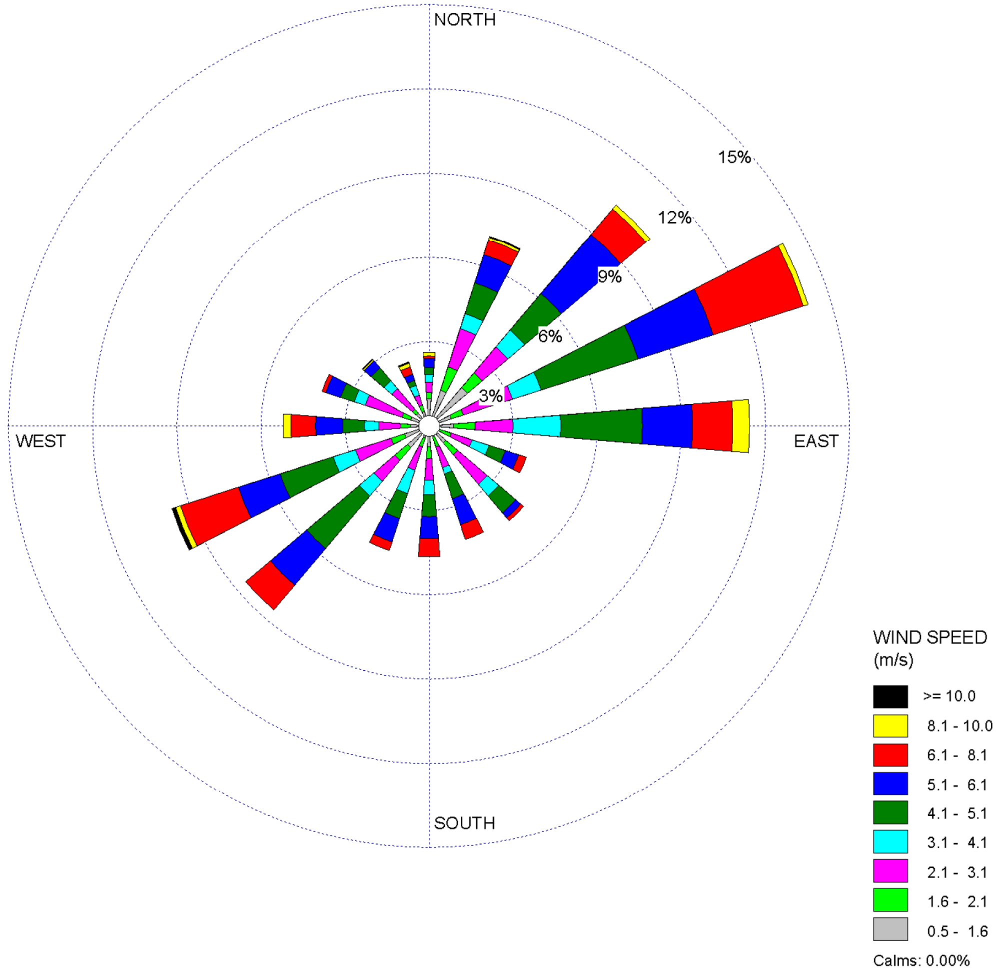



**Figure 2.3-213. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — October (Sheet 10 of 12)**

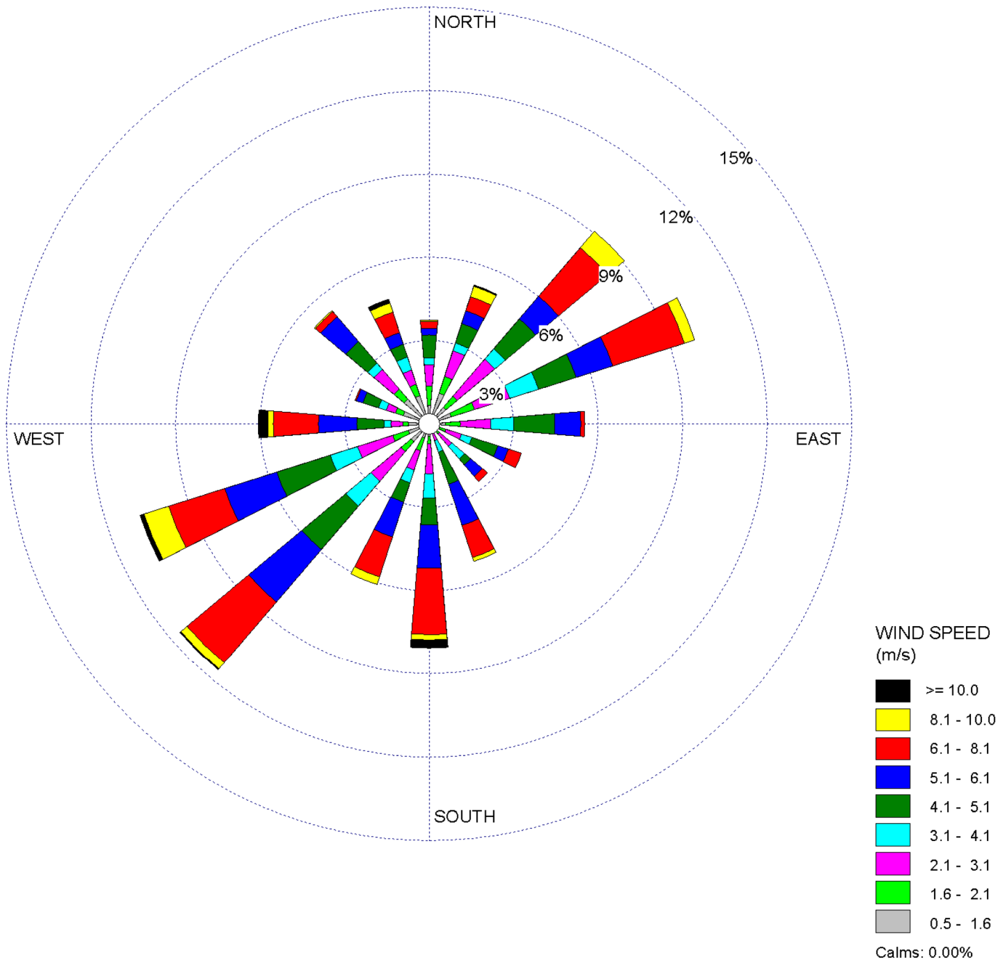



**Figure 2.3-213. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — November (Sheet 11 of 12)**

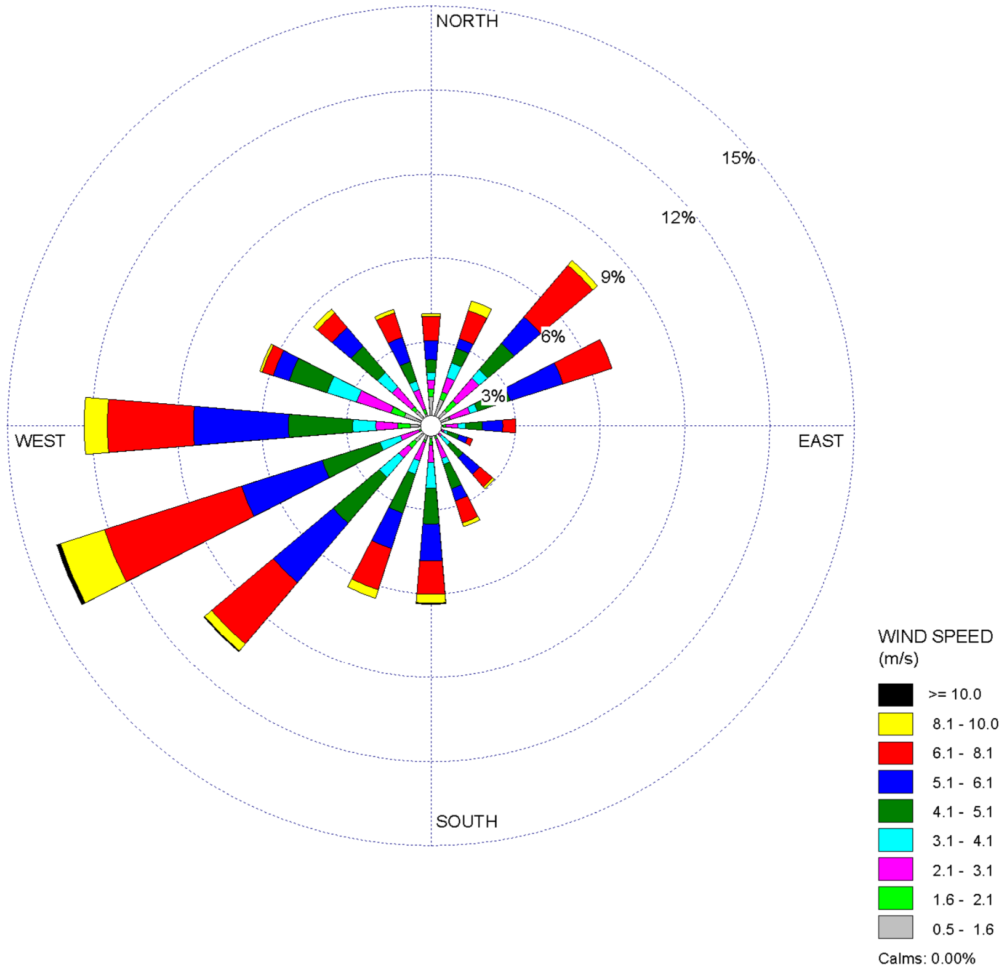



**Figure 2.3-213. 61-Meter Level Composite Wind Rose for the Unit 1 Monitoring Program (July 1, 2003–June 30, 2006) — December (Sheet 12 of 12)**

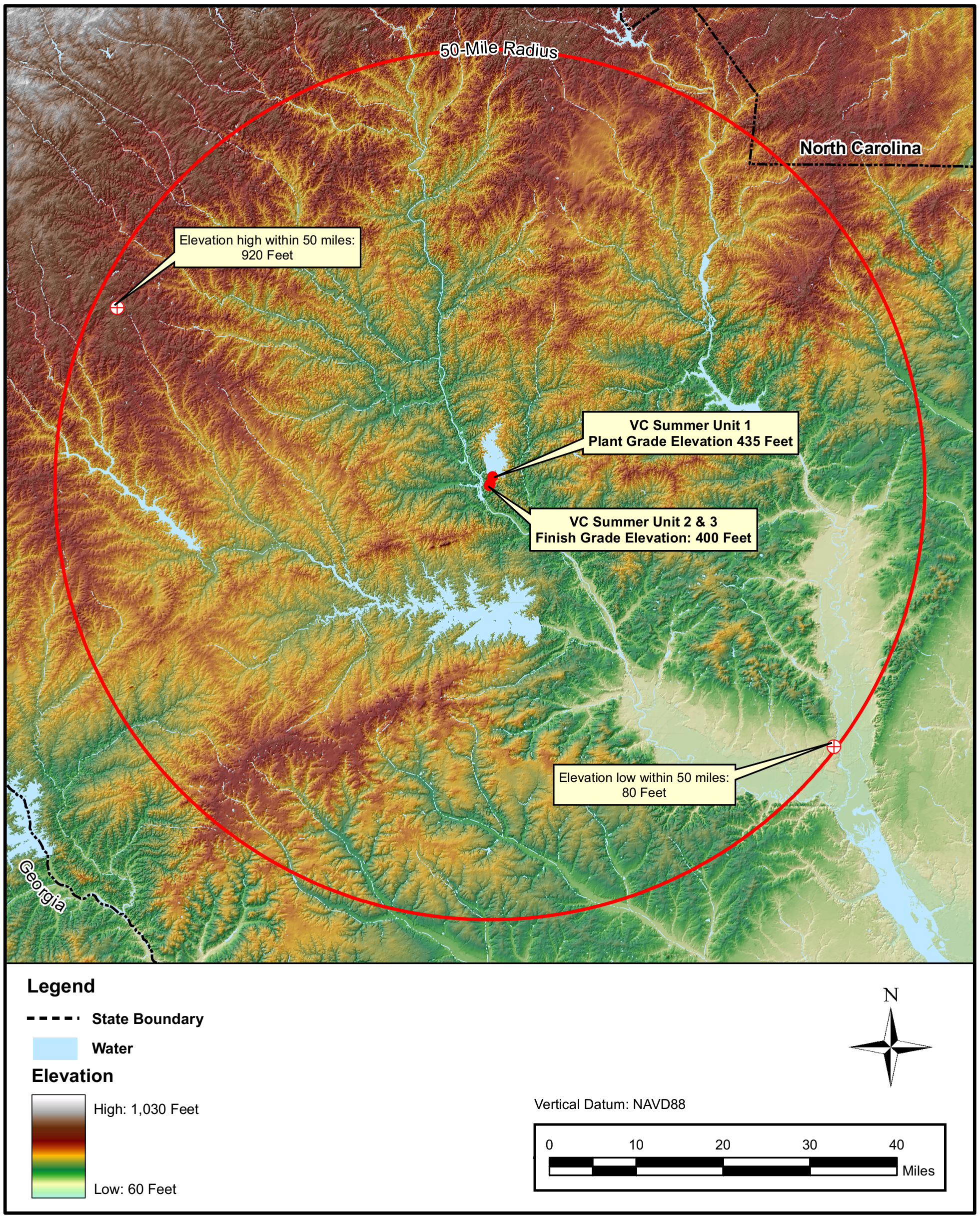
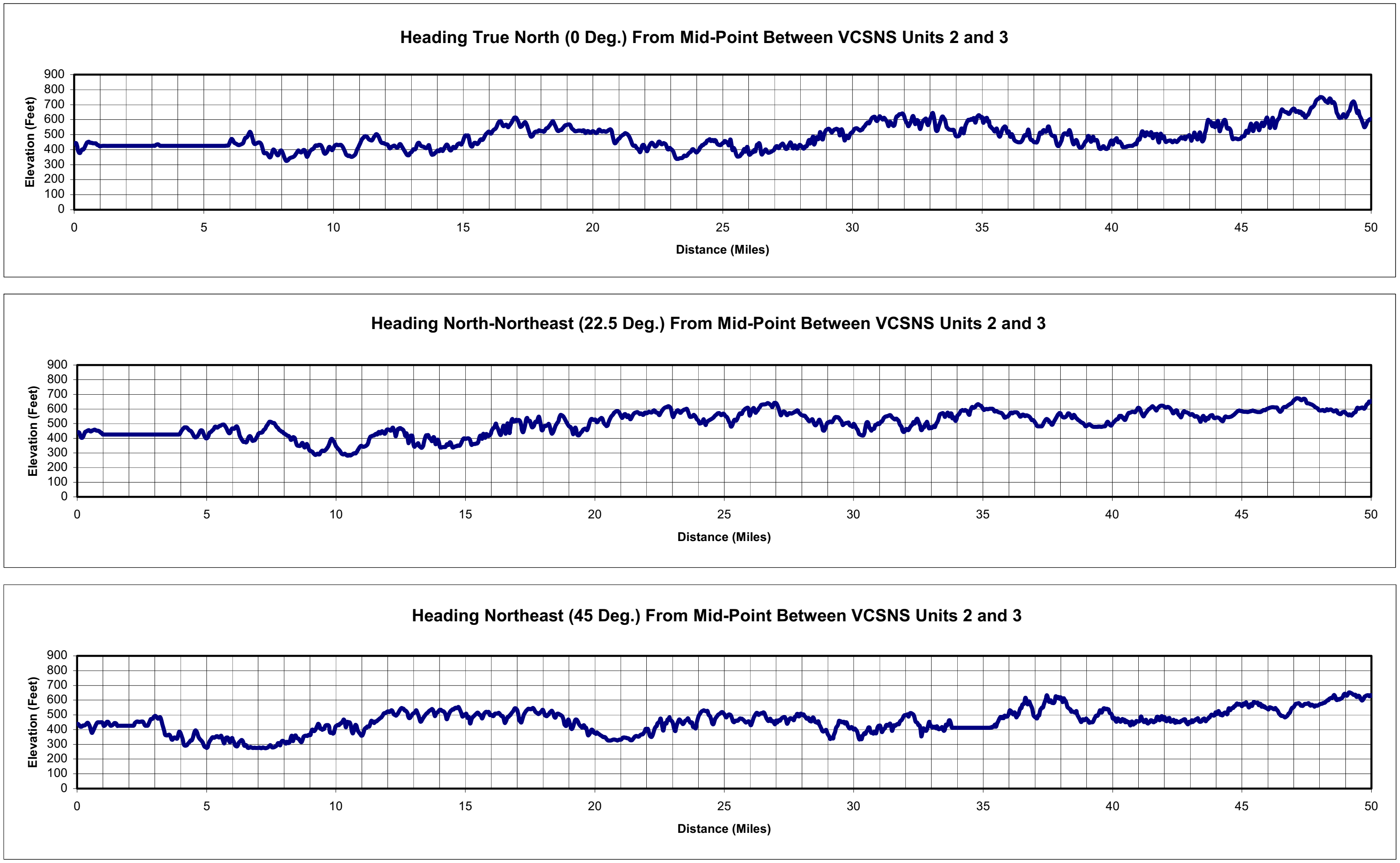
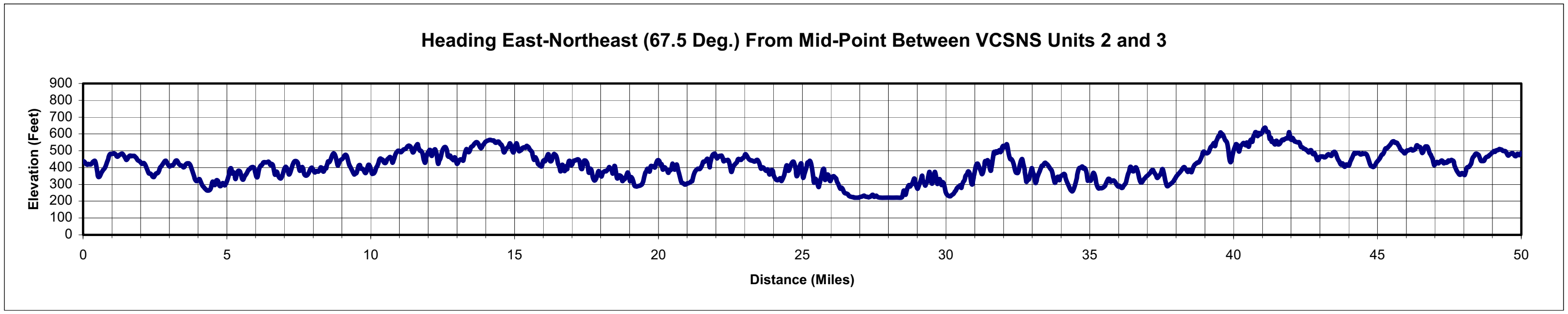


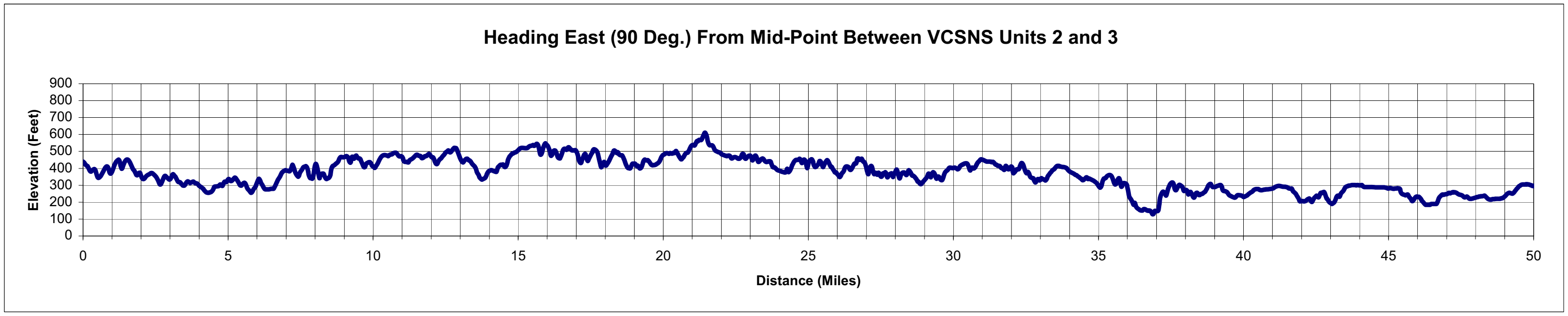

**Figure 2.3-214. Site Area Map (50-Mile Radius)**

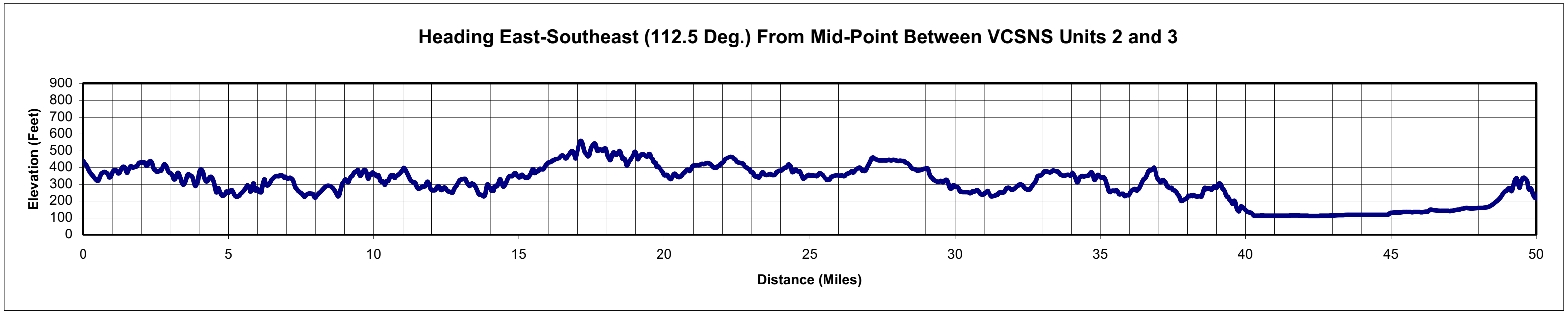



*Nominal Plant Grade Elevation = 400 Feet*

**Figure 2.3-215. Terrain Elevation Profiles Within 50 Miles of the Site for Units 2 and 3 (Sheet 1 of 6)**

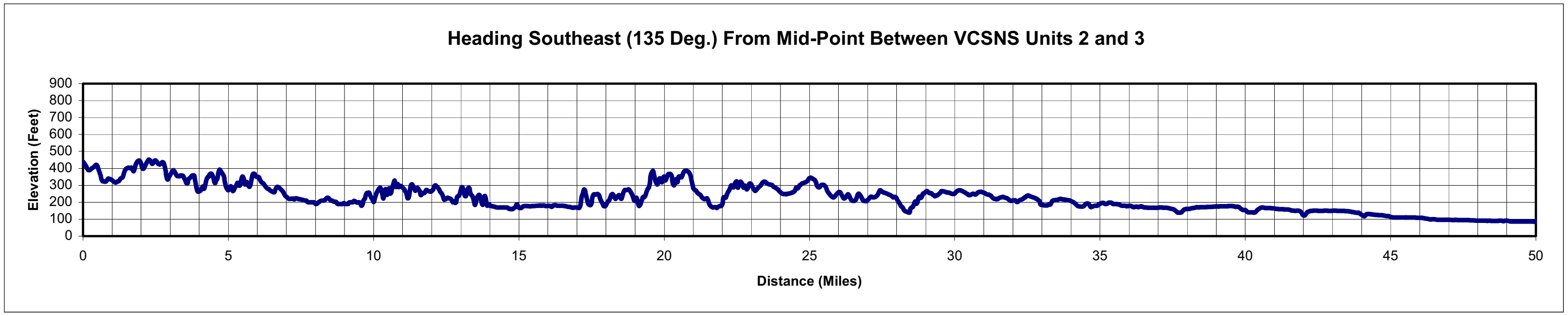


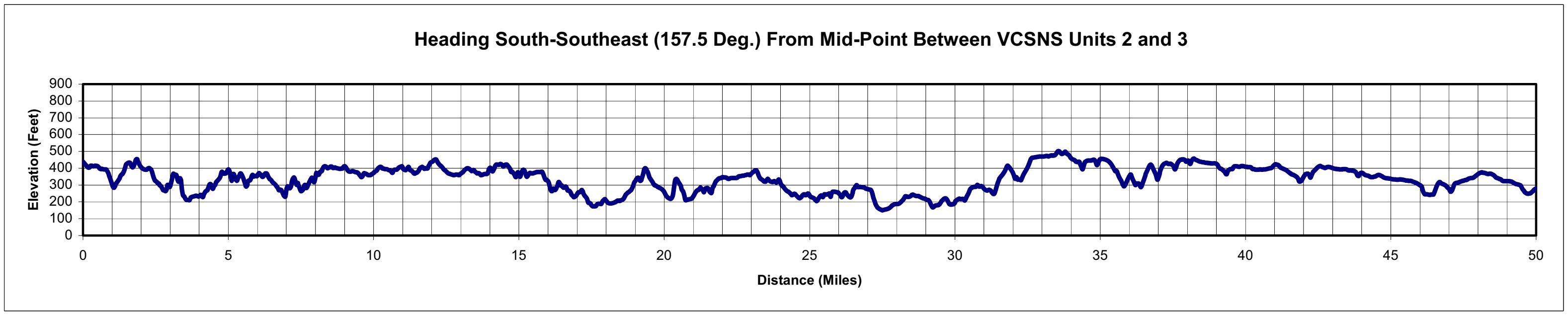



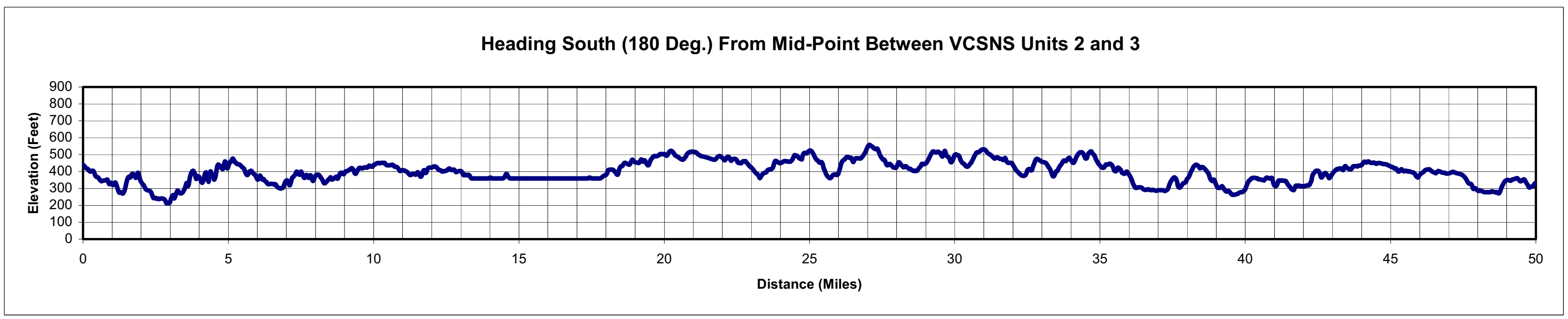




*Nominal Plant Grade Elevation = 400 Feet*

**Figure 2.3-215. Terrain Elevation Profiles Within 50 Miles of the Site for Units 2 and 3 (Sheet 2 of 6)**

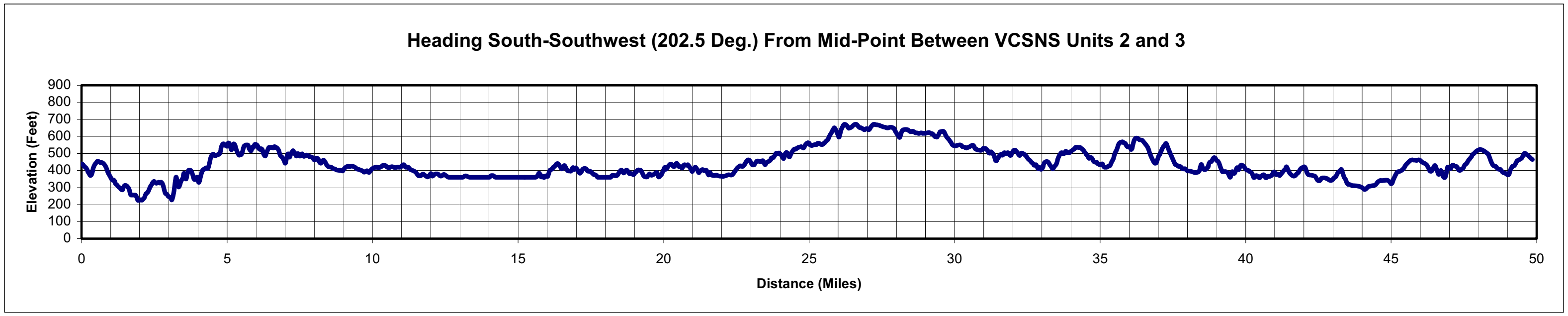


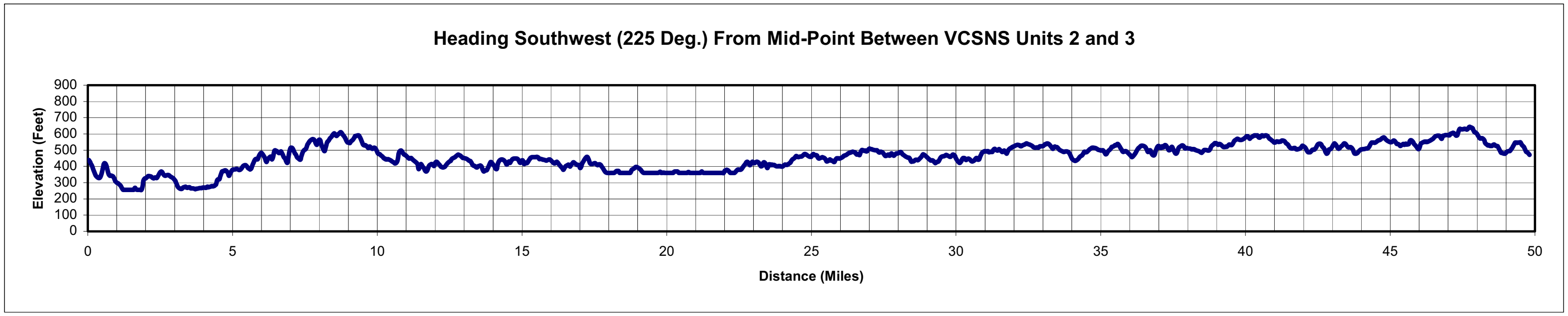



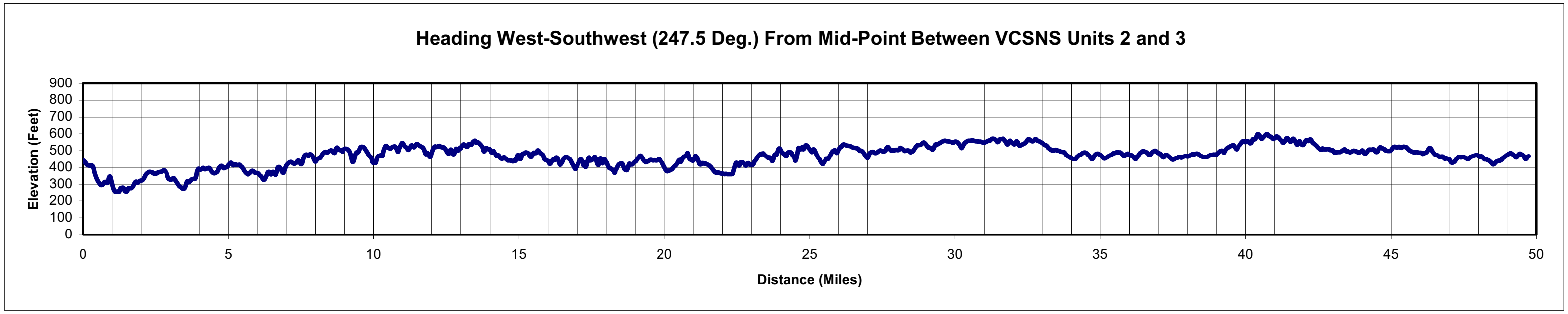




*Nominal Plant Grade Elevation = 400 Feet*

**Figure 2.3-215. Terrain Elevation Profiles Within 50 Miles of the Site for Units 2 and 3 (Sheet 3 of 6)**

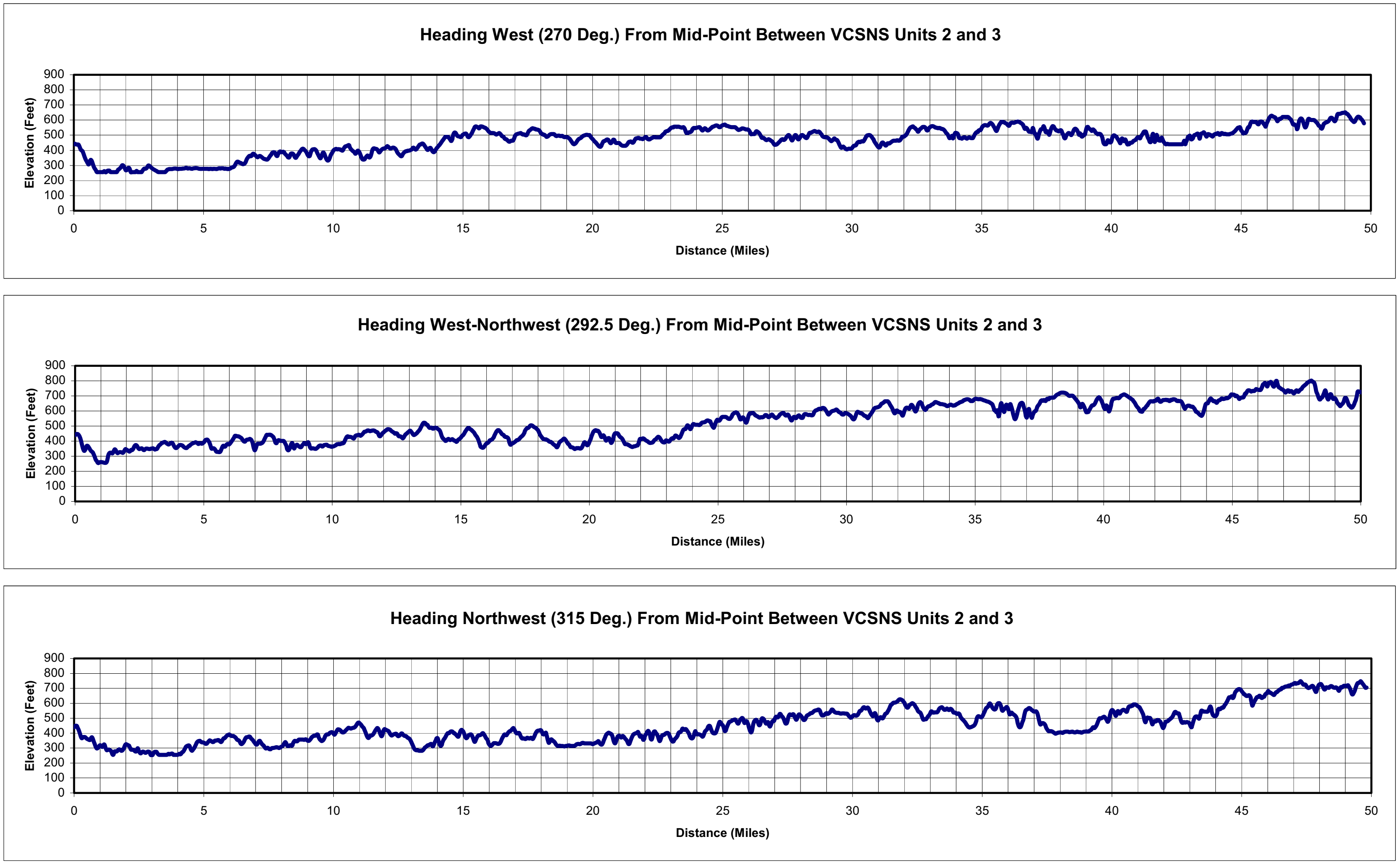


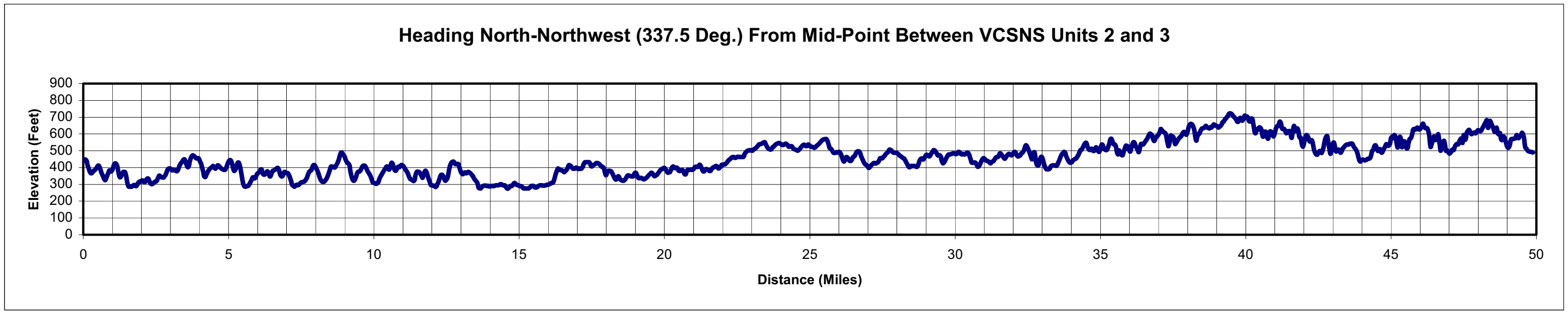

*Nominal Plant Grade Elevation = 400 Feet*

**Figure 2.3-215. Terrain Elevation Profiles Within 50 Miles of the Site for Units 2 and 3 (Sheet 4 of 6)**




*Nominal Plant Grade Elevation = 400 Feet*

**Figure 2.3-215. Terrain Elevation Profiles Within 50 Miles of the Site for Units 2 and 3 (Sheet 5 of 6)**




*Nominal Plant Grade Elevation = 400 Feet*

**Figure 2.3-215. Terrain Elevation Profiles Within 50 Miles of the Site for Units 2 and 3 (Sheet 6 of 6)**

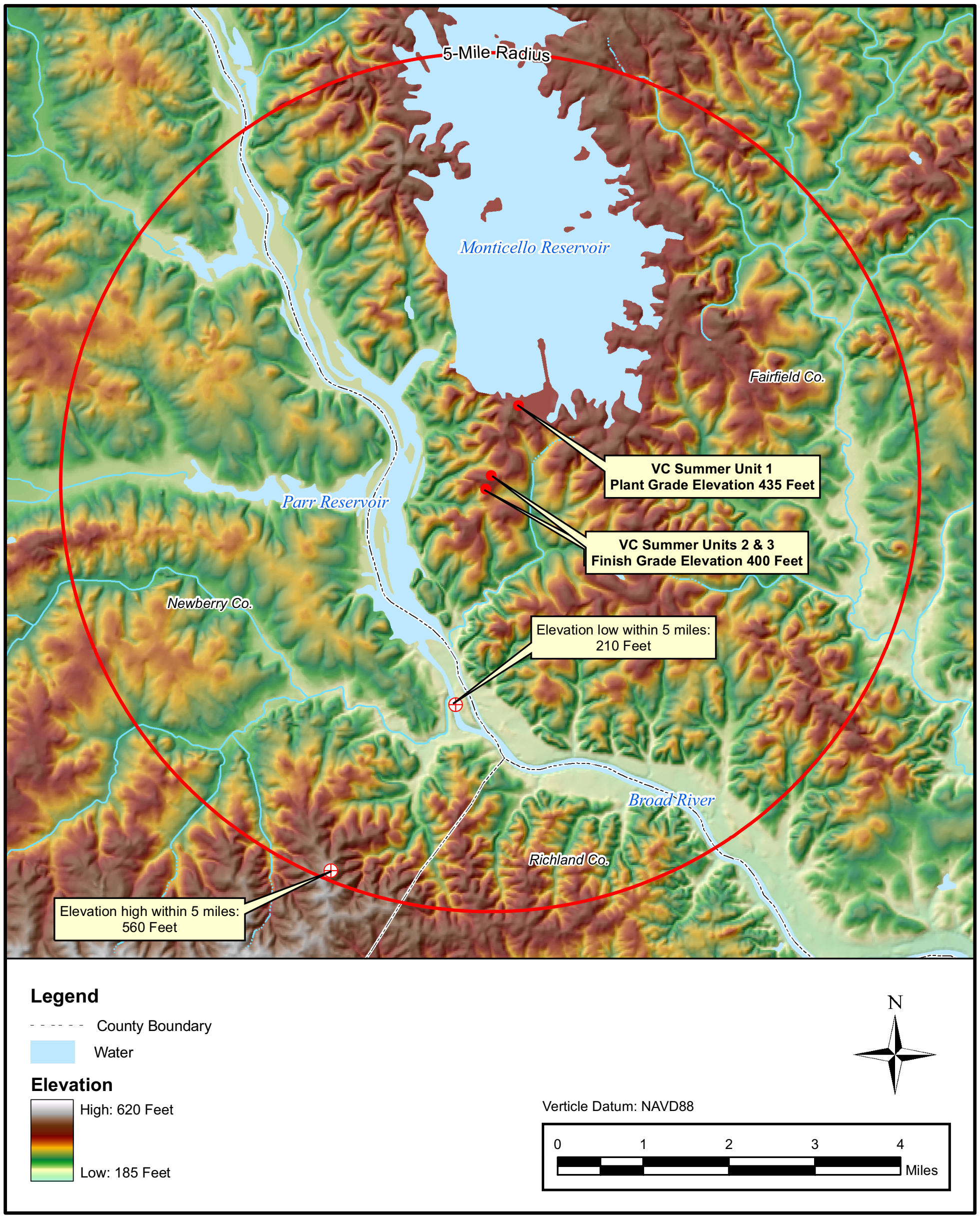



**Figure 2.3-216. Site and Vicinity Map (5-Mile Radius)**

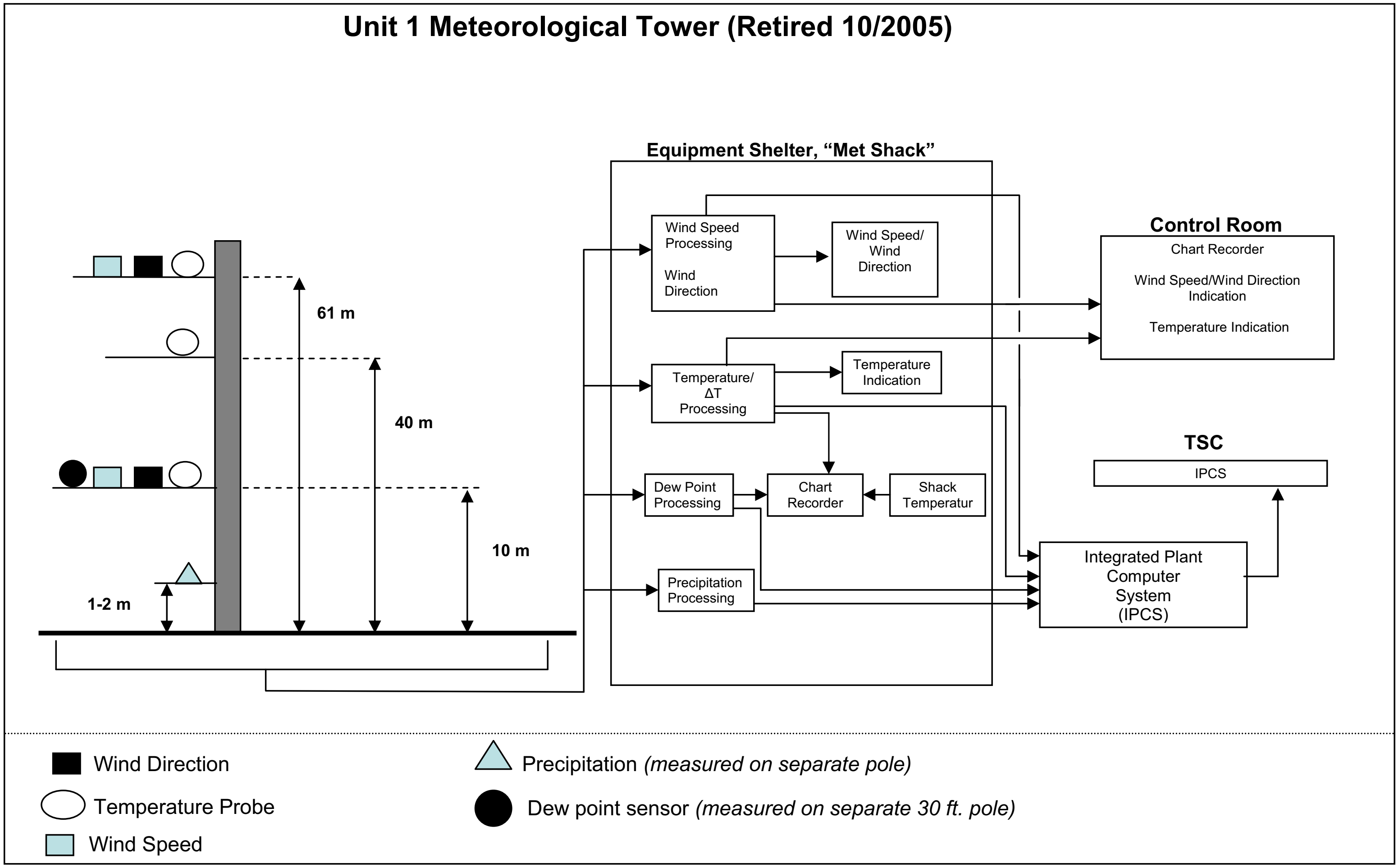



**Figure 2.3-217. Unit 1 Retired Meteorological Tower Block Diagram**

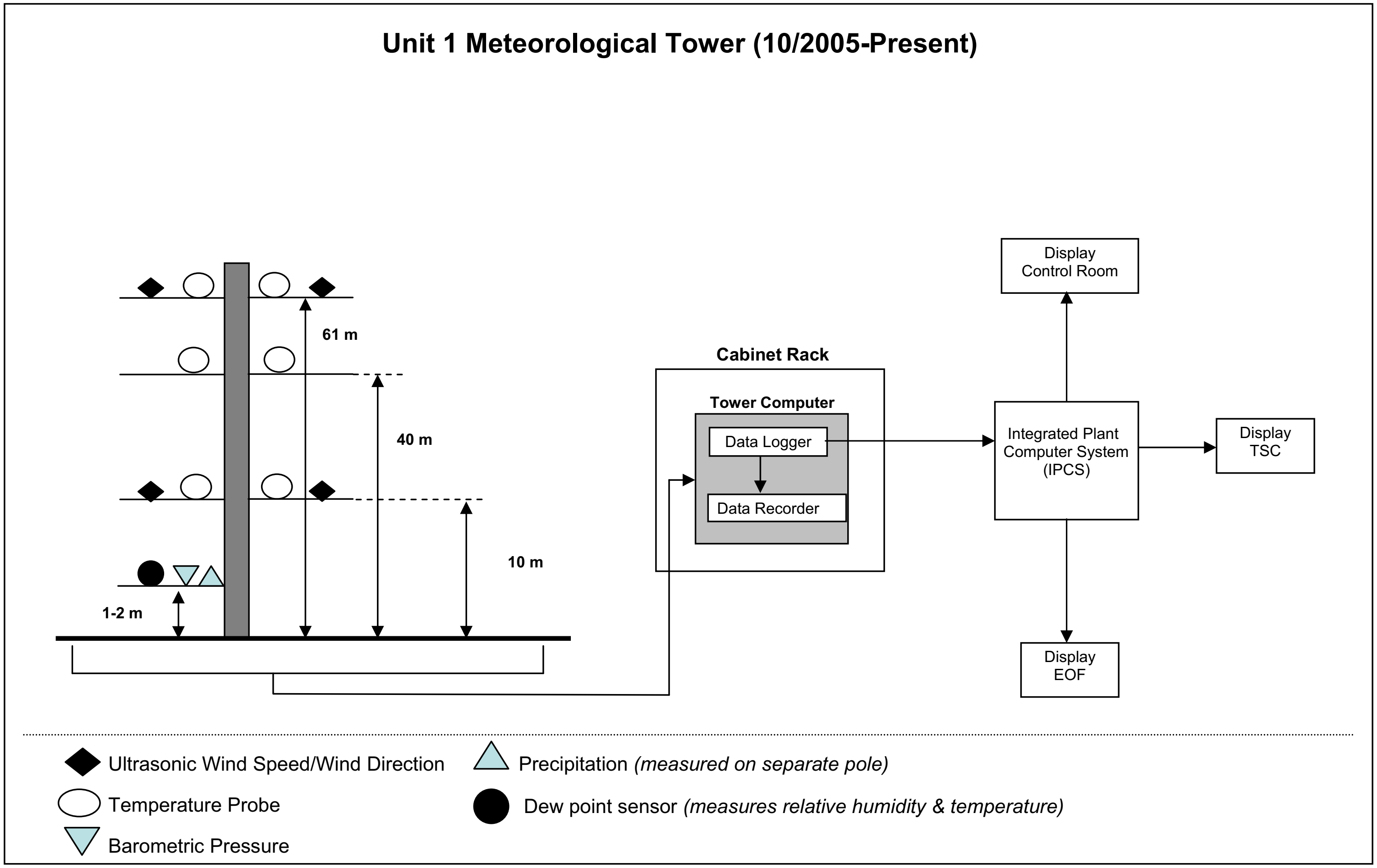



**Figure 2.3-218. Unit 1 Meteorological Tower Block Diagram — Current Configuration**

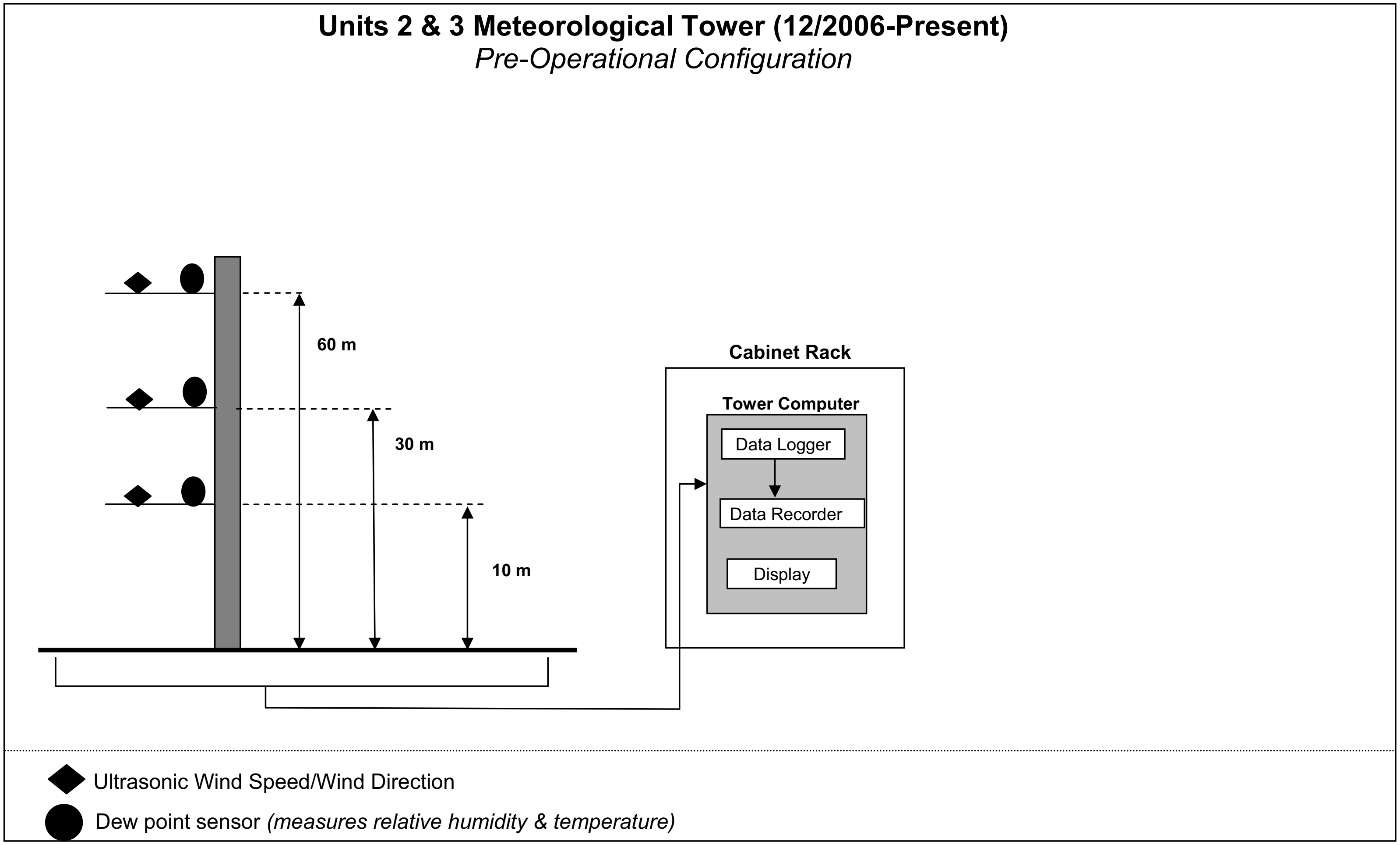



**Figure 2.3-219. Units 2 and 3 Meteorological Tower Block Diagram — Preoperational Configuration**

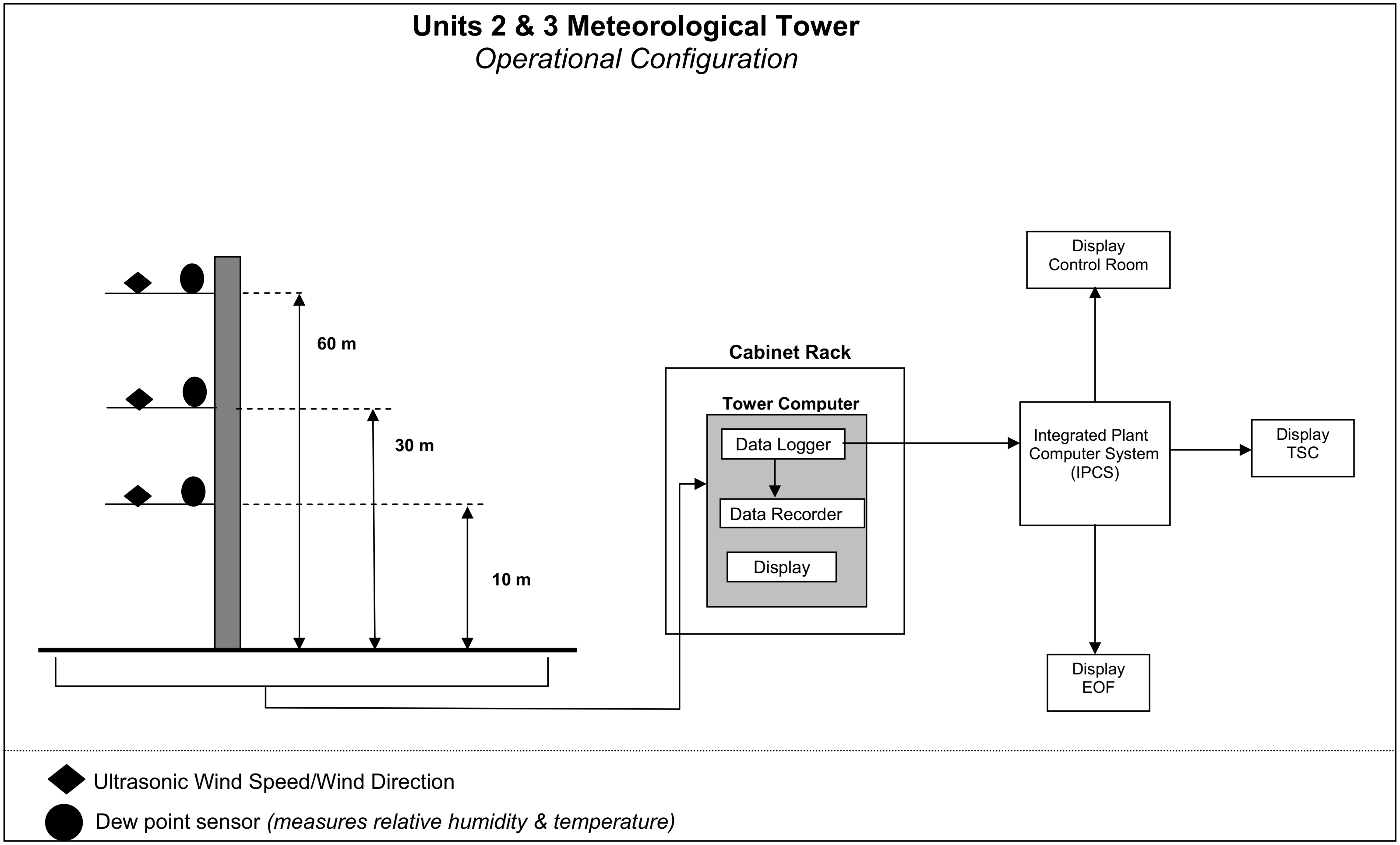



**Figure 2.3-220. Units 2 and 3 Meteorological Tower Block Diagram — Operational Configuration**

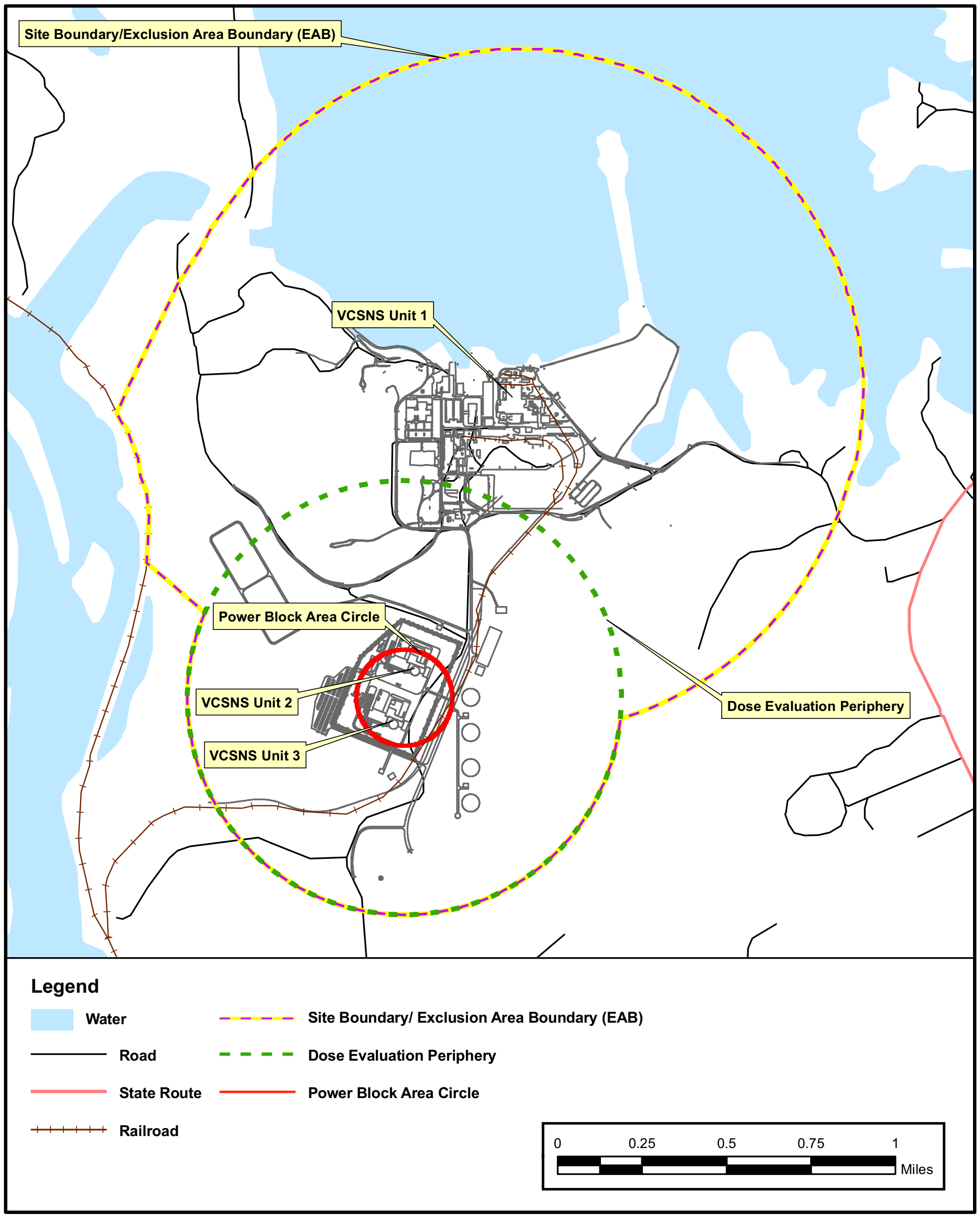



Figure 2.3-221. Site Boundary/Exclusion Area Boundary, Dose Evaluation Periphery, and Power Block Area Circle