SECTION 2.3
METEOROLOGY

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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).

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.

2.3.1 REGIONAL CLIMATOLOGY

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

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 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 region 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 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 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 collected 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.

The identification of stations to be included was based on the following general considerations:

- Proximity to the site (*i.e.,* within the nominal 50-mile 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 region.

Nevertheless, if an overall extreme precipitation or temperature condition was identified for a station located within a reasonable distance beyond the nominal 50-mile radius, and that event was considered to be reasonably representative for the site region, 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 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 region 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. 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 region 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 region.

2.3.1.3 Severe Weather

This subsection addresses severe weather phenomena that affect the Units 2 and 3 site 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 region.

The Shaw Air Force Base (AFB) wind speed for Hurricane Hugo was provided as a data point because it was a source for tropical cyclones and demonstrated the unusual nature of this hurricane; however, the Shaw AFB observation is not representative of the maximum wind speed that would be observed at the site. Shaw AFB is located approximately 50 miles to the southeast of the VCSNS site, and due to its location relative to the storm path, it received the strongest of the hurricane’s winds that existed at the time. The VCSNS site received winds that were on the weaker, western side of the storm. Hurricane Hugo was noteworthy for rapid inland movement and a widespread circulation. This suggests that the winds for Hugo were stronger inland than for most storms. Hurricanes that move inland decrease in wind speed, and winds continue to decrease in intensity as the storm moves further inland due to friction and loss of warm moist inflow air. Shaw AFB is positioned closer to the coast than the site is located. Hugo had observed winds of 109 mph as it passed Shaw AFB, followed by a rapid decrease in storm intensity to 70 mph at Columbia (Reference 212). Therefore Hugo had decreased in storm intensity below the site characteristic value at Columbia. While maximum wind gusts of 109 mph were reported at Shaw AFB, the maximum wind gusts associated with Hurricane Hugo at the site were much lower due to the location of the VCSNS site. On this basis it is concluded that historical Hurricane winds that have occurred around the site would not exceed the design basis wind speed of 102 mph given above.

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 (from NUREG/CR-4461 Table 8-1 and Regulatory Guide 1.76) 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.

There were 124 tornadoes (see Table 2.3-227) that occurred in the surrounding (Saluda, Chester, Lancaster, Newberry, Lexington, Kershaw, Richland, Union and Fairfield) counties during the period from 1950-August 2003 (Reference 250). Based on the 124 tornadoes during the period of record of about 54 years the annual frequency would be about 2.3 tornadoes per year within approximately 50 miles of VCSNS. This period of record was selected to follow the period of record from NUREG/CR-4461, from which the design basis tornado characteristics given in Table 2.0-201 were selected.

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 tropical storms that have become extratropical, 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 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 region 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 region.

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 region 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 region 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 region—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 region—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 31,1952 (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 region 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 regional 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, 15.7 inches, being measured at the Columbia, South Carolina, NWS station about 26 miles to the south-southeast 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 14.8 inches at the Johnston 4SW cooperative observing station, 46 miles to the southwest (References 213, 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 region 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 region; 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 these climate-related components:

- Normal Winter Precipitation Event
- Extreme Frozen Winter Precipitation Event
- Extreme Liquid Winter Precipitation Event

According to the proposed NRC interim staff guidance (ISG) on assessment of normal and extreme winter precipitation loads on the roofs of seismic category I structures (Reference 241), the normal winter precipitation event should be the highest ground level weight (in lb/ft^2) among:

- the 100-year return period snowpack,
- the historical maximum snowpack,
- the 100-year return period snowfall event, or
- the historical maximum snowfall event in the site region.

An analysis was performed to determine the highest ground level weight of these parameters. The 100-year return period snowfall event is the greatest of these values. The 100-year return period snowfall, within the site region, is 15.9 inches at the Catawba, South Carolina, cooperative station (Reference 249). Using

Equation 2 from the ISG (Reference 241), the 100-year return period snowfall is equivalent to 12.4 lb/ft^2. Thus the normal winter precipitation event is 12.4 lb/ft^2.

The extreme frozen winter precipitation event (Reference 241) should be the higher ground-level weight (in lb/ft^2) between:

- the 100-year return period snowfall event and
- the historical maximum snowfall event in the site region.

The 100-year return period snowfall event is, again, the greater value between these two parameters. Thus, the extreme frozen winter precipitation event is 12.4 lb/ft^2.

The extreme liquid winter precipitation event (Reference 241) is defined as the theoretically greatest depth of precipitation (in inches of water) for a 48-hour period that is physically possible over a 25.9-square-kilometer (10-square-mile) area during the months of historically highest snowpacks. This is also known as the 48-hour probable maximum winter precipitation.

The 48-hour probable maximum winter precipitation component 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, 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. Thus, the extreme liquid winter precipitation event 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 loads based on the normal winter precipitation and extreme frozen winter precipitation event) 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 region 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 region averages less than one day per year (see also Table 2.3-202).

Additional details regarding extreme snowfall events in the site region 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 region 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 regional 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 ($\boldsymbol{T}$) and the number of lightning strokes to earth per square mile per year ($\boldsymbol{N}$), where:

$$\boldsymbol{N} = 0.31\boldsymbol{T}$$

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 in the VCSNS site region. This frequency is essentially equivalent to the mean of the 5-year (1996 to 2000) flash density for the region 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 the Units 2 and 3 site 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 the PBA circle is approximately 0.063 square mile. Given the estimated annual average frequency of lightning strokes to earth in the VCSNS site region, the frequency of lightning strokes in the PBA circle 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 PBA circle.

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 1.0%, 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 1.0%.

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 1.0% annual exceedance probability is 94°F with a corresponding mean coincident wet bulb temperature value of 75°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 1.0% 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. The maximum wet bulb temperature (noncoincident), persisting for at least 2 hours, was determined to be 82.5°F (References 217 and 207).

The Air Force Combat Climatology Center-NCDC data summaries, from which the dry bulb and mean coincident wet bulb temperatures and the maximum non-coincident wet bulb temperatures were developed, 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 maximum dry bulb temperature is extrapolated from 30 years of observed data, no maximum coincident wet bulb temperature is directly available.

The coincident wet bulb temperature corresponding to the maximum dry bulb temperature was approximated by using a 47-year period (1949-1995) of record from the Columbia, SC station provided by the International Station Meteorological Climate Summary (ISMCS) (Reference 242). To determine the 100-year return maximum coincident wet bulb temperature, a polynominal curve is plotted to the data to estimate coincident wet bulb temperature as a function of dry bulb temperature.

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Based on 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. As discussed above, the 100-year return maximum coincident wet bulb temperature (74.5°F) is estimated using a polynomial curve fit.

10 CFR 52.79(a)(1)(iii) states the COL FSAR shall include “the seismic, meteorological, hydrologic, and geologic characteristics of the proposed site with appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area and with sufficient margin for the limited accuracy, quantity, and time in which the historical data have been accumulated.” Temperatures based on a 100-year return period provide sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated as required by the regulation. Therefore, the higher of either the maximum recorded values (dry bulb and non-coincident wet bulb) or the maximum 100-year values are reported as the 0% exceedance maximum dry bulb site characteristic values.

Similarly, the lower of either the minimum recorded dry bulb value or the minimum 100-year dry bulb value are listed as the 0% exceedance minimum dry bulb site characteristic value. For VCSNS, the maximum safety dry bulb / coincident wet bulb temperatures are the 100-year return values of 112.4°F (dry bulb) / 74.5°F (wet bulb). The maximum safety noncoincident wet bulb temperature is the 100-
VCS DEP 2.0-2 year return value of 87.3°F (wet bulb). Similarly, the minimum safety dry bulb temperature is the 100-year return value of -8.9°F.

The AP1000 DCD maximum and minimum normal temperature site characteristics are 1-percent (99-percent) seasonal exceedance values which are approximately equal to the annual 0.4-percent (99.6-percent) annual exceedance values according to the 2001 ASHRAE Fundamentals Handbook (Reference 248).

Using the relationship from ASHRAE, the maximum normal dry and coincident wet bulb temperature values (represented by the 0.4% annual exceedance probability) for Columbia, South Carolina, are 97°F and 76°F, respectively) (Reference 202). Following the same approach, the maximum normal wet bulb temperature (noncoincident) is represented by the 0.4% 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. The period of record for Chester 1NW is July 1948 – June 2006.

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 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.

2.3.1.6 Restrictive Dispersion Conditions

Atmospheric dispersion can be described as the horizontal and vertical transport and turbulent 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 Units 2 and 3. 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 region 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 (Reference 206).

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 horizontally interpolated 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 region. 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 regional 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 regional 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 regional 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).

	Temperature (°F)			Rainfall (inches)		
Period	**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

Period	Temperature (°F)			Rainfall (inches)		
	SC-03	SC-05	SC-06	SC-03	SC-05	SC-06
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 region (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.

General predictions on global and US climatic changes expected during the period of reactor operation are uncertain on the regional scale. Until higher resolution, more sophisticated, Global Climate Models (GCM's) can be developed it will be difficult to determine with certainty the characteristic changes that will occur in the site region. VCSNS is in a region where forecasts show little agreement between various modeling scenarios with respect to the relative changes in modeled climatic quantities (Reference 251). Many of the environmental quantities used for design purposes are not reported in the literature from GCM output. It is unclear, and may be speculative, as to how the general large scale trends in these climatic quantities would translate to design criteria in the site region, specifically with respect to the extreme values.

The historic data record provides the climatic trends and severe natural phenomena that are included in the site characterization. A margin of safety is provided by the difference between the site characteristics and the DCD site parameters, used for design. This margin accounts for limitations to the accuracy, quantity and period of time in which the historical data have been accumulated, in addition to the potential for increases due to changes in the climate. However, there is considerable uncertainty from GCM output as to how this will impact the characteristic quantities of the site area.

Future changes in the climate of the site region would potentially impact environmental conditions. The increases in the air temperature can be reasonably expected to remain below the DCD (Tier 2, Table 2.0-1) 0% exceedance dry bulb temperature of 115°F, due to the margin of safety from the site value of 105.1°F to 115°F (9.9°F) given that the best estimate of future temperature change is about 7.2°F (4°C) based on Table TS.6, Page 70 of the Technical Summary for Reference 251.

GCM forecasts indicate more showery precipitation, leading to increased surface runoff, which would tend to provide more water available for recharge of the Monticello Reservoir and/or higher water levels in the Broad River. The site placement on top of the hills above the Broad River provides a margin of safety for the VCSNS plant by keeping it above the flood plain.

Regional forecasts are extremely uncertain at this point. The hierarchies of GCM forecasts available have little certainty with respect to many forecast parameters. The current generation of models used to produce climate forecasts are not regional models. The current generation of climate models relies on extensive parameterizations for processes that are not well understood physically. Uncertainties of future model inputs (such as future greenhouse gas reductions), make the use of regionalized GCM output highly speculative at best.

2.3.2 LOCAL METEOROLOGY

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

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 Units 2 and 3, 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 Units 2 and 3. 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 for Units 2 and 3—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 the 2007 and 2008 annual cycles.

Refer to Subsection 2.3.3.3 for a discussion of relevant details about this preoperational monitoring program, including:

- Tower location

- Terrain features and elevations at Units 2 and 3 and in the vicinity of the Units 2 and 3 meteorological tower.
- 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 Units 2 and 3, 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 Units 2 and 3 and, for comparison, from data recorded at the regional Columbia, South Carolina, NWS station.

Subsection 2.3.3.3 includes a description of the preoperational monitoring program that provides onsite meteorological data. Wind direction and wind speed measurements were made at three levels on a 60-meter instrumented tower (*i.e.,* at 10 meters, 30 meters, and 60 meters).

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 the 2007 and 2008 annual cycles.

The wind direction distribution at the 10-meter level has prevailing wind (*i.e.,* defined as the direction from which the wind blows most often) from the west-southwest; with about 30% of the winds blowing from the south-southwest through west sectors. There is also a component of the wind from the northwest and southeast sectors for all seasons (see Figure 2.3-202). This is notable and corresponds with the Broad River valley orientation (northwest-southeast).

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).

Annual and seasonal wind rose plots based on measurements at the 60-meter level are shown in Figures 2.3-208 through 2.3-212. By comparison, wind direction distributions for the 60-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.

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 Units 2 and 3 from January 1, 2007 through December 31, 2008, 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 60-meter levels are 2.4 and 4.4 meters per second, respectively, at the VCSNS site. The annual mean wind speed at Columbia (*i.e.,* 3.0 meters/second) is slightly higher than the 10-meter level at the VCSNS site, differing by only 0.6 meters/second. Seasonal average wind speeds at Columbia are greater throughout every season of the year 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 were no reported hours with calm winds during the period of record. Minimal incidence of calm conditions can be attributed to the low measurement threshold of the sonic anemometers that were in place (see Subsection 2.3.3.3.1).

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 Units 2 and 3 monitoring program over a period of January 1, 2007 through December 31, 2008. 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 (60-meter) tower levels, respectively, identified in the preceding subsection.

At the 10-meter level, the longest persistence period is less than or equal to 18 hours for winds from the north-northeast and northeast sectors. This duration appears only in the lowest wind speed group (*i.e.,* for wind speeds greater than or equal to 5 mph). Persistence periods lasting for at least 12 hours are indicated for several directional sectors for wind speeds greater than or equal to 5 mph, including winds from the north, north-northeast, northeast, south, southwest, west-southwest, west, and northwest sectors. Wind speeds greater than or equal to 20 mph persisted for three periods of less than or equal to two hours, once in the south-southwest sector and twice in the west-southwest sector. There were no periods greater than or equal to 24 hours or persistent period of wind speeds greater than or equal to 25 mph.

At the 60-meter level, the longest persistence period is 24 hours and occurs for winds from the west directional sector (see Table 2.3-208) for wind speeds greater than or equal to 5 mph and 10 mph. For wind speeds greater than or equal to 15 mph, maximum persistence periods are limited to periods of 12 hours or less in north-northeast, south, west-southwest and west sectors.Wind speeds greater than or equal to 30 mph persisted for only two hours in the southeast, west-southwest and west sectors.

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

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 record from January 1, 2007 through December 31, 2008 for the monitoring program as operated in support of Units 2 and 3, Δ**T** was determined from the difference between temperature measurements made at the 60- and 10-meter tower levels. Seasonal and annual frequencies of atmospheric stability class and associated 10-meter level mean wind speeds for this period of record are presented in Table 2.3-209.

The data indicate a predominance of neutral stability (Class D) and slightly stable (Class E) conditions throughout the year, ranging from about 63 to 73% of the time for these stability classes combined. Extremely unstable conditions (Class A) are more frequent during the spring 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 autumn (about 26% 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 60-meter wind measurement levels are presented in Table 2.3-210 and Table 2.3-211. 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 region 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 region.

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 site region 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). Maximum and minimum values from COOP and first-order stations represent sub-hourly time periods. As defined in the AP1000 DCD, the maximum/minimum safety temperatures are defined as values excluding peaks of less than 2-hour duration. Because the maximum and minimum values are not sequential 2-hour duration hourly data they are not used for comparison to site characteristic values in Table 2.0-201.

Extreme minimum temperatures in the site region for Units 2 and 3 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 regional 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 region. 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).

There is no enhancement of naturally occurring fog conditions due to operation of the mechanical draft cooling towers associated with Units 2 and 3 because of the buoyancy of the thermal plume.

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 160 feet higher (towards the south-southwest), and to approximately 190 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 region. Neither the mean and extreme climatological characteristics of the site region 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 region 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) have been evaluated. Salt deposition in the switchyards is expected to be low, with natural wash off removing accumulation before adversely impacting operations of the electrical equipment. Water deposition would occur at a rate that is several orders of magnitude below the measured precipitation rates at Columbia (FSAR Reference 213). The thermal plume would have a higher virtual temperature (temperature that represents both temperature and moisture contributions to buoyancy) than the maximum historically observed temperature value or ambient temperature. This would cause the plume to rise away from the control room HVAC intakes and switchyard electrical equipment due to buoyancy, except in high wind situations. In high winds, turbulence would cause enough mixing to prevent any adverse effects.

Subsections 2.3.3.2 and 2.3.3.3.1 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 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 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

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.

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).

The VCSNS Units 2 and 3 are located approximately one mile south of the VCSNS Unit 1. A new meteorological tower, located onsite near the proposed units, was placed in service in December 2006 and is dedicated to serve Units 2 and 3.

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

1. The preoperational monitoring phase provides baseline data for the VCSNS Units 2 and 3 site collected from the recently installed meteorological tower.

2. The operational monitoring phase will continue use of the VCSNS Units 2 and 3 meteorological tower for data collection. Emergency preparedness support will use the current meteorological monitoring system for Units 2 and 3 as the basis for data collection during station operation.

Due to its close proximity to Units 2 and 3, the meteorological data collection system for the VCSNS Unit 1 will serve as a backup data source for Units 2 and 3 during routine service and maintenance of the Units 2 and 3 tower and during and following any accidental atmospheric radiological release of these units.

Data collected by the meteorological monitoring system is used to:

- Describe local and regional atmospheric transport and diffusion characteristics.

- Calculate the dispersion estimates for both postulated accidental and expected routine airborne releases of effluents.
- 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 and Topographical Features of the Site Area

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 topographical 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 topographical characteristics within a 50-mile radius of the Units 2 and 3 site. A topographical 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 as shown on Figure 1.1-202. 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 2.3-216, 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 2.3-215.

2.3.3.2 Siting of Meteorological Towers

2.3.3.2.1 Siting Criteria

To select a location for a meteorological tower, the following siting criteria are considered:

- The tower should be located where the measurements will accurately represent the overall site 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 heat and moisture sources under the prevailing wind direction

Other factors to be 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.

2.3.3.2.2 Units 2 and 3 Meteorological Tower

The site selected for the Units 2 and 3 meteorological tower is adjacent to the General Pearson Cemetery, as shown on Figure 1.1-202, since it best met the above siting criteria.

The new 60-meter (197-foot) guyed meteorological tower sits on a gently sloping plateau toward the west and south and along a dirt road leading to the General 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 cleared areas in the vicinity. The selected location offers a northern exposure similar to the Units 2 and 3 site. The Universal Transverse Mercator (UTM) system coordinates of the new meteorological tower are Northing/Y: 12443526.991 and Easting/X: 1541812.303.

The siting evaluations for the Units 2 and 3 tower are discussed in the following subsections.

2.3.3.2.2.1 Evaluation of Potential Airflow Alteration

The surrounding terrain, design finish grade, nearby trees and structures (existing and planned) were evaluated to determine whether these features might affect the wind measurements on the Units 2 and 3 tower. The findings are described below:

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

- The terrain variations of 35.5 feet between the Units 2 and 3 tower base (El. 435.5 feet NAVD88) and the VCSNS Units 2 and 3 design finish grade (El. 400 feet NAVD88) are minimal. No noticeable local wind flow alteration or disruption is expected. Therefore, the meteorological data collected at the tower for Units 2 and 3 can be considered representative of the location for Units 2 and 3 from the perspective of terrain effects.

- The tree line to the south is approximately 620 feet from the Units 2 and 3 tower with tree heights above the tower base ranging from 40 feet to 64 feet. To the north, the tree line at 400 feet from the tower base has trees of heights approximately 22 feet above the tower base. The tower is greater than 10 obstruction heights from the tree line to the north and nearly 10 obstruction heights from the tree line to the south (approximately 9.7 for the upper height value). Therefore, wind flow pattern alterations caused by these trees are expected to be negligible based on the horizontal separation from the Units 2 and 3 tower (Reference 233).

- Trees at the General Pearson Cemetery are preserved for historic reasons. All the trees surrounding the Units 2 and 3 tower, including the trees located within the boundary of the cemetery, meet the 10-obstruction-heights-separation criteria. Therefore, no discernible influence is expected on the wind measurements at the Units 2 and 3 tower.

- The Units 2 and 3 tower is approximately 4,365 feet south-southwest from the center of the Unit 2 containment and 3,470 feet from the center of the Unit 3 containment. The Units 2 and 3 shield buildings are approximately 230 feet high. Therefore, wind flow pattern alterations caused by the buildings are expected to be negligible based on the horizontal separation of the shield buildings from the Units 2 and 3 tower.

2.3.3.2.2.2 Heat and Moisture Source Influences and Evaluation

The location of the Units 2 and 3 tower was evaluated for heat and moisture sources that might influence the ambient temperature and relative humidity measurements. The existing and planned structures that would present heat and moisture sources are shown in Figure 1.1-202. These sources include, for example, ventilation sources, cooling towers, water bodies and large parking lots. The findings of the analysis follow:

- The VCSNS Units 2 and 3 meteorological tower is located on open grassy fields containing a small area of mixture of grass, soil and gravel immediately underlying the tower base. Heat reflection characteristics of the surface underlying the meteorological tower that could have localized influence on the measurements are expected to be minimal.

- Currently, there are no large parking lots or temporary land disturbances such as plowed fields or storage areas nearby. The closest planned asphalt parking lots and ventilation sources for VCSNS Units 2 and 3 are located more than 3000 feet from the meteorological tower. Parr Reservoir is approximately 0.7 mile to the west and Monticello Reservoir is about 1.7 miles to the north of the VCSNS Units 2 and 3 meteorological tower. The influences on ambient temperature, and relative humidity measurements are expected to be minimal from these potential heat and moisture sources because of the large distance separation between the tower and these sources.

- The cooling system for VCSNS Units 2 and 3 includes a bank of four circular, mechanical-draft cooling towers. These cooling towers are located downwind of the VCSNS Units 2 and 3 meteorological tower under the predominantly westerly wind direction at the VCSNS site (that is, winds are from the west-southwest and southwest). The relative humidity and temperature measurements are made at the 10-, 30-, and 60-meter levels on the tower. The nearest cooling tower is located more than 3000 feet east-northeast of the meteorological tower. The results from a recent cooling tower plume analysis performed by SCE&G indicate that the annual average modeled plume height is 1200 feet with an average median plume height of 390 feet. Based on these modeling results, the visible cooling tower plume height at 3000 feet downwind during most of the year is expected to exceed the height of the relative humidity and temperature sensors installed at the meteorological tower. Therefore, operation of these cooling towers would have minimal effects on the relative humidity and temperature measurements made on the Units 2 and 3 meteorological tower.

2.3.3.2.3 Backup Meteorological Data Source

The Unit 1 meteorological tower will serve as a backup source of data for the Units 2 and 3 tower. The Unit 1 tower is located approximately 188 feet off the Monticello Reservoir and 1563 feet west from the Unit 1 reactor building, the nearby tallest obstruction (i.e., 165 feet in height). The siting study for the Unit 1 tower is documented in the VCSNS Unit 1 FSAR. In early 2006, NRC assessed the Unit 1 tower siting based on near-field obstruction, ground cover, proximity to the Unit 1, and found the Unit 1 tower siting acceptable (Reference 235).

2.3.3.3 Preoperational Monitoring Program

The onsite, meteorological monitoring program for the VCSNS Units 2 and 3 is conducted in accordance with the guidance criteria in Regulatory Guide 1.23. The new system supports the onsite preoperational monitoring program for the proposed VCSNS Units 2 and 3.

Regulatory Guide 1.206, Subsection C.III.1 (C.I.2.3.3) states that the applicant should provide meteorological data for at least two consecutive annual cycles, including the most recent one-year period, at the time of application submittal.

Regulatory Guide 1.206 (Reference 244) also stipulates if two years of onsite data are not available at the time the application is submitted, at least one annual cycle of meteorological data collected onsite should be provided with the application.

Two years of meteorological data collected from the VCSNS Units 2 and 3 meteorological tower have been provided. The first year of meteorological data for the period, January 2007 through December 2007, was used to establish a baseline for preparing the VCSNS Units 2 and 3 COL Application. On-site meteorological data collected from January 2008 through December 2008 provide the second year of data.

2.3.3.3.1 Measurements Made and Instrument Elevations and Exposures

In general, the location and heights (elevations) of meteorological measurements depend on the planned data applications. For the purpose of making estimates of atmospheric dispersion for expected routine and postulated accidental effluent releases, it is important to determine wind speed, wind direction, and atmospheric stability class in the area of interest, the nature of effluent release, and the effluent release height, and to consider the surrounding building configuration for potential airflow alteration.

The Units 2 and 3 meteorological tower is a 60-meter open lattice tower, supported by a concrete foundation and guy wires. On the tower, wind speed, wind direction, relative humidity, and ambient temperature are monitored at 10-, 30-, and 60-meter levels. A system block diagram of the Units 2 and 3 meteorological tower is provided in Figure 2.3-219. The reasons for selection of these measurement levels are discussed below.

The most probable atmospheric release point from Units 2 and 3 is through the plant vent, which is 182.7 feet (55.7 meters) above ground. Other potential accident release points include releases from the passive containment cooling system air diffuser, 229 feet (69.8 meters) above ground and other atmospheric release points, all below the plant vent elevation. Since the plant vent and all other potential release points are within the building complex, none can be treated solely as an elevated release due to building wake effects. Therefore, all releases are conservatively assumed to be at ground level for the purpose of making atmospheric dispersion estimates.

With respect to the diffusion conditions at the site, temperature difference between the 60-meter and 10-meter levels is calculated 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. These measurement heights represent a range of possible release heights of the moisture plume. For the selected Units 2 and 3 cooling towers, the 30-meter level measurements best represent the approximate discharge height of the cooling tower plumes. Thus, dewpoint temperature is calculated from the concurrent measurements of temperature and relative humidity made at the 30-meter level on the tower for cooling tower plume impact assessment.

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 are used.

In addition, factors that have been considered in selecting these measurement levels and installation of instruments include location of manmade and vegetation obstruction, prevailing wind direction and topography.

The tower site has been cleared of trees to a distance of approximately ten times or greater the height of the tallest tree and existing and planned buildings as described in Subsection 2.3.3.2.2.1 to avoid airflow alteration.

The wind sensors are mounted on booms 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 to minimize tower structure influence. Wind sensors are mounted perpendicular to the southwest prevailing wind direction (as recorded at both the Unit 1 meteorological tower and the Columbia, South Carolina, NWS station) 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, the sensors are mounted in fan-aspirated solar radiation shields.

Due to the close proximity of Unit 1 meteorological tower to the proposed Units 2 and 3, precipitation information for Units 2 and 3 is obtained from the VCSNS Unit 1 integrated plant computer system. Precipitation is measured on an individual 5-foot pedestal located approximately 8 feet from the southwest leg of the Unit 1 tower. The precipitation gauge is equipped with an aerodynamically shaped wind shield to minimize wind-caused loss of precipitation from the sample.

An examination of the instrumentation on the Units 2 and 3 tower concludes that the parameters measured and levels and location of measurements are 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). Findings of the examination are summarized in Table 2.3-216.

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. In addition, the three anchors for the guyed-tower are grounded.

2.3.3.3.2 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 WS425 requires virtually no maintenance and provides wind measurements that completely eliminate the effects of altitude, temperature, and humidity. 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. 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 at 68°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.

Meteorological sensors used onsite were designed to operate in the environmental conditions found at the VCSNS site. Specifically, the instrumentation is capable of withstanding the environmental conditions as described in Regulatory Guide 1.23 for the specification of the meteorological monitoring systems.

Operational experience indicates that ultrasonic wind sensors are durable and require much less calibration and maintenance services than conventional sensors (e.g., cup anemometer). A platinum resistance temperature device is used for temperature measurements. No inoperable effects on the sensors used onsite have been identified due to corrosion, blowing sand, salt, air pollutants, birds and insects.

The meteorological sensor used, 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.

2.3.3.3.3 Data Acquisition and Reduction

2.3.3.3.3.1 Data Collection and Data Transmission

A processing computer 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 keypad, backup batteries, and a removable compact flash memory card (for onsite data retrieval). Normal system operation relies on an offsite power supply.

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 differential temperature and dew point are calculated by the processing computer.

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

- Wind speed/wind direction (60-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).

Data are collected locally from the Units 2 and 3 processing computer at the base of the tower. The processing computer has sufficient storage capacity to archive several months of data. Data are downloaded on a weekly basis for data analysis and review.

2.3.3.3.3.2 Data Analysis and Review

Meteorological data quality and monitoring are performed in accordance with VCSNS Units 2 and 3 procedures. Data analysis for both wind distribution and diffusion characteristics requires three basic atmospheric parameters. These three parameters, together with their primary and secondary (backup) measurements are:

Wind speed	primary measurement	10-meter wind speed
	secondary measurement	30-meter wind speed
	secondary measurement	60-meter wind speed
Wind direction	primary measurement	10-meter wind direction

	secondary measurement	30-meter wind direction
	secondary measurement	60-meter wind direction
Differential temperature:	primary measurement	(60–10 meters)
	secondary measurement	(30–10 meters)

As discussed in Subsection 2.3.3.3.1, the plant vent and other potential radiological release points are within the building complex; i.e., none can be treated as an elevated release point. Thus, all releases are treated as ground level releases and their associated atmospheric dispersion estimates (X/Qs) are based primarily on wind conditions at the 10-meter level.

In addition, relative humidity and temperature are measured at the 10-, 30-, and 60-meter levels.

The following data analysis and review program has been implemented to ensure a valid, accurate, and representative meteorological database. In accordance with procedures, routine meteorological tower site surveillance checks, data collection/validation are performed to ensure this information is properly maintained on the designated remote computer.

Data screening and validation, and identification and handling of suspect data are accomplished using the following processes:

- The 15-minute and hourly averages calculated by the processing computer are used for data validation. Hourly data are reviewed based on the pre-determined expected data range and data trending. In the screening process, each parameter is analyzed by data screening software. Subsequently, the data and screening results are reviewed to determine the data validity.

- In addition, questionable data are also compared to measurements from the VCSNS Unit 1 tower or a nearby NWS for a consistency check. Information from maintenance logs and calibration results are taken into consideration as well in determining data validity. If inconsistencies are discovered in the data screening or validation process, the events are communicated to project engineering personnel for corrective action. Routine site visitation logs, calibration logs, and equipment maintenance logs are generated in accordance with the SCE&G procedures.

- In the review process, inconsistent data entries are identified for further review; questionable data are examined in detail; and a determination is made whether the inconsistent data will be invalidated or replaced with substitute data.

Note that normal data validation does not include the wind speed and wind direction measurements at the 30-meter level. As for the relative humidity/

temperature measurements, only those collected at the 30-meter level are validated.

Data substitution, if required, is made by reviewing the 15-minute time-averaged data to determine if a valid 15-minute period average of continuous data can be obtained to replace the invalid hourly period. The invalid hourly data are edited using replacement valid 15-minute data.

Although alternative substitution methods have not been implemented, if required, these methods can be considered:

- Where data for a given parameter is missing for brief periods (e.g., 1 to 5 hours), interpolation may be used to fill data gaps.
- If wind data is missing or is invalid from one sensor level on the Unit 2 and 3 tower, data from the other sensor level on the tower is substituted.
- When interpolation is necessary to fill stability gaps, time of day, season, and weather conditions at the time are considered.

For the Years 2007 and 2008, no data substitution has been required and the annualized data recovery rates for all parameters measured at the Units 2 and 3 meteorological tower well exceed 90%.

The final step in the data analysis is the listing, in sequential order, of the concurrent, hourly averaged values of the meteorological variables observed at the site. The basic reduced data is compiled monthly and annually. 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 analysis needed to define the site atmospheric dispersive qualities.

2.3.3.3.4 Instrumentation Surveillance

Calibrations and maintenance activities of the onsite meteorological monitoring system are performed in accordance with RG 1.23, Section C5, Regulatory Position, Instrument Maintenance and Servicing Schedules (Reference 238) and ANSI/ANS-3.11, Section 7, System Performance (Reference 204). The instrumentation used to calibrate the meteorological system (where applicable) has been maintained such that the recordings can be traced to the National Institute of Standards and Technology.

Meteorological instrumentation is calibrated on a semi-annual basis. To ensure data quality and accuracy, the meteorological instruments are calibrated in accordance with the VCSNS Units 2 and 3 procedures. Inspection of meteorological tower hardware is performed during the semi-annual calibration, while the tower structure and lighting are inspected every three years (Reference 243) to ensure structure safety. Federal Aviation Administration lighting inspections are performed quarterly, as required.

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

- Meteorological monitoring site checks - To identify any abnormal functions, and to check site conditions once per week
- Data review - To identify equipment failures and to validate data on a monthly basis

During the meteorological monitoring site checks, tower instrumentation is visually checked and proper positioning of the instrument boom is verified. Support systems (e.g., elevator system) are checked to ensure their continued operation. Maintenance activity includes cleaning the rain gauge. Erroneous data displayed on the data logger panel could indicate a failure in the cable between the boom and the data logger, or an instrument failure. Any erroneous data are reported immediately to ensure timely corrective action can be taken.

If an equipment failure is suspected, a condition report is generated and supervisory personnel are notified. The cause of the failure will be investigated and corrective action taken, if required.

2.3.3.3.5 System Accuracy and Annual Data Recovery Rate

2.3.3.3.5.1 System Accuracy

The overall system accuracies include the errors introduced by sensors, cables, signal conditioners and recording and processing equipment. The time-averaged accuracies have been calculated for the Units 2 and 3 meteorological data collection system and are provided in Table 2.3-216.

It should be noted that temperature data collected by the U.S. Weather Service are normally measured near the ground level (about 1.5 – 2 meters above ground level). The temperature measurement as specified in Regulatory Guide 1.23 is measured at 10-meters and higher levels. The “system accuracy” shown in Table 2.3-216 is based on an observed temperature range of -0.6°F to 107.7°F. This range is about 5°F more than the minimum recorded and 3°F less than the maximum historical extremes measured in the site region. Strong lapse rates are a necessary condition under which extreme temperatures occur. Values that are less extreme than the historical limits would be measured at the 10-m or higher levels on the VCSNS Units 2 and 3 tower than would be observed close to the surface by temperature probes at U.S. Weather Service observation sites.

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

2.3.3.3.5.2 Annual 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 January 2007 through December 2008 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.

2.3.3.4 Operational Monitoring 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 during routine service and maintenance of the Units 2 and 3 tower and during and following any accidental atmospheric radiological releases from the new units.

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

The onsite meteorological monitoring program for the operational phase is expected to be similar to that described in Subsection 2.3.3.3 for the preoperational phase.

The functional requirements of the operational phase monitoring program are described below relative to the current system configuration for preoperational monitoring.

2.3.3.4.1 Description of Monitoring Program

The location of the meteorological tower and instrumentation are not anticipated to change during the operational monitoring phase, although monitoring of certain parameters not related to atmospheric dispersion may be discontinued. Instrumentation surveillance and methods for data recording, transmittal, acquisition and reduction, while expected to be similar during the operational phase, will be controlled by plant-specific instrumentation design and procedures to be developed at a later date. Other anticipated, phase-specific monitoring program differences are addressed below.

- Meteorological parameters measured during plant operation include wind speed, wind direction and ambient temperature at the 10- and 60-meter levels, and precipitation at ground level. The 60–10 meter vertical differential temperature is calculated based on temperature measurements made at these two levels. Since no adverse cooling tower plume impacts have been predicted, relative humidity measurements will not be continued during plant operation.

- During the pre-operational phase, meteorological data is collected locally at the tower and recorded as hourly average values; the 15-minute averages are also recorded (for validation purpose). During the plant operational phase, 15-minute average values of wind speed, wind direction and atmospheric stability class are required to be determined.

Both the 15-minute and hourly averages would be calculated by the Units 2 and 3 integrated plant computer system and compiled for reporting purposes.

- The data collected at the meteorological tower would be transmitted to the Units 2 and 3 integrated plant computer system (IPCS).
- The 15-minute average data would be transmitted to the plant Control Room, Technical Support Center, and/or Emergency Operations Facility designated to serve the new units in accordance with RG 1.97, Revision 3 (Reference 247).
- For instrumentation surveillance, channel checks will be performed daily.
- During system servicing, channel calibrations would be performed no less than semiannually. System calibrations encompass the entire data channel, including all recorders and displays (e.g., those local at the meteorological tower and in the emergency response facilities, as well as those used to compile the historical data set).
- Meteorological data necessary for the estimation of offsite dose projections would be available via terminals to personnel in the Control Room, the Technical Support Center, and the Emergency Operation Facility serving Units 2 and 3.
- Wind speed, wind direction, and atmospheric stability data averages calculated by the plant computer will be submitted as input to the NRC Emergency Response Data System.
- Meteorological monitoring requirements for emergency preparedness and response support are discussed in Subsection 2.3.3.4.2.

Annual operating reports of effluent releases (both routine and batch) and waste disposal that include meteorological data collected onsite will be prepared and submitted in accordance with RG 1.21, Revision 1 (Reference 245).

2.3.3.4.2 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.

Should the computerized meteorological information of the computer-based assessment system not be available, or if results are suspect, the Unit 1 meteorological tower data will be used. When both onsite meteorological towers are not available for the estimation of offsite dose projections, meteorological data from the NWS in Columbia, South Carolina, will be acquired and used.

2.3.3.5 Meteorological Data

2.3.3.5.1 Representativeness and Adequacy of Data

The data collection system of the new meteorological tower, dedicated to serve Units 2 and 3 conforms to Regulatory Guide 1.23. In support of the VCSNS Units 2 and 3 COL application, two years of available onsite data (i.e., 1/1/2007 – 12/31/2008) from the Units 2 and 3 tower was used to make the atmospheric dispersion estimates. The results of these dispersion estimates are reported in Subsections 2.3.4 and 2.3.5.

2.3.3.5.1.1 Long-Term and Climatological Conditions

In order to provide evidence to show how well the onsite data collected at the Units 2 and 3 tower represent long-term conditions at the site, a data comparison between the onsite and the nearby offsite data was made using data collected for Unit 1 (which has long-term meteorological data) as a surrogate.

Long-term meteorological data from the Columbia NWS, S.C. and onsite data at the VCSNS site have been examined and summarized, as follows:

Two periods of recent Unit 1 wind direction data (*i.e.,* January 2007–December 2007 and July 2003–June 2006) used to support Units 2 and 3 were 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 2.3-213. 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).

Similarly, the Unit 1 wind speed data for the same two recent periods (i.e. 1/1/2007-12/31/2007, 7/2003-6/2006) were compared with two periods of wind data (Year 2004 and 49 years of long-term summary data) at Columbia NWS, S.C. The results of the comparisons are provided in Table 2.3-214. As shown in the table, the seasonal and annual mean wind speeds between these two data collection systems are in reasonable good agreement.

Since there are no vertical temperature difference (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 three periods of onsite data (*i.e.*, 1975, 2003-2006, and 2007) collected at the Unit 1 meteorological tower to reveal the long-term trend of the stability class conditions determined from the vertical temperature difference measured onsite. The results as shown in Table 2.3-215 indicate a reasonable agreement with the highest frequencies occurring at classes D. The major difference (22.4% versus 14.6%) 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 reasonably representative of the long-term climatological conditions at the site.

2.3.3.5.1.2 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, meteorological data collected by the Units 2 and 3 tower 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.

2.3.3.5.2 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 60-meter level measurements.

2.3.3.5.3 Submittal of Preoperational Meteorological Data

Data are provided for the collection period from January 1, 2007, through December 31, 2008. Specifically, an electronic sequential, hour-by-hour listing of the data set, in the format specified in Appendix A of Regulatory Guide 1.23, is provided.

Two- years of available onsite data were used to calculate both the short-term and long-term atmospheric dispersion estimates presented in Subsections 2.3.4 and 2.3.5, in accordance with Regulatory Guide 1.206.

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).

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 from January 1, 2007 through December 31, 2008, 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 the two-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: 2-years (January 1, 2007 to December 31, 2008) 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: (60 meters – 10 meters)
- Number of wind speed categories: 11 (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	3.57E-04	+	+	+	+	+
DCD*	5.1E-04	-	-	-	-	-
LPZ Boundary	+	1.16E-04	7.45E-05	2.84E-05	7.13E-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 (3.57E-04) determined by the PAVAN modeling analyses at the Dose Evaluation Periphery is bounded by the 0–2-hour DCD X/Q value of 5.1E-04 as described in DCD Tier 1, Table 5.0-1 and DCD Tier 2, Table 2-1. 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. Two annual cycles (January 1, 2007–December 31, 2008) of hourly meteorological data collected onsite were used as part of the input for the ARCON96 program. The two years of meteorological data have a data recovery rate 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).

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; the nearest: milk animal, residence, garden, and 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. Regulatory Guide 1.111 states that a constant mean wind direction (straight-line trajectory) model may be used provided that the single station used is representative of the site region (within 50 miles of the site). Onsite meteorological data collected at the VCSNS Units 2 and 3 meteorological tower, under the guidance specified in Regulatory Guide 1.23 (Reference 238), is considered representative of the site region when compared to the National Weather Service first-order observations from Columbia, SC. The site region has relatively homogeneous topography. The wind roses from both stations are similar and the mean wind speeds for the onsite observations are somewhat lower than those at Columbia, leading to more conservative transport and diffusion estimates (as discussed in Subsections 2.3.1.6 and 2.3.2.2). The spatial homogeneity and similar wind characteristics are considered reasonable justification for the use of the constant mean direction (straight-line trajectory) model XOQDOQ.

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

- Meteorological Data: 2-year (January 1, 2007 to December 31, 2008) 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: (60 meters – 10 meters)
- Number of wind speed categories: 11 (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).

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 1.7E-05 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:

- 5.8E-06 sec/m^3 for the Dose Evaluation Periphery occurring in the southeast sector at a distance of 0.5 mile

- 8.7E-07 sec/m^3 for the nearest residence occurring in the southeast sector at a distance of 1.68 miles
- 4.6E-07 sec/m^3 for the nearest meat animal occurring in the west-northwest sector at a distance of 1.74 miles
- 1.7E-07 sec/m^3 for the nearest milk animal in the northwest sector at a receptor distance of 4.14 miles
- 8.7E-07 sec/m^3 for the nearest vegetable garden occurring in the southeast sector at a distance of 1.68 miles

Finally, Table 2.3-226 presents 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). The results along the southeast and east-northeast radials presented in Table 2.3-226 represent the highest X/Q and D/Q values, respectively, from among all the direction radials modeled.

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.

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 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.

2.3.6.2 Local Meteorology

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

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)

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.

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 2.3.3.3)
- Operational Monitoring Program (Subsection 2.3.3.4)

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).

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.

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.

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

published by: NCDC Asheville, NC 3

(Reference 213)

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

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)	15.7[r] (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
(r) Source: Reference 213

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

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 Region

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 Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008) and the Columbia, South Carolina NWS Station

Primary Tower Elevation	Location	Winter	Spring	Summer	Autumn	Annual
Upper Level (60 meters) (m/sec)	Units 2 and 3 Site	4.6	4.7	3.8	4.3	4.4
Lower Level (10 meters) (m/sec)	Units 2 and 3 Site	2.5	2.7	2.2	2.2	2.4
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 Units 2 and 3 Monitoring Program – 10-Meter Level

Site Name: Summer **Start Date: 1/1/2007 00:00** **End Date: 12/31/2008 23:00**
Number of Sectors Included: 1 **Width in Degrees: 22.5**
Measurement Height, m: 10 **Speed Sensor: 3** **Direction Sensor: 3**

Speed Greater than or Equal to: 5.00 mph

Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	449	531	635	376	271	249	300	459	579	745	920	818	619	424	334	456
2	225	286	362	165	96	93	104	207	254	379	505	415	321	207	162	240
4	74	115	173	47	11	24	18	52	65	125	189	126	117	58	67	105
8	14	31	67	7	0	0	1	1	10	15	43	22	23	5	16	18
12	2	11	29	0	0	0	0	0	4	0	11	5	3	0	6	0
18	0	3	5	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: 10.00 mph

Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	51	53	12	7	6	9	6	36	72	149	249	252	181	72	74	97
2	28	29	6	1	2	4	3	16	34	73	126	133	96	33	46	55
4	11	10	0	0	0	0	0	5	9	18	41	41	29	4	25	19
8	2	0	0	0	0	0	0	0	2	0	5	5	2	0	4	0
12	0	0	0	0	0	0	0	0	0	0	1	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: 15.00 mph

Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	2	0	0	0	0	0	3	1	6	15	13	51	24	3	9	4
2	1	0	0	0	0	0	2	0	3	5	2	28	9	1	5	1
4	0	0	0	0	0	0	0	0	0	1	0	8	0	0	1	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 2.3-207 (Sheet 2 of 2)
Wind Direction Persistence/Wind Speed Distributions for the Units 2 and 3 Monitoring Program – 10-Meter Level

Site Name: Summer **Start Date: 1/1/2007 00:00** **End Date: 12/31/2008 23:00**
Number of Sectors Included: 1 **Width in Degrees: 22.5**
Measurement Height, m: 10 **Speed Sensor: 3** **Direction Sensor: 3**

Speed Greater than or Equal to: 20.00 mph

Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	0	0	0	0	0	0	1	0	0	2	2	5	1	0	0	0
2	0	0	0	0	0	0	0	0	0	1	0	2	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: 25.00 mph

Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	0	0	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

Speed Greater than or Equal to:30.00mph

Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	0	0	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 Units 2 and 3 Monitoring Program – 60-Meter Level

Site Name: Summer **Start Date: 1/1/2007 00:00** **End Date: 12/31/2008 23:00**
Number of Sectors Included: 1 **Width in Degrees: 22.5**
Measurement Height, m: 60 **Speed Sensor: 4** **Direction Sensor: 4**

Speed Greater than or Equal to: 5.00 mph

Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	560	904	1100	1099	723	586	615	705	1122	1281	1375	1675	1417	631	482	706
2	240	514	649	626	345	283	299	325	601	674	704	959	856	274	197	378
4	43	229	287	267	98	89	89	92	204	251	248	393	396	66	56	152
8	2	66	76	54	16	14	13	5	43	49	27	82	110	13	8	27
12	0	23	18	16	1	0	2	0	16	8	0	24	41	5	0	8
18	0	3	0	0	0	0	0	0	1	0	0	6	12	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	3	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	SSW	SW	WSW	W	WNW	NW	NNW
1	260	514	635	571	345	280	309	379	611	665	753	1005	900	216	184	351
2	120	324	395	331	172	133	142	172	321	363	404	586	586	82	88	207
4	29	163	185	130	53	48	36	39	116	148	146	246	296	16	33	95
8	2	57	53	28	13	11	7	0	34	25	12	37	88	1	7	14
12	0	21	12	6	0	0	2	0	14	3	0	6	36	0	0	2
18	0	3	0	0	0	0	0	0	1	0	0	0	12	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	3	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	SSW	SW	WSW	W	WNW	NW	NNW
1	61	164	145	97	57	37	38	74	126	115	165	299	381	49	65	120
2	29	103	80	44	21	12	9	15	60	47	65	169	254	15	32	71
4	5	51	30	14	4	0	0	1	18	8	15	68	121	1	8	22
8	0	15	5	2	0	0	0	0	6	0	1	12	30	0	0	1
12	0	2	0	0	0	0	0	0	2	0	0	2	8	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 2 of 2)
Wind Direction Persistence/Wind Speed Distributions for the Units 2 and 3 Monitoring Program – 60-Meter Level

Site Name: Summer | **Start Date: 1/1/2007 00:00** | **End Date: 12/31/2008 23:00**
Number of Sectors Included: 1 | **Width in Degrees: 22.5**
Measurement Height, m: 60 | **Speed Sensor: 4** | **Direction Sensor: 4**

Speed Greater than or Equal to: 20.00 mph

Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	9	18	1	0	1	4	3	2	17	16	17	90	109	7	10	26
2	5	9	0	0	0	2	2	0	9	5	4	48	72	1	6	11
4	2	5	0	0	0	0	0	0	0	1	0	15	37	0	1	5
8	0	1	0	0	0	0	0	0	0	0	0	0	6	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	SSW	SW	WSW	W	WNW	NW	NNW
1	1	3	0	0	0	0	3	0	2	2	2	14	27	1	1	0
2	0	1	0	0	0	0	2	0	0	1	0	8	10	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	4	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	SSW	SW	WSW	W	WNW	NW	NNW
1	0	1	0	0	0	0	3	0	0	0	0	4	5	0	0	0
2	0	0	0	0	0	0	2	0	0	0	0	1	1	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 2.3-209
Seasonal and Annual Vertical Stability Class and Mean 10-Meter Level Wind Speed Distributions for the Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008)

Period	Vertical Stability Categories[a]							
	A	B	C	D	E	F	G	All
Winter								
Frequency (%)	0.26	1.21	3.82	39.34	33.16	13.24	8.97	
Wind Speed (m/sec)	4.92	4.96	4.16	2.95	2.41	1.61	1.21	2.50
Spring								
Frequency (%)	4.01	5.56	8.07	30.71	31.87	11.92	7.84	
Wind Speed (m/sec)	4.43	3.98	3.53	2.95	2.50	1.65	1.30	2.68
Summer								
Frequency (%)	3.34	5.09	8.16	31.34	34.73	14.69	2.64	
Wind Speed (m/sec)	3.53	3.13	2.86	2.46	1.88	1.56	1.30	2.19
Autumn								
Frequency (%)	2.43	2.98	5.60	30.77	31.76	14.55	11.91	
Wind Speed (m/sec)	3.98	3.49	3.13	2.46	2.15	1.56	1.16	2.19
Annual								
Frequency (%)	2.52	3.73	6.43	33.01	32.88	13.60	7.82	
Wind Speed (m/sec)	4.02	3.67	3.31	2.73	2.24	1.61	1.21	2.41

(a) Vertical stability based on temperature difference (ΔT) between 60-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 Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008)

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2007 00:00 12/31/2008 23:00

Elevation: **Speed:** SPD10NEW **Direction:** DIR10NEW **Lapse:** DT60NEW

Stability Class A Delta Temperature Extremely Unstable

Wind Speed (m/s)

Wind Direction (from)	0.22-0.50	0.51-0.75	0.76-1.0	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	0	0	15	31	4	0	0	0	0	50
NNE	0	0	0	0	0	17	39	7	0	0	0	0	63
NE	0	0	0	0	0	6	64	0	0	0	0	0	70
ENE	0	0	0	0	0	12	30	1	0	0	0	0	43
E	0	0	0	0	0	2	12	0	0	0	0	0	14
ESE	0	0	0	0	1	0	4	0	0	0	0	0	5
SE	0	0	0	0	0	0	4	0	0	0	0	0	4
SSE	0	0	0	0	0	0	0	0	0	0	0	0	0
S	0	0	0	0	0	1	2	1	0	0	0	0	4
SSW	0	0	0	0	1	3	2	0	0	0	0	0	6
SW	0	0	0	0	0	0	13	5	0	0	0	0	18
WSW	0	0	0	0	0	2	23	10	3	0	0	0	38
W	0	0	0	0	1	2	22	15	0	0	0	0	40
WNW	0	0	0	1	0	2	12	4	0	0	0	0	19
NW	0	0	0	0	2	4	13	9	1	0	0	0	29
NNW	0	0	0	0	1	4	18	13	1	0	0	0	37
Totals	0	0	0	1	6	70	289	69	5	0	0	0	440

Number of Calm Hours not included above for:	**Total Period**	0
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	111
Number of Valid Hours for:	**Total Period**	440
Total Hours for:	**Total Period**	17544

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-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 Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008)

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2007 00:00 12/31/2008 23:00

Elevation: **Speed:** SPD10NEW **Direction:** DIR10NEW **Lapse:** DT60NEW

Stability Class B Delta Temperature Moderately Unstable

Wind Speed (m/s)

Wind Direction (from)	0.22-0.50	0.51-0.75	0.76-1.0	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	0	1	36	30	0	0	0	0	0	67
NNE	0	0	0	0	2	28	27	2	0	0	0	0	59
NE	0	0	0	0	1	29	39	1	0	0	0	0	70
ENE	0	0	0	0	0	18	25	0	0	0	0	0	43
E	0	0	0	0	1	12	18	0	0	0	0	0	31
ESE	0	0	0	0	0	4	4	0	0	0	0	0	8
SE	0	0	0	0	0	0	2	0	0	0	0	0	2
SSE	0	0	0	0	0	2	3	1	0	0	0	0	6
S	0	0	0	0	0	6	18	1	0	0	0	0	25
SSW	0	0	0	0	1	7	22	10	0	0	0	0	40
SW	0	0	0	0	0	8	21	16	1	0	0	0	46
WSW	0	0	0	0	0	5	44	18	6	0	0	0	73
W	0	0	0	0	2	7	35	15	3	0	0	0	62
WNW	0	0	0	1	6	12	20	3	0	0	0	0	42
NW	0	0	0	0	2	15	13	9	2	0	0	0	41
NNW	0	0	0	0	3	9	15	6	2	0	0	0	35
Totals	0	0	0	1	19	198	336	82	14	0	0	0	650

Number of Calm Hours not included above for:	**Total Period**	0
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	111
Number of Valid Hours for:	**Total Period**	650
Total Hours for:	**Total Period**	17544

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-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 Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008)

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2007 00:00 12/31/2008 23:00

Elevation: **Speed:** SPD10NEW **Direction:** DIR10NEW **Lapse:** DT60NEW

Stability Class C Delta Temperature Slightly Unstable

Wind Speed (m/s)

Wind Direction (from)	0.22-0.50	0.51-0.75	0.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	>18.0	Total
N	0	0	0	1	9	52	20	2	0	0	0	0	84
NNE	0	0	0	1	3	33	35	0	0	0	0	0	72
NE	0	0	1	0	2	35	24	0	0	0	0	0	62
ENE	0	0	0	0	4	53	25	0	0	0	0	0	82
E	0	0	0	2	5	28	15	0	0	0	0	0	50
ESE	0	0	0	0	0	8	3	0	0	0	0	0	11
SE	0	0	0	1	1	7	9	0	0	0	0	0	18
SSE	0	0	0	0	3	9	10	0	0	0	0	0	22
S	0	0	0	0	4	17	33	4	1	0	0	0	59
SSW	0	0	0	0	1	23	53	16	0	0	0	0	93
SW	0	0	0	0	7	26	49	19	0	0	0	0	101
WSW	0	0	0	0	10	40	60	28	6	0	0	0	144
W	0	0	0	3	11	24	47	15	4	0	0	0	104
WNW	0	0	0	2	11	37	32	5	0	0	0	0	87
NW	0	0	1	2	10	24	25	11	1	0	0	0	74
NNW	0	0	0	2	9	24	16	7	0	0	0	0	58
Totals	0	0	2	14	90	440	456	107	12	0	0	0	1121

Number of Calm Hours not included above for:	**Total Period**	0
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	111
Number of Valid Hours for:	**Total Period**	1121
Total Hours for:	**Total Period**	17544

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-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 Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008)

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2007 00:00 12/31/2008 23:00

Elevation: **Speed:** SPD10NEW **Direction:** DIR10NEW **Lapse:** DT60NEW

Stability Class D Delta Temperature Neutral

Wind Speed (m/s)

Wind Direction (from)	0.22-0.50	0.51-0.75	0.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	>18.0	Total
N	1	4	8	25	50	70	75	19	1	0	0	0	253
NNE	1	3	5	32	48	114	140	3	0	0	0	0	346
NE	0	3	7	37	75	226	110	0	0	0	0	0	458
ENE	0	3	17	55	73	146	55	0	0	0	0	0	349
E	0	4	14	33	65	106	39	0	0	0	0	0	261
ESE	0	2	7	30	49	110	24	1	0	0	0	0	223
SE	1	2	5	23	41	103	20	0	0	0	0	0	195
SSE	0	3	4	24	38	117	69	7	0	0	0	0	262
S	0	2	8	24	41	127	117	21	2	0	0	0	342
SSW	0	2	8	27	65	142	169	35	7	0	0	0	455
SW	0	0	6	26	63	149	249	72	6	0	0	0	571
WSW	0	1	7	56	100	137	175	64	18	0	0	0	558
W	1	1	13	60	96	120	115	37	9	0	0	0	452
WNW	0	2	14	75	73	146	77	29	2	0	0	0	418
NW	0	3	14	72	87	93	55	16	1	0	0	0	341
NNW	0	2	9	44	58	79	60	18	0	0	0	0	270
Totals	4	37	146	643	1022	1985	1549	322	46	0	0	0	5754

Number of Calm Hours not included above for:	**Total Period**	0
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	111
Number of Valid Hours for:	**Total Period**	5754
Total Hours for:	**Total Period**	17544

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-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 Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008)

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2007 00:00 12/31/2008 23:00
Elevation: **Speed:** SPD10NEW **Direction:** DIR10NEW **Lapse:** DT60NEW

Stability Class E Delta Temperature Slightly Stable

Wind Speed (m/s)

Wind Direction (from)	0.22-0.50	0.51-0.75	0.76-1.0	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	7	15	37	40	67	63	2	0	0	0	0	232
NNE	1	7	18	38	40	66	65	1	0	0	0	0	236
NE	0	5	15	60	83	135	50	0	0	0	0	0	348
ENE	2	4	13	88	84	69	8	0	0	0	0	0	268
E	1	6	21	73	68	66	2	0	0	0	0	0	237
ESE	3	8	17	57	80	84	19	2	0	0	0	0	270
SE	2	1	15	68	112	124	27	0	2	1	0	0	352
SSE	2	5	14	62	126	191	73	2	1	0	0	0	476
S	2	9	34	111	87	152	84	13	2	0	0	0	494
SSW	2	5	31	78	57	140	132	19	5	0	0	0	469
SW	1	11	20	62	77	176	146	28	3	0	0	0	524
WSW	0	13	18	66	130	124	97	24	0	0	0	0	472
W	0	9	21	82	88	101	102	18	1	0	0	0	422
WNW	1	17	21	82	74	74	35	3	0	0	0	0	307
NW	0	10	21	76	63	66	29	6	0	0	0	0	271
NNW	3	5	24	44	72	109	87	10	0	0	0	0	354
Totals	21	122	318	1084	1281	1744	1019	128	14	1	0	0	5732

Number of Calm Hours not included above for:	**Total Period**	0
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	111
Number of Valid Hours for:	**Total Period**	5732
Total Hours for:	**Total Period**	17544

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-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 Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008)

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2007 00:00 12/31/2008 23:00

Elevation: **Speed:** SPD10NEW **Direction:** DIR10NEW **Lapse:** DT60NEW

Stability Class F Delta Temperature Moderately Stable

Wind Speed (m/s)

Wind Direction (from)	0.22-0.50	0.51-0.75	0.76-1.0	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	16	22	16	12	1	0	0	0	0	0	71
NNE	1	4	6	14	7	9	0	0	0	0	0	0	41
NE	1	8	5	36	26	5	0	0	0	0	0	0	81
ENE	0	8	6	34	76	35	1	0	0	0	0	0	160
E	5	4	14	68	77	38	1	0	0	0	0	0	207
ESE	3	3	17	48	53	53	1	0	0	0	0	0	178
SE	4	5	14	50	68	93	3	0	0	0	0	0	237
SSE	3	5	14	49	86	81	3	0	0	0	0	0	241
S	3	5	20	53	70	53	5	1	0	0	0	0	210
SSW	4	5	17	60	27	35	7	0	0	0	0	0	155
SW	4	7	16	49	26	19	2	0	0	0	0	0	123
WSW	1	13	9	41	35	23	3	0	0	0	0	0	125
W	1	9	21	31	27	15	2	0	0	0	0	0	106
WNW	2	10	18	42	33	6	1	0	0	0	0	0	112
NW	0	9	35	74	30	11	0	0	0	0	0	0	159
NNW	1	8	14	40	59	40	3	0	0	0	0	0	165
Totals	34	106	242	711	716	528	33	1	0	0	0	0	2371

Number of Calm Hours not included above for:	**Total Period**	0
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	111
Number of Valid Hours for:	**Total Period**	2371
Total Hours for:	**Total Period**	17544

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-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 Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008)

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2007 00:00 12/31/2008 23:00

Elevation: **Speed:** SPD10NEW **Direction:** DIR10NEW **Lapse:** DT60NEW

Stability Class G Delta Temperature Extremely Stable

Wind Speed (m/s)

Wind Direction (from)	0.22-0.50	0.51-0.75	0.76-1.0	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	3	5	16	17	11	3	0	0	0	0	0	0	55
NNE	2	4	5	6	2	1	0	0	0	0	0	0	20
NE	6	10	0	7	0	0	1	0	0	0	0	0	24
ENE	4	4	11	6	6	0	0	0	0	0	0	0	31
E	4	9	6	13	18	12	0	0	0	0	0	0	62
ESE	4	8	16	20	23	16	2	0	0	0	0	0	89
SE	5	10	15	37	26	24	1	0	0	0	0	0	118
SSE	6	4	12	21	19	7	0	0	0	0	0	0	69
S	3	6	11	20	17	10	1	0	0	0	0	0	68
SSW	7	8	12	19	14	2	0	0	0	0	0	0	62
SW	9	9	5	18	8	1	0	0	0	0	0	0	50
WSW	12	7	11	15	2	3	0	0	0	0	0	0	50
W	8	8	16	11	2	0	0	0	0	0	0	0	45
WNW	1	18	26	23	7	0	0	0	0	0	0	0	75
NW	12	13	71	164	52	2	0	0	0	0	0	0	314
NNW	7	14	30	95	66	21	0	0	0	0	0	0	233
Totals	93	137	263	492	273	102	5	0	0	0	0	0	1365

Number of Calm Hours not included above for:	Total Period	0
Number of Variable Direction Hours for:	Total Period	0
Number of Invalid Hours for:	Total Period	111
Number of Valid Hours for:	Total Period	1365
Total Hours for:	Total Period	17544

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-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 Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008)

Hours at Each Wind Speed and Direction

Summary of All Stability Classes

Total Period

Period of Record = 1/1/2007 00:00 12/31/2008 23:00

Elevation: **Speed:** SPD10NEW **Direction:** DIR10NEW **Lapse:** DT60NEW

Delta Temperature

Wind Speed (m/s)

Wind Direction (from)	0.22-0.50	0.51-0.75	0.76-1.0	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	6	19	55	102	127	255	220	27	1	0	0	0	812
NNE	5	18	34	91	102	268	306	13	0	0	0	0	837
NE	7	26	28	140	187	436	288	1	0	0	0	0	1113
ENE	6	19	47	183	243	333	144	1	0	0	0	0	976
E	10	23	55	189	234	264	87	0	0	0	0	0	862
ESE	10	21	57	155	206	275	57	3	0	0	0	0	784
SE	12	18	49	179	248	351	66	0	2	1	0	0	926
SSE	11	17	44	156	272	407	158	10	1	0	0	0	1076
S	8	22	73	208	219	366	260	41	5	0	0	0	1202
SSW	13	20	68	184	166	352	385	80	12	0	0	0	1280
SW	14	27	47	155	181	379	480	140	10	0	0	0	1433
WSW	13	34	45	178	277	334	402	144	33	0	0	0	1460
W	10	27	71	187	227	269	323	100	17	0	0	0	1231
WNW	4	47	79	226	204	277	177	44	2	0	0	0	1060
NW	12	35	142	388	246	215	135	51	5	0	0	0	1229
NNW	11	29	77	225	268	286	199	54	3	0	0	0	1152
Totals	152	402	971	2946	3407	5067	3687	709	91	1	0	0	17433

Number of Calm Hours not included above for:	**Total Period**	0
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	111
Number of Valid Hours for:	**Total Period**	17433
Total Hours for:	**Total Period**	17544

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

Table 2.3-211 (Sheet 1 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008)

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2007 00:00 12/31/2008 23:00

Elevation: **Speed:** SPD60NEW **Direction:** DIR60NEW **Lapse:** DT60NEW

Stability Class A Delta Temperature Extremely Unstable

Wind Speed (m/s)

Wind Direction (from)	0.22-0.50	0.51-0.75	0.76-1.0	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	0	0	1	21	15	5	0	0	0	42
NNE	0	0	0	0	0	4	27	17	19	0	0	0	67
NE	0	0	0	0	0	1	26	42	7	0	0	0	76
ENE	0	0	0	0	0	0	21	23	4	0	0	0	48
E	0	0	0	0	0	1	6	8	1	0	0	0	16
ESE	0	0	0	0	0	0	0	1	1	0	0	0	2
SE	0	0	0	0	0	1	1	3	0	0	0	0	5
SSE	0	0	0	0	0	0	1	0	0	0	0	0	1
S	0	0	0	0	0	0	3	1	0	0	0	0	4
SSW	0	0	0	0	0	2	1	2	0	0	0	0	5
SW	0	0	0	0	0	0	6	7	3	0	0	0	16
WSW	0	0	0	0	1	2	9	7	8	4	0	0	31
W	0	0	0	0	1	1	6	20	29	0	0	0	57
WNW	0	0	0	0	0	2	3	5	2	0	0	0	12
NW	0	0	0	1	0	1	7	5	7	2	0	0	23
NNW	0	0	0	0	1	4	9	8	12	1	0	0	35
Totals	0	0	0	1	3	20	147	164	98	7	0	0	440

Number of Calm Hours not included above for:	**Total Period**	1
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	137
Number of Valid Hours for:	**Total Period**	440
Total Hours for:	**Total Period**	17544

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

Table 2.3-211 (Sheet 2 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008)

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2007 00:00 12/31/2008 23:00

Elevation: **Speed:** SPD60NEW **Direction:** DIR60NEW **Lapse:** DT60NEW

Stability Class B Delta Temperature Moderately Unstable

Wind Speed (m/s)

Wind Direction (from)	0.22-0.50	0.51-0.75	0.76-1.0	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	0	0	8	23	9	0	0	0	0	40
NNE	0	0	0	0	1	13	44	10	6	0	0	0	74
NE	0	0	0	0	1	9	29	20	6	0	0	0	65
ENE	0	0	0	0	1	1	38	19	3	0	0	0	62
E	0	0	0	0	0	4	18	10	2	0	0	0	34
ESE	0	0	0	0	0	1	1	0	0	0	0	0	2
SE	0	0	0	0	0	1	3	0	0	0	0	0	4
SSE	0	0	0	0	0	2	6	1	1	0	0	0	10
S	0	0	0	0	0	3	16	6	0	0	0	0	25
SSW	0	0	0	0	0	4	14	10	4	0	0	0	32
SW	0	0	0	0	1	4	12	13	8	0	0	0	38
WSW	0	0	0	0	0	4	23	32	17	5	0	0	81
W	0	0	0	1	2	5	17	26	18	7	0	0	76
WNW	0	0	0	0	5	8	13	6	2	0	0	0	34
NW	0	0	0	0	2	8	8	7	6	3	0	0	34
NNW	0	0	0	0	2	3	14	12	5	3	0	0	39
Totals	0	0	0	1	15	78	279	181	78	18	0	0	650

Number of Calm Hours not included above for:	**Total Period**	1
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	137
Number of Valid Hours for:	**Total Period**	650
Total Hours for:	**Total Period**	17544

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

Table 2.3-211 (Sheet 3 of 8) Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008)

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2007 00:00 12/31/2008 23:00

Elevation: **Speed:** SPD60NEW **Direction:** DIR60NEW **Lapse:** DT60NEW

Stability Class C Delta Temperature Slightly Unstable

Wind Speed (m/s)

Wind Direction (from)	0.22-0.50	0.51-0.75	0.76-1.0	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	0	6	19	27	2	0	0	0	0	54
NNE	0	0	0	1	2	18	53	14	8	0	0	0	96
NE	0	0	1	0	2	9	41	16	3	0	0	0	72
ENE	0	0	0	0	3	23	46	13	3	0	0	0	88
E	0	0	0	0	2	7	30	10	1	0	0	0	50
ESE	0	0	0	0	0	4	9	0	0	0	0	0	13
SE	0	0	0	1	2	5	16	1	0	0	0	0	25
SSE	0	0	0	0	2	8	10	3	1	0	0	0	24
S	0	0	0	0	0	11	32	15	1	1	0	0	60
SSW	0	0	0	0	3	14	44	24	4	0	0	0	89
SW	0	0	0	0	2	15	29	21	6	0	0	0	73
WSW	0	0	0	1	11	25	51	34	28	8	0	0	158
W	0	0	0	3	10	16	36	33	18	10	3	0	129
WNW	0	0	0	4	5	22	24	10	6	0	0	0	71
NW	0	0	0	2	5	15	18	8	9	1	0	0	58
NNW	0	0	1	2	1	19	19	7	10	1	0	0	60
Totals	0	0	2	14	56	230	485	211	98	21	3	0	1120

Number of Calm Hours not included above for:	**Total Period**	1
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	137
Number of Valid Hours for:	**Total Period**	1120
Total Hours for:	**Total Period**	17544

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

Table 2.3-211 (Sheet 4 of 8) Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008)

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2007 00:00 12/31/2008 23:00

Elevation: **Speed:** SPD60NEW **Direction:** DIR60NEW **Lapse:** DT60NEW

Stability Class D Delta Temperature Neutral

Wind Speed (m/s)

Wind Direction (from)	0.22-0.50	0.51-0.75	0.76-1.0	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	7	19	23	41	38	26	22	1	0	0	180
NNE	0	2	5	11	16	56	79	136	55	4	1	0	365
NE	0	2	3	19	24	59	192	154	21	0	0	0	474
ENE	0	3	6	15	28	74	221	98	12	0	0	0	457
E	0	2	3	17	30	66	122	37	3	0	0	0	280
ESE	0	2	5	13	14	69	105	21	5	0	0	0	234
SE	0	1	4	12	15	52	89	20	3	0	0	0	196
SSE	0	3	2	11	20	58	92	40	9	0	0	0	235
S	0	1	1	19	22	70	130	69	30	3	0	0	345
SSW	0	1	7	13	45	99	139	92	21	4	0	0	421
SW	0	1	6	14	37	106	158	123	46	3	0	0	494
WSW	0	0	4	32	85	109	171	128	84	16	4	0	633
W	0	3	7	35	77	89	130	93	79	35	2	0	550
WNW	0	0	9	40	49	95	94	38	20	2	0	0	347
NW	1	7	11	47	56	62	51	21	17	1	0	0	274
NNW	0	0	7	23	31	68	71	28	32	2	0	0	262
Totals	1	31	87	340	572	1173	1882	1124	459	71	7	0	5747

Number of Calm Hours not included above for:	**Total Period**	1
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	137
Number of Valid Hours for:	**Total Period**	5747
Total Hours for:	**Total Period**	17544

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

Table 2.3-211 (Sheet 5 of 8) Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008)

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2007 00:00 12/31/2008 23:00

Elevation: **Speed:** SPD60NEW **Direction:** DIR60NEW **Lapse:** DT60NEW

Stability Class E Delta Temperature Slightly Stable

Wind Speed (m/s)

Wind Direction (from)	0.22-0.50	0.51-0.75	0.76-1.0	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	1	3	6	5	17	64	80	15	0	0	0	192
NNE	0	1	0	12	10	20	56	100	36	1	0	0	236
NE	1	1	2	10	7	30	134	125	65	0	0	0	375
ENE	0	2	1	9	7	32	136	129	14	0	0	0	330
E	0	0	5	5	6	29	118	64	2	0	0	0	229
ESE	0	0	2	6	4	28	109	76	13	1	0	0	239
SE	0	1	3	3	4	27	128	98	12	0	2	1	279
SSE	0	2	2	7	12	29	82	114	23	0	0	0	271
S	1	1	4	7	10	43	203	191	41	2	0	0	503
SSW	0	3	3	9	7	60	234	172	41	2	0	0	531
SW	0	1	1	8	14	74	262	158	47	2	0	0	567
WSW	0	3	6	7	14	64	284	215	69	1	0	0	663
W	1	3	3	12	12	58	216	161	109	4	0	0	579
WNW	1	4	3	16	12	50	110	39	10	0	0	0	245
NW	0	0	3	11	23	49	66	37	6	0	0	0	195
NNW	0	1	2	11	15	36	97	84	34	0	0	0	280
Totals	5	24	43	139	162	646	2299	1843	537	13	2	1	5714

Number of Calm Hours not included above for:	**Total Period**	1
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	137
Number of Valid Hours for:	**Total Period**	5714
Total Hours for:	**Total Period**	17544

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

Table 2.3-211 (Sheet 6 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008)

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2007 00:00 12/31/2008 23:00

Elevation: **Speed:** SPD60NEW **Direction:** DIR60NEW **Lapse:** DT60NEW

Stability Class F Delta Temperature Moderately Stable

Wind Speed (m/s)

Wind Direction (from)	0.22-0.50	0.51-0.75	0.76-1.0	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	2	1	4	3	13	45	21	2	0	0	0	91
NNE	1	1	2	4	3	14	38	8	1	0	0	0	72
NE	1	2	2	1	6	28	20	12	1	0	0	0	73
ENE	1	0	0	2	6	18	40	69	31	0	0	0	167
E	1	0	2	5	6	14	50	72	13	0	0	0	163
ESE	1	0	1	4	5	13	46	52	7	0	0	0	129
SE	0	1	1	8	4	16	56	57	6	0	0	0	149
SSE	0	1	1	5	9	17	62	77	11	0	0	0	183
S	1	1	3	3	10	26	71	81	9	0	0	0	205
SSW	0	1	1	6	5	30	97	95	8	0	0	0	243
SW	0	0	2	5	12	13	94	101	7	0	0	0	234
WSW	1	0	3	6	3	24	90	93	6	0	0	0	226
W	0	0	3	6	9	22	63	66	6	0	0	0	175
WNW	0	0	1	1	6	35	35	11	0	0	0	0	89
NW	1	2	1	3	3	20	28	10	0	0	0	0	68
NNW	0	0	2	7	5	11	49	28	1	0	0	0	103
Totals	8	11	26	70	95	314	884	853	109	0	0	0	2370

Number of Calm Hours not included above for:	**Total Period**	1
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	137
Number of Valid Hours for:	**Total Period**	2370
Total Hours for:	**Total Period**	17544

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

Table 2.3-211 (Sheet 7 of 8) Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008)

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2007 00:00 12/31/2008 23:00

Elevation: **Speed:** SPD60NEW **Direction:** DIR60NEW **Lapse:** DT60NEW

Stability Class G Delta Temperature Extremely Stable

Wind Speed (m/s)

Wind Direction (from)	0.22-0.50	0.51-0.75	0.76-1.0	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	1	3	7	12	40	17	1	0	0	0	85
NNE	0	1	0	3	7	28	54	11	0	0	0	0	104
NE	1	1	1	2	5	34	41	12	0	0	0	0	97
ENE	0	2	1	6	9	24	28	8	0	0	0	0	78
E	0	1	1	3	4	13	19	22	7	0	0	0	70
ESE	0	0	2	3	3	9	28	14	0	0	0	0	59
SE	1	0	0	1	6	2	28	11	1	0	0	0	50
SSE	0	0	0	2	6	12	35	25	2	0	0	0	82
S	0	2	1	3	9	15	54	26	0	0	0	0	110
SSW	0	0	3	4	5	23	48	27	0	0	0	0	110
SW	1	1	1	5	6	18	44	32	3	0	0	0	111
WSW	0	3	0	5	8	27	48	34	0	0	0	0	125
W	0	1	1	3	9	22	35	17	1	0	0	0	89
WNW	0	0	2	4	6	19	20	3	0	0	0	0	54
NW	0	0	0	2	4	30	21	1	0	0	0	0	58
NNW	0	1	1	4	7	23	37	10	0	0	0	0	83
Totals	4	16	15	53	101	311	580	270	15	0	0	0	1365

Number of Calm Hours not included above for:	**Total Period**	1
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	137
Number of Valid Hours for:	**Total Period**	1365
Total Hours for:	**Total Period**	17544

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

Table 2.3-211 (Sheet 8 of 8) Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008)

Hours at Each Wind Speed and Direction

Summary of All Stability Classes

Total Period

Period of Record = 1/1/2007 00:00 12/31/2008 23:00

Elevation: **Speed:** SPD60NEW **Direction:** DIR60NEW **Lapse:** DT60NEW

Delta Temperature

Wind Speed (m/s)

Wind Direction (from)	0.22-0.50	0.51-0.75	0.76-1.0	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	2	9	12	32	44	111	258	170	45	1	0	0	684
NNE	1	5	7	31	39	153	351	296	125	5	1	0	1014
NE	3	6	9	32	45	170	483	381	103	0	0	0	1232
ENE	1	7	8	32	54	172	530	359	67	0	0	0	1230
E	1	3	11	30	48	134	363	223	29	0	0	0	842
ESE	1	2	10	26	26	124	298	164	26	1	0	0	678
SE	1	3	8	25	31	104	321	190	22	0	2	1	708
SSE	0	6	5	25	49	126	288	260	47	0	0	0	806
S	2	5	9	32	51	168	509	389	81	6	0	0	1252
SSW	0	5	14	32	65	232	577	422	78	6	0	0	1431
SW	1	3	10	32	72	230	605	455	120	5	0	0	1533
WSW	1	6	13	51	122	255	676	543	212	34	4	0	1917
W	1	7	14	60	120	213	503	416	260	56	5	0	1655
WNW	1	4	15	65	83	231	299	112	40	2	0	0	852
NW	2	9	15	66	93	185	199	89	45	7	0	0	710
NNW	0	2	13	47	62	164	296	177	94	7	0	0	862
Totals	18	82	173	618	1004	2772	6556	4646	1394	130	12	1	17406

Number of Calm Hours not included above for:	**Total Period**	1
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	137
Number of Valid Hours for:	**Total Period**	17406
Total Hours for:	**Total Period**	17544

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

Table 2.3-212
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Table 2.3-213
Comparison of Onsite Data with Long-Term Climatological Data: Wind Direction

	Frequency Distribution (%)			
Wind Direction	VCSNS Unit 1 One Year Jan 2007—Dec 2007	VCSNS Unit 1 Onsite Data Three Years (Jul 2003–Jun 2006)	Columbia NWS Ten Years 1951–1960[(a)]	Columbia NWS 20 Years 1956–1975[(a)]
N	5.6	3.8	4.9	6.8
NNE	6.8	5.2	6.5	6.5
NE	8.6	9.0	8.1	7.9
ENE	6.1	6.6	5.3	7.0
E	3.6	4.1	3.7	6.3
ESE	2.9	2.2	3.1	4.4
SE	3.8	2.9	3.1	3.3
SSE	6.1	5.6	3.0	2.6
S	7.6	7.1	4.5	6.3
SSW	9.0	9.0	7.4	6.4
SW	10.3	11.6	10.1	10.7
WSW	10.1	10.5	7.4	9.8
W	8.4	9.2	5.4	8.4
WNW	4.2	4.1	4.7	5.5
NW	3.8	3.4	4.3	4.2
NNW	3.3	2.8	4.1	4.0

(a) Data Source: NCDC 2005

Table 2.3-214
Comparison of Onsite data with Long-term Climatological Data: Seasonal and Annual Mean Wind Speed

Time Period	Distribution of Mean Wind Speed (meters per second)			
	VCSNS Unit 1 Onsite Data Recent One Year (2007)	VCSNS Unit 1 Onsite Data Three Years (Jul 2003–Jun 2006)	Columbia NWS Short-Term (2004)[(a)]	Columbia NWS Long-Term (49 years)[(a)]
Winter (Dec, Jan, Feb)	2.8	3.3	3.0	3.2
Spring (Mar, Apr, May)	3.1	3.3	3.0	3.5
Summer (Jun, Jul, Aug)	2.5	2.9	2.5	2.7
Fall (Sep, Oct, Nov)	3.2	3.5	2.7	2.7
Annual	3.0	3.2	2.8	3.0

Data Sources:

(a) NCDC 2005

Table 2.3-215
Comparison of Onsite Data with Long-Term Climatological Data: VCSNS Unit 1 Annual Percentage by Stability Class (%)

Record Period	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
2007	5.6	7.5	11.1	37.6	23.5	14.6

Table 2.3-216
Meteorological System Accuracies (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] [e]	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 [e]	—	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.
(e) Both precipitation and barometric pressure are collected at the Unit 1 tower.

Table 2.3-217
Annual Data Recovery Rate for VCSNS Units 2 and 3 Meteorological Monitoring System (January 2007–December 2008)

Parameter	Recovery Rate (in Percent)
Wind Speed (10 meters)	99.4
Wind Speed (60 meters)	99.3
Wind Direction (10 meters)	99.4
Wind Direction (60 meters)	99.3
Delta-T (60 meters – 10 meters)[a]	99.4
Ambient Temperature (10 meters)	99.2
Dew Point/Relative Humidity (30-meters)	98.5
Precipitation (ground)[b]	—
Composite Parameters	
WS/WD (10 meters), delta-T (60 meters–10 meters)(a)	99.4
WS/WD (60 meters), delta-T (60 meters–10 meters)(a)	99.2

(a) Temperature difference (delta-T) between 60-meters and 10-meters levels.
(b) Precipitation is measured at the base of the Unit 1 meteorological tower and events confirmed for consistency with Columbia NWS precipitation events.

Table 2.3-218
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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

Dose Evaluation Periphery Calculations — Building Wake Credit Is Not Included. Relative Concentration (X/Q) Values (Sec/Cubic Meter) Versus Averaging Time								
Downwind Sector	**Distance (Meters)**	**0–2 Hours**	**0–8 Hours**	**8–24 Hours**	**1–4 Days**	**4–30 Days**	**Annual Average**	**Hrs Per Year Max 0–2 Hr X/Q Exceeded In Sector**
S	805	1.75E-04	1.15E-04	9.38E-05	5.97E-05	3.13E-05	1.42E-05	10.5
SSW	805	1.22E-04	8.22E-05	6.75E-05	4.41E-05	2.39E-05	1.13E-05	256.0
SW	805	1.40E-04	9.87E-05	8.29E-05	5.68E-05	3.30E-05	1.70E-05	11.9
WSW	805	1.47E-04	1.04E-04	8.75E-05	6.00E-05	3.49E-05	1.80E-05	9.0
W	805	2.07E-04	1.41E-04	1.16E-04	7.64E-05	4.19E-05	2.01E-05	14.6
WNW	805	2.22E-04	1.49E-04	1.22E-04	7.91E-05	4.25E-05	1.99E-05	13.6
NW	805	2.45E-04	1.67E-04	1.38E-04	9.04E-05	4.95E-05	2.37E-05	17.2
NNW	805	2.02E-04	1.41E-04	1.18E-04	8.00E-05	4.57E-05	2.30E-05	13.1
N	805	2.09E-04	1.46E-04	1.22E-04	8.27E-05	4.73E-05	2.38E-05	11.2
NNE	805	2.06E-04	1.43E-04	1.19E-04	8.03E-05	4.56E-05	2.28E-05	15.1
NE	805	1.99E-04	1.39E-04	1.16E-04	7.85E-05	4.48E-05	2.25E-05	16.4
ENE	805	1.92E-04	1.35E-04	1.14E-04	7.80E-05	4.54E-05	2.34E-05	16.8
E	805	1.98E-04	1.37E-04	1.13E-04	7.60E-05	4.28E-05	2.12E-05	15.1
ESE	805	2.39E-04	1.62E-04	1.33E-04	8.69E-05	4.72E-05	2.24E-05	19.9
SE	805	3.57E-04	2.48E-04	2.06E-04	1.39E-04	7.85E-05	3.91E-05	43.7
SSE	805	2.94E-04	2.01E-04	1.67E-04	1.11E-04	6.13E-05	2.98E-05	25.4
MAX X/Q		3.57E-04	Total Hours Entire Site Max 0–2 hr X/Q Exceeded					509.7

Site Limit	2.82E-04	2.03E-04	1.73E-04	1.21E-04	7.28E-05	3.91E-05

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

Low Population Zone Calculations — Building Wake Credit Is Not Included. Relative Concentration (X/Q) Values (Sec/ Cubic Meter) Versus Averaging Time								
Downwind Sector	**Distance (Meters)**	**0–2 Hours**	**0–8 Hours**	**8–24 Hours**	**1–4 Days**	**4–30 Days**	**Annual Average**	**Hrs Per Year Max 0–2 Hr X/Q Exceeded In Sector**
S	3130	4.50E-05	2.26E-05	1.60E-05	7.56E-06	2.58E-06	6.91E-07	15.3
SSW	3057	2.78 E-05	1.46E-05	1.06E-05	5.31E-06	1.96E-06	5.77E-07	7.5
SW	3147	3.76 E-05	2.00E-05	1.45E-05	7.32E-06	2.73E-06	8.18E-07	14.1
WSW	3403	4.09 E-05	2.10E-05	1.51E-05	7.33E-06	2.60E-06	7.33E-07	10.5
W	3823	4.46 E-05	2.22E-05	1.56E-05	7.31E-06	2.46E-06	6.48E-07	10.9
WNW	4378	4.27E-05	2.04E-05	1.41E-05	6.32E-06	2.00E-06	4.89E-07	10.0
NW	5008	4.23E-05	1.99E-05	1.37E-05	6.06E-06	1.88E-06	4.48E-07	8.4
NNW	5595	3.10E-05	1.47E-05	1.02E-05	4.55E-06	1.43E-06	3.48E-07	6.1
N	6005	2.90E-05	1.37E-05	9.42E-06	4.18E-06	1.30E-06	3.12E-07	3.5
NNE	6142	2.92E-05	1.36E-05	9.25E-06	4.03E-06	1.22E-06	2.84E-07	6.2
NE	5972	2.73E-05	1.29E-05	8.88E-06	3.94E-06	1.23E-06	2.95E-07	7.3
ENE	5536	3.03E-05	1.45E-05	1.00E-05	4.52E-06	1.43E-06	3.53E-07	10.1
E	4940	3.23E-05	1.56E-05	1.09E-05	4.94E-06	1.59E-06	3.99E-07	10.0
ESE	4315	4.82E-05	2.31E-05	1.59E-05	7.17E-06	2.27E-06	5.58E-07	15.0
SE	3768	8.97E-05	4.46E-05	3.15E-05	1.48E-05	4.97E-06	1.31E-06	43.7
SSE	3368	7.96E-05	4.01E-05	2.85E-05	1.36E-05	4.67E-06	1.27E-06	32.0
MAX X/Q		8.97E-05	Total Hours Entire Site Max 0–2 hr X/Q Exceeded					210.4

Site Limit	2.82E-04	1.16E-04	7.45E-04	2.84E-04	7.13E-06	1.31E-06

Table 2.3-222
ARCON96 X/Q Values at the Control Room HVAC Intake (sec/m^3)

Release Point and DCD Values[(a)]	0–2 hours	2–8 hours	8–24 hours	1–4 days	4–30 days
Plant Vent	1.90E-03	1.39E-03	4.82E-04	3.52E-04	2.59E-04
DCD	3.00E-03	2.50E-03	1.00E-03	8.00E-04	6.00E-04
PCS Air Diffuser	1.65E-03	1.24E-03	4.71E-04	3.46E-04	2.66E-04
DCD	3.00E-03	2.50E-03	1.00E-03	8.00E-04	6.00E-04
Fuel Building Blowout Panel	1.53E-03	1.13E-03	4.05E-04	3.03E-04	2.28E-04
DCD	6.00E-03	4.00E-03	2.00E-03	1.50E-03	1.00E-03
Radwaste Building Truck Staging Area Door	1.12E-03	8.20E-04	3.10E-04	2.18E-04	1.88E-04
DCD	6.00E-03	4.00E-03	2.00E-03	1.50E-03	1.00E-03
Steam Vent	1.54E-02	1.27E-02	5.54E-03	3.90E-03	3.11E-03
DCD	2.40E-02	2.00E-02	7.50E-03	5.50E-03	5.00E-03
PORV & Safety Valves	1.35E-02	1.10E-02	4.87E-03	3.45E-03	2.64E-03
DCD	2.00E-02	1.80E-02	7.00E-03	5.00E-03	4.50E-03
Condenser Air Removal Stack	1.58E-03	1.20E-03	4.90E-04	3.16E-04	2.65E-04
DCD	6.00E-03	4.00E-03	2.00E-03	1.50E-03	1.00E-03
Containment Shell (As Diffuse Area Source)	2.72E-03	1.66E-03	6.58E-04	5.36E-04	4.10E-04
DCD	6.00E-03	3.60E-03	1.40E-03	1.80E-03	1.50E-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 (sec/m^3)

Release Point and DCD Values[(a)]	0-2 hours	2-8 hours	8-24 hours	1-4 days	4-30 days
Plant Vent	4.15E-04	3.12E-04	1.09E-04	7.97E-05	5.80E-05
DCD	1.00E-03	7.50E-04	3.50E-04	2.80E-04	2.50E-04
PCS Air Diffuser	4.25E-04	3.16E-04	1.11E-04	8.22E-05	6.24E-05
DCD	1.00E-03	7.50E-04	3.50E-04	2.80E-04	2.50E-04
Fuel Building Blowout Panel	3.81E-04	2.93E-04	1.01E-04	7.78E-05	6.20E-05
DCD	6.00E-03	4.00E-03	2.00E-03	1.50E-03	1.00E-03
Radwaste Building Truck Staging Area Door	3.46E-04	2.64E-04	9.18E-05	7.10E-05	5.52E-05
DCD	6.00E-03	4.00E-03	2.00E-03	1.50E-03	1.00E-03
Steam Vent	9.47E-04	7.44E-04	2.48E-04	2.01E-04	1.52E-04
DCD	4.00E-03	3.20E-03	1.20E-03	1.00E-03	8.00E-04
PORV & Safety Valves	9.97E-04	7.78E-04	2.62E-04	2.10E-04	1.56E-04
DCD	4.00E-03	3.20E-03	1.20E-03	1.00E-03	8.00E-04
Condenser Air Removal Stack	3.89E-03	3.09E-03	1.18E-03	9.11E-04	6.92E-04
DCD	2.00E-02	1.80E-02	7.00E-03	5.00E-03	4.50E-03
Containment Shell (As Diffuse Area Source)	3.94E-04	3.21E-04	1.10E-04	8.43E-05	6.78E-05
DCD	1.00E-03	7.50E-04	3.50E-04	2.80E-04	2.50E-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	6756	—	7260	7718	805	—
NNE	9313	—	5981	6480	805	—
NE	3429	—	3429	3703	805	—
ENE	—	—	2094	2647	805	—
E	—	—	1978	1978	805	—
ESE	—	—	—	—	805	—
SE	—	—	2704	2704	805	—
SSE	—	—	—	—	805	—
S	6403	—	4099	4099	805	274
SSW	5793	—	3234	4296	805	274
SW	—	—	3719	3719	805	274
WSW	6570	—	—	6570	805	—
W	7396	7396	3540	—	805	—
WNW	2795	—	3597	3973	805	—
NW	6659	6659	6801	7556	805	—
NNW	5664	—	5664	5664	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	SE	1.68	8.70E-07
Meat Animal	WNW	1.74	4.60E-07
Milk Animal	NW	4.14	1.70E-07
Vegetable Garden	SE	1.68	8.70E-07
Dose Evaluation Periphery	SE	0.50	5.80E-06
Unit 3 Reactor	SW	0.17	1.70E-05

Type of Sensitive Receptor Location	Direction from Site	Distance (miles)	X/Q (sec/m^3) (2.26-Day Decay)
Residence	SE	1.68	8.60E-07
Meat Animal	WNW	1.74	4.50E-07
Milk Animal	NW	4.14	1.70E-07
Vegetable Garden	SE	1.68	8.60E-07
Dose Evaluation Periphery	SE	0.50	5.80E-06
Unit 3 Reactor	SW	0.17	1.70E-05

Type of Sensitive Receptor Location	Direction from Site	Distance (miles)	X/Q (sec/m^3) (8-Day Decay)
Residence	SE	1.68	7.30E-07
Meat Animal	WNW	1.74	3.80E-07
Milk Animal	NW	4.14	1.30E-07
Vegetable Garden	SE	1.68	7.30E-07
Dose Evaluation Periphery	SE	0.50	5.30E-06
Unit 3 Reactor	SW	0.17	1.60E-05

Type of Sensitive Receptor Location	Direction from Site	Distance (miles)	D/Q (1/m^3)
Residence	ENE	1.30	3.30E-09
Meat Animal	NE	2.13	1.40E-09
Milk Animal	NW	4.14	2.70E-10
Vegetable Garden	E	1.23	3.10E-09
Dose Evaluation Periphery	ENE,NE	0.50	1.60E-08
Unit 3 Reactor	SW	0.17	6.50E-08

Table 2.3-226 (Sheet 1 of 12)
XOQDOQ-Predicted Maximum Annual Average X/Q and D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

RELEASE POINT - GROUND LEVEL - NO INTERMITTENT RELEASES

NO DECAY, UNDEPLETED

ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	.250	.500	.750	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500
S	7.137E-06	2.162E-06	1.127E-06	7.256E-07	4.054E-07	2.692E-07	1.968E-07	1.540E-07	1.252E-07	1.046E-07	8.937E-08
SSW	5.698E-06	1.762E-06	9.458E-07	6.166E-07	3.448E-07	2.282E-07	1.660E-07	1.287E-07	1.038E-07	8.614E-08	7.312E-08
SW	8.492E-06	2.615E-06	1.397E-06	9.098E-07	5.114E-07	3.398E-07	2.480E-07	1.927E-07	1.558E-07	1.296E-07	1.102E-07
WSW	8.964E-06	2.746E-06	1.452E-06	9.400E-07	5.322E-07	3.555E-07	2.604E-07	2.029E-07	1.644E-07	1.370E-07	1.167E-07
W	9.995E-06	3.018E-06	1.565E-06	1.005E-06	5.729E-07	3.852E-07	2.838E-07	2.228E-07	1.815E-07	1.520E-07	1.300E-07
WNW	9.834E-06	2.950E-06	1.527E-06	9.820E-07	5.577E-07	3.745E-07	2.761E-07	2.174E-07	1.776E-07	1.491E-07	1.278E-07
NW	1.172E-05	3.495E-06	1.797E-06	1.153E-06	6.554E-07	4.409E-07	3.256E-07	2.570E-07	2.104E-07	1.769E-07	1.518E-07
NNW	1.136E-05	3.409E-06	1.782E-06	1.152E-06	6.587E-07	4.436E-07	3.273E-07	2.571E-07	2.097E-07	1.757E-07	1.504E-07
N	1.176E-05	3.549E-06	1.871E-06	1.214E-06	6.925E-07	4.653E-07	3.425E-07	2.683E-07	2.183E-07	1.825E-07	1.560E-07
NNE	1.130E-05	3.430E-06	1.805E-06	1.169E-06	6.612E-07	4.420E-07	3.244E-07	2.538E-07	2.063E-07	1.725E-07	1.473E-07
NE	1.118E-05	3.412E-06	1.807E-06	1.174E-06	6.624E-07	4.419E-07	3.237E-07	2.527E-07	2.051E-07	1.711E-07	1.459E-07
ENE	1.167E-05	3.569E-06	1.889E-06	1.225E-06	6.883E-07	4.579E-07	3.348E-07	2.612E-07	2.118E-07	1.767E-07	1.506E-07
E	1.054E-05	3.224E-06	1.708E-06	1.108E-06	6.232E-07	4.147E-07	3.032E-07	2.365E-07	1.918E-07	1.600E-07	1.363E-07
ESE	1.115E-05	3.397E-06	1.781E-06	1.150E-06	6.452E-07	4.294E-07	3.144E-07	2.460E-07	1.999E-07	1.671E-07	1.427E-07
SE	1.953E-05	5.790E-06	2.904E-06	1.841E-06	1.019E-06	6.767E-07	4.977E-07	3.956E-07	3.258E-07	2.754E-07	2.375E-07
SSE	1.488E-05	4.417E-06	2.238E-06	1.427E-06	7.946E-07	5.291E-07	3.893E-07	3.085E-07	2.535E-07	2.139E-07	1.841E-07

Table 2.3-226 (Sheet 2 of 12)
XOQDOQ-Predicted Maximum Annual Average X/Q and D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

NO DECAY, UNDEPLETED

ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	5.000	7.500	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	50.000
S	7.765E-08	4.537E-08	3.107E-08	1.832E-08	1.265E-08	9.502E-09	7.532E-09	6.193E-09	5.230E-09	4.507E-09	3.947E-09
SSW	6.318E-08	3.614E-08	2.439E-08	1.408E-08	9.576E-09	7.115E-09	5.588E-09	4.559E-09	3.825E-09	3.277E-09	2.855E-09
SW	9.535E-08	5.482E-08	3.711E-08	2.151E-08	1.467E-08	1.092E-08	8.585E-09	7.012E-09	5.888E-09	5.049E-09	4.402E-09
WSW	1.012E-07	5.847E-08	3.972E-08	2.314E-08	1.583E-08	1.181E-08	9.305E-09	7.613E-09	6.401E-09	5.495E-09	4.796E-09
W	1.131E-07	6.628E-08	4.545E-08	2.680E-08	1.848E-08	1.387E-08	1.099E-08	9.023E-09	7.613E-09	6.555E-09	5.736E-09
WNW	1.114E-07	6.567E-08	4.523E-08	2.683E-08	1.857E-08	1.398E-08	1.109E-08	9.127E-09	7.713E-09	6.651E-09	5.828E-09
NW	1.325E-07	7.848E-08	5.423E-08	3.230E-08	2.242E-08	1.691E-08	1.345E-08	1.108E-08	9.376E-09	8.093E-09	7.098E-09
NNW	1.309E-07	7.674E-08	5.265E-08	3.105E-08	2.141E-08	1.606E-08	1.271E-08	1.044E-08	8.804E-09	7.579E-09	6.630E-09
N	1.355E-07	7.903E-08	5.402E-08	3.171E-08	2.179E-08	1.631E-08	1.289E-08	1.056E-08	8.898E-09	7.651E-09	6.686E-09
NNE	1.279E-07	7.453E-08	5.092E-08	2.989E-08	2.055E-08	1.539E-08	1.217E-08	9.978E-09	8.408E-09	7.233E-09	6.323E-09
NE	1.266E-07	7.344E-08	5.003E-08	2.925E-08	2.006E-08	1.499E-08	1.183E-08	9.691E-09	8.157E-09	7.010E-09	6.123E-09
ENE	1.306E-07	7.568E-08	5.153E-08	3.012E-08	2.066E-08	1.545E-08	1.219E-08	9.990E-09	8.411E-09	7.230E-09	6.317E-09
E	1.182E-07	6.850E-08	4.662E-08	2.723E-08	1.867E-08	1.395E-08	1.101E-08	9.020E-09	7.592E-09	6.525E-09	5.700E-09
ESE	1.240E-07	7.232E-08	4.946E-08	2.908E-08	2.003E-08	1.502E-08	1.189E-08	9.762E-09	8.234E-09	7.089E-09	6.203E-09
SE	2.082E-07	1.254E-07	8.773E-08	5.318E-08	3.738E-08	2.847E-08	2.281E-08	1.892E-08	1.610E-08	1.397E-08	1.231E-08
SSE	1.611E-07	9.646E-08	6.718E-08	4.049E-08	2.835E-08	2.153E-08	1.720E-08	1.424E-08	1.210E-08	1.048E-08	9.222E-09

Table 2.3-226 (Sheet 3 of 12)
XOQDOQ-Predicted Maximum Annual Average X/Q and D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

RELEASE POINT - GROUND LEVEL - NO INTERMITTENT RELEASES

NO DECAY, UNDEPLETED

CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT

	SEGMENT BOUNDARIES IN MILES FROM THE SITE									
DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	1.179E-06	4.160E-07	1.990E-07	1.256E-07	8.955E-08	4.619E-08	1.863E-08	9.552E-09	6.208E-09	4.514E-09
SSW	9.808E-07	3.534E-07	1.677E-07	1.042E-07	7.330E-08	3.693E-08	1.437E-08	7.160E-09	4.573E-09	3.283E-09
SW	1.451E-06	5.237E-07	2.504E-07	1.563E-07	1.104E-07	5.596E-08	2.194E-08	1.098E-08	7.033E-09	5.058E-09
WSW	1.512E-06	5.443E-07	2.628E-07	1.650E-07	1.170E-07	5.963E-08	2.357E-08	1.188E-08	7.635E-09	5.504E-09
W	1.639E-06	5.855E-07	2.864E-07	1.821E-07	1.303E-07	6.743E-08	2.725E-08	1.395E-08	9.046E-09	6.565E-09
WNW	1.601E-06	5.706E-07	2.789E-07	1.781E-07	1.280E-07	6.674E-08	2.725E-08	1.405E-08	9.150E-09	6.661E-09
NW	1.888E-06	6.706E-07	3.289E-07	2.109E-07	1.521E-07	7.970E-08	3.278E-08	1.700E-08	1.111E-08	8.104E-09
NNW	1.863E-06	6.727E-07	3.303E-07	2.103E-07	1.507E-07	7.806E-08	3.156E-08	1.615E-08	1.047E-08	7.591E-09
N	1.952E-06	7.074E-07	3.456E-07	2.190E-07	1.563E-07	8.046E-08	3.226E-08	1.640E-08	1.059E-08	7.663E-09
NNE	1.884E-06	6.767E-07	3.275E-07	2.070E-07	1.476E-07	7.590E-08	3.041E-08	1.548E-08	1.001E-08	7.244E-09
NE	1.882E-06	6.781E-07	3.268E-07	2.057E-07	1.462E-07	7.485E-08	2.978E-08	1.508E-08	9.718E-09	7.022E-09
ENE	1.967E-06	7.052E-07	3.382E-07	2.125E-07	1.509E-07	7.715E-08	3.067E-08	1.553E-08	1.002E-08	7.242E-09
E	1.778E-06	6.383E-07	3.063E-07	1.924E-07	1.366E-07	6.983E-08	2.774E-08	1.403E-08	9.045E-09	6.536E-09
ESE	1.859E-06	6.615E-07	3.177E-07	2.006E-07	1.430E-07	7.364E-08	2.959E-08	1.510E-08	9.787E-09	7.100E-09
SE	3.073E-06	1.050E-06	5.046E-07	3.265E-07	2.379E-07	1.271E-07	5.383E-08	2.858E-08	1.896E-08	1.399E-08
SSE	2.362E-06	8.171E-07	3.943E-07	2.541E-07	1.844E-07	9.780E-08	4.102E-08	2.162E-08	1.427E-08	1.049E-08

Table 2.3-226 (Sheet 4 of 12)
XOQDOQ-Predicted Maximum Annual Average X/Q and D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

RELEASE POINT - GROUND LEVEL - NO INTERMITTENT RELEASES

2.260 DAY DECAY, UNDEPLETED

ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	.250	.500	.750	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500
S	7.127E-06	2.156E-06	1.123E-06	7.219E-07	4.023E-07	2.665E-07	1.943E-07	1.516E-07	1.229E-07	1.025E-07	8.727E-08
SSW	5.691E-06	1.757E-06	9.424E-07	6.137E-07	3.424E-07	2.261E-07	1.640E-07	1.268E-07	1.020E-07	8.446E-08	7.151E-08
SW	8.481E-06	2.608E-06	1.392E-06	9.054E-07	5.077E-07	3.366E-07	2.450E-07	1.899E-07	1.531E-07	1.270E-07	1.077E-07
WSW	8.953E-06	2.739E-06	1.447E-06	9.355E-07	5.284E-07	3.521E-07	2.573E-07	2.000E-07	1.617E-07	1.344E-07	1.142E-07
W	9.982E-06	3.010E-06	1.559E-06	9.998E-07	5.684E-07	3.812E-07	2.801E-07	2.193E-07	1.782E-07	1.488E-07	1.270E-07
WNW	9.821E-06	2.942E-06	1.521E-06	9.769E-07	5.534E-07	3.707E-07	2.726E-07	2.140E-07	1.744E-07	1.460E-07	1.248E-07
NW	1.171E-05	3.486E-06	1.790E-06	1.147E-06	6.506E-07	4.365E-07	3.216E-07	2.531E-07	2.067E-07	1.734E-07	1.484E-07
NNW	1.134E-05	3.401E-06	1.775E-06	1.146E-06	6.540E-07	4.395E-07	3.235E-07	2.535E-07	2.062E-07	1.724E-07	1.472E-07
N	1.175E-05	3.540E-06	1.864E-06	1.208E-06	6.876E-07	4.609E-07	3.385E-07	2.645E-07	2.147E-07	1.791E-07	1.527E-07
NNE	1.128E-05	3.421E-06	1.798E-06	1.163E-06	6.563E-07	4.376E-07	3.203E-07	2.500E-07	2.026E-07	1.689E-07	1.439E-07
NE	1.117E-05	3.403E-06	1.801E-06	1.168E-06	6.575E-07	4.375E-07	3.196E-07	2.489E-07	2.014E-07	1.676E-07	1.425E-07
ENE	1.165E-05	3.559E-06	1.881E-06	1.219E-06	6.830E-07	4.532E-07	3.305E-07	2.571E-07	2.079E-07	1.729E-07	1.470E-07
E	1.053E-05	3.215E-06	1.701E-06	1.103E-06	6.183E-07	4.104E-07	2.993E-07	2.328E-07	1.882E-07	1.566E-07	1.331E-07
ESE	1.114E-05	3.388E-06	1.774E-06	1.144E-06	6.402E-07	4.249E-07	3.103E-07	2.421E-07	1.962E-07	1.636E-07	1.393E-07
SE	1.950E-05	5.773E-06	2.892E-06	1.831E-06	1.010E-06	6.692E-07	4.908E-07	3.890E-07	3.194E-07	2.693E-07	2.316E-07
SSE	1.486E-05	4.406E-06	2.230E-06	1.419E-06	7.885E-07	5.238E-07	3.844E-07	3.038E-07	2.489E-07	2.095E-07	1.799E-07

Table 2.3-226 (Sheet 5 of 12)
XOQDOQ-Predicted Maximum Annual Average X/Q and D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

2.260 DAY DECAY, UNDEPLETED

ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	5.000	7.500	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	50.000
S	7.562E-08	4.358E-08	2.944E-08	1.688E-08	1.134E-08	8.291E-09	6.396E-09	5.118E-09	4.208E-09	3.531E-09	3.012E-09
SSW	6.164E-08	3.480E-08	2.318E-08	1.303E-08	8.635E-09	6.250E-09	4.782E-09	3.802E-09	3.109E-09	2.597E-09	2.206E-09
SW	9.296E-08	5.273E-08	3.521E-08	1.985E-08	1.316E-08	9.527E-09	7.287E-09	5.790E-09	4.730E-09	3.947E-09	3.350E-09
WSW	9.872E-08	5.634E-08	3.779E-08	2.145E-08	1.430E-08	1.040E-08	7.992E-09	6.375E-09	5.228E-09	4.378E-09	3.727E-09
W	1.101E-07	6.366E-08	4.306E-08	2.471E-08	1.658E-08	1.211E-08	9.336E-09	7.466E-09	6.135E-09	5.146E-09	4.387E-09
WNW	1.085E-07	6.310E-08	4.288E-08	2.476E-08	1.668E-08	1.223E-08	9.449E-09	7.575E-09	6.237E-09	5.241E-09	4.476E-09
NW	1.292E-07	7.554E-08	5.152E-08	2.991E-08	2.024E-08	1.488E-08	1.153E-08	9.269E-09	7.649E-09	6.442E-09	5.513E-09
NNW	1.278E-07	7.400E-08	5.014E-08	2.885E-08	1.940E-08	1.420E-08	1.097E-08	8.789E-09	7.236E-09	6.082E-09	5.196E-09
N	1.323E-07	7.623E-08	5.146E-08	2.948E-08	1.977E-08	1.444E-08	1.113E-08	8.911E-09	7.328E-09	6.153E-09	5.252E-09
NNE	1.246E-07	7.161E-08	4.826E-08	2.755E-08	1.842E-08	1.342E-08	1.032E-08	8.238E-09	6.757E-09	5.659E-09	4.818E-09
NE	1.233E-07	7.053E-08	4.737E-08	2.691E-08	1.793E-08	1.303E-08	9.995E-09	7.961E-09	6.517E-09	5.448E-09	4.631E-09
ENE	1.271E-07	7.259E-08	4.870E-08	2.763E-08	1.840E-08	1.335E-08	1.024E-08	8.145E-09	6.661E-09	5.564E-09	4.724E-09
E	1.151E-07	6.571E-08	4.408E-08	2.501E-08	1.665E-08	1.209E-08	9.263E-09	7.371E-09	6.029E-09	5.035E-09	4.276E-09
ESE	1.207E-07	6.942E-08	4.681E-08	2.676E-08	1.791E-08	1.306E-08	1.005E-08	8.023E-09	6.580E-09	5.509E-09	4.688E-09
SE	2.023E-07	1.202E-07	8.283E-08	4.877E-08	3.330E-08	2.465E-08	1.919E-08	1.547E-08	1.280E-08	1.080E-08	9.247E-09
SSE	1.569E-07	9.274E-08	6.374E-08	3.741E-08	2.550E-08	1.887E-08	1.469E-08	1.185E-08	9.812E-09	8.286E-09	7.107E-09

Table 2.3-226 (Sheet 6 of 12)
XOQDOQ-Predicted Maximum Annual Average X/Q and D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

RELEASE POINT - GROUND LEVEL - NO INTERMITTENT RELEASES

2.260 DAY DECAY, UNDEPLETED

CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT

DIRECTION FROM SITE	SEGMENT BOUNDARIES IN MILES FROM THE SITE									
	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	1.174E-06	4.130E-07	1.965E-07	1.233E-07	8.746E-08	4.442E-08	1.721E-08	8.346E-09	5.136E-09	3.539E-09
SSW	9.774E-07	3.510E-07	1.657E-07	1.024E-07	7.169E-08	3.560E-08	1.333E-08	6.299E-09	3.818E-09	2.604E-09
SW	1.446E-06	5.200E-07	2.474E-07	1.537E-07	1.080E-07	5.388E-08	2.029E-08	9.601E-09	5.814E-09	3.958E-09
WSW	1.507E-06	5.405E-07	2.597E-07	1.622E-07	1.145E-07	5.751E-08	2.191E-08	1.048E-08	6.400E-09	4.388E-09
W	1.633E-06	5.811E-07	2.827E-07	1.787E-07	1.272E-07	6.483E-08	2.517E-08	1.219E-08	7.493E-09	5.158E-09
WNW	1.595E-06	5.663E-07	2.753E-07	1.749E-07	1.250E-07	6.420E-08	2.520E-08	1.230E-08	7.601E-09	5.253E-09
NW	1.881E-06	6.658E-07	3.249E-07	2.073E-07	1.487E-07	7.678E-08	3.041E-08	1.497E-08	9.299E-09	6.456E-09
NNW	1.857E-06	6.681E-07	3.264E-07	2.068E-07	1.475E-07	7.534E-08	2.938E-08	1.429E-08	8.820E-09	6.096E-09
N	1.945E-06	7.026E-07	3.416E-07	2.154E-07	1.530E-07	7.768E-08	3.005E-08	1.454E-08	8.943E-09	6.168E-09
NNE	1.877E-06	6.717E-07	3.235E-07	2.033E-07	1.442E-07	7.301E-08	2.809E-08	1.351E-08	8.269E-09	5.673E-09
NE	1.875E-06	6.731E-07	3.227E-07	2.021E-07	1.428E-07	7.197E-08	2.747E-08	1.312E-08	7.992E-09	5.462E-09
ENE	1.960E-06	6.999E-07	3.338E-07	2.086E-07	1.473E-07	7.408E-08	2.821E-08	1.345E-08	8.177E-09	5.578E-09
E	1.772E-06	6.335E-07	3.023E-07	1.889E-07	1.334E-07	6.707E-08	2.553E-08	1.217E-08	7.401E-09	5.048E-09
ESE	1.852E-06	6.565E-07	3.136E-07	1.969E-07	1.396E-07	7.076E-08	2.728E-08	1.315E-08	8.052E-09	5.522E-09
SE	3.061E-06	1.041E-06	4.977E-07	3.202E-07	2.319E-07	1.218E-07	4.947E-08	2.477E-08	1.552E-08	1.082E-08
SSE	2.353E-06	8.111E-07	3.893E-07	2.496E-07	1.801E-07	9.412E-08	3.797E-08	1.897E-08	1.189E-08	8.301E-09

Table 2.3-226 (Sheet 7 of 12)
XOQDOQ-Predicted Maximum Annual Average X/Q and D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

RELEASE POINT - GROUND LEVEL - NO INTERMITTENT RELEASES

8.000 DAY DECAY, DEPLETED

ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	.250	.500	.750	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500
S	6.752E-06	1.973E-06	1.003E-06	6.343E-07	3.436E-07	2.223E-07	1.589E-07	1.218E-07	9.716E-08	7.984E-08	6.712E-08
SSW	5.391E-06	1.608E-06	8.420E-07	5.390E-07	2.923E-07	1.885E-07	1.340E-07	1.018E-07	8.057E-08	6.576E-08	5.494E-08
SW	8.034E-06	2.386E-06	1.244E-06	7.953E-07	4.335E-07	2.806E-07	2.002E-07	1.524E-07	1.209E-07	9.890E-08	8.277E-08
WSW	8.480E-06	2.506E-06	1.293E-06	8.217E-07	4.511E-07	2.935E-07	2.102E-07	1.605E-07	1.277E-07	1.046E-07	8.772E-08
W	9.456E-06	2.754E-06	1.393E-06	8.784E-07	4.855E-07	3.180E-07	2.291E-07	1.761E-07	1.409E-07	1.160E-07	9.766E-08
WNW	9.303E-06	2.692E-06	1.359E-06	8.583E-07	4.726E-07	3.092E-07	2.229E-07	1.719E-07	1.379E-07	1.138E-07	9.599E-08
NW	1.109E-05	3.189E-06	1.600E-06	1.008E-06	5.555E-07	3.640E-07	2.628E-07	2.032E-07	1.633E-07	1.350E-07	1.141E-07
NNW	1.074E-05	3.111E-06	1.586E-06	1.007E-06	5.583E-07	3.664E-07	2.643E-07	2.034E-07	1.628E-07	1.342E-07	1.130E-07
N	1.113E-05	3.239E-06	1.665E-06	1.061E-06	5.869E-07	3.843E-07	2.765E-07	2.123E-07	1.695E-07	1.394E-07	1.172E-07
NNE	1.069E-05	3.130E-06	1.607E-06	1.022E-06	5.604E-07	3.650E-07	2.618E-07	2.008E-07	1.602E-07	1.316E-07	1.106E-07
NE	1.058E-05	3.113E-06	1.609E-06	1.026E-06	5.614E-07	3.649E-07	2.612E-07	1.999E-07	1.592E-07	1.306E-07	1.096E-07
ENE	1.104E-05	3.256E-06	1.681E-06	1.071E-06	5.833E-07	3.780E-07	2.702E-07	2.065E-07	1.644E-07	1.348E-07	1.131E-07
E	9.973E-06	2.942E-06	1.520E-06	9.687E-07	5.281E-07	3.424E-07	2.447E-07	1.870E-07	1.489E-07	1.220E-07	1.024E-07
ESE	1.055E-05	3.100E-06	1.585E-06	1.005E-06	5.468E-07	3.545E-07	2.537E-07	1.945E-07	1.552E-07	1.275E-07	1.072E-07
SE	1.847E-05	5.283E-06	2.585E-06	1.609E-06	8.633E-07	5.586E-07	4.016E-07	3.127E-07	2.528E-07	2.101E-07	1.783E-07
SSE	1.408E-05	4.031E-06	1.993E-06	1.247E-06	6.734E-07	4.369E-07	3.142E-07	2.440E-07	1.968E-07	1.632E-07	1.383E-07

Table 2.3-226 (Sheet 8 of 12)
XOQDOQ-Predicted Maximum Annual Average X/Q and D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

8.000 DAY DECAY, DEPLETED

ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	5.000	7.500	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	50.000
S	5.745E-08	3.162E-08	2.056E-08	1.113E-08	7.158E-09	5.056E-09	3.789E-09	2.958E-09	2.380E-09	1.960E-09	1.643E-09
SSW	4.677E-08	2.521E-08	1.615E-08	8.562E-09	5.428E-09	3.792E-09	2.817E-09	2.183E-09	1.746E-09	1.429E-09	1.192E-09
SW	7.056E-08	3.822E-08	2.456E-08	1.307E-08	8.303E-09	5.807E-09	4.317E-09	3.347E-09	2.677E-09	2.192E-09	1.829E-09
WSW	7.489E-08	4.079E-08	2.631E-08	1.408E-08	8.979E-09	6.301E-09	4.697E-09	3.651E-09	2.926E-09	2.401E-09	2.007E-09
W	8.369E-08	4.619E-08	3.007E-08	1.628E-08	1.046E-08	7.382E-09	5.527E-09	4.312E-09	3.466E-09	2.851E-09	2.389E-09
WNW	8.240E-08	4.577E-08	2.993E-08	1.630E-08	1.052E-08	7.441E-09	5.585E-09	4.365E-09	3.516E-09	2.897E-09	2.430E-09
NW	9.804E-08	5.473E-08	3.590E-08	1.965E-08	1.271E-08	9.020E-09	6.783E-09	5.311E-09	4.284E-09	3.535E-09	2.969E-09
NNW	9.688E-08	5.354E-08	3.488E-08	1.891E-08	1.215E-08	8.576E-09	6.423E-09	5.012E-09	4.031E-09	3.317E-09	2.780E-09
N	1.003E-07	5.514E-08	3.579E-08	1.931E-08	1.237E-08	8.715E-09	6.516E-09	5.077E-09	4.078E-09	3.353E-09	2.807E-09
NNE	9.465E-08	5.195E-08	3.369E-08	1.816E-08	1.163E-08	8.185E-09	6.116E-09	4.763E-09	3.824E-09	3.141E-09	2.628E-09
NE	9.367E-08	5.118E-08	3.309E-08	1.776E-08	1.134E-08	7.964E-09	5.939E-09	4.618E-09	3.701E-09	3.037E-09	2.538E-09
ENE	9.660E-08	5.272E-08	3.407E-08	1.827E-08	1.167E-08	8.193E-09	6.110E-09	4.750E-09	3.807E-09	3.123E-09	2.610E-09
E	8.745E-08	4.772E-08	3.083E-08	1.653E-08	1.055E-08	7.407E-09	5.523E-09	4.294E-09	3.441E-09	2.823E-09	2.359E-09
ESE	9.172E-08	5.039E-08	3.271E-08	1.766E-08	1.133E-08	7.987E-09	5.975E-09	4.658E-09	3.743E-09	3.078E-09	2.578E-09
SE	1.539E-07	8.735E-08	5.798E-08	3.226E-08	2.112E-08	1.512E-08	1.145E-08	9.016E-09	7.307E-09	6.054E-09	5.104E-09
SSE	1.192E-07	6.725E-08	4.446E-08	2.461E-08	1.606E-08	1.147E-08	8.670E-09	6.819E-09	5.521E-09	4.571E-09	3.851E-09

Table 2.3-226 (Sheet 9 of 12)
XOQDOQ-Predicted Maximum Annual Average X/Q and D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

RELEASE POINT - GROUND LEVEL - NO INTERMITTENT RELEASES

8.000 DAY DECAY, DEPLETED

CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT

	SEGMENT BOUNDARIES IN MILES FROM THE SITE									
DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	1.055E-06	3.543E-07	1.609E-07	9.760E-08	6.731E-08	3.244E-08	1.146E-08	5.110E-09	2.976E-09	1.967E-09
SSW	8.775E-07	3.010E-07	1.357E-07	8.099E-08	5.512E-08	2.597E-08	8.855E-09	3.838E-09	2.198E-09	1.435E-09
SW	1.298E-06	4.459E-07	2.025E-07	1.215E-07	8.303E-08	3.934E-08	1.351E-08	5.877E-09	3.369E-09	2.201E-09
WSW	1.353E-06	4.634E-07	2.126E-07	1.283E-07	8.798E-08	4.193E-08	1.453E-08	6.373E-09	3.674E-09	2.411E-09
W	1.467E-06	4.984E-07	2.316E-07	1.415E-07	9.792E-08	4.736E-08	1.676E-08	7.462E-09	4.337E-09	2.862E-09
WNW	1.433E-06	4.857E-07	2.255E-07	1.384E-07	9.623E-08	4.687E-08	1.676E-08	7.518E-09	4.390E-09	2.907E-09
NW	1.690E-06	5.709E-07	2.660E-07	1.640E-07	1.143E-07	5.599E-08	2.018E-08	9.110E-09	5.340E-09	3.547E-09
NNW	1.668E-06	5.727E-07	2.672E-07	1.635E-07	1.133E-07	5.488E-08	1.945E-08	8.669E-09	5.042E-09	3.330E-09
N	1.746E-06	6.022E-07	2.795E-07	1.702E-07	1.175E-07	5.658E-08	1.989E-08	8.811E-09	5.108E-09	3.366E-09
NNE	1.685E-06	5.761E-07	2.649E-07	1.609E-07	1.109E-07	5.332E-08	1.871E-08	8.276E-09	4.792E-09	3.154E-09
NE	1.684E-06	5.773E-07	2.643E-07	1.599E-07	1.099E-07	5.258E-08	1.831E-08	8.054E-09	4.646E-09	3.049E-09
ENE	1.760E-06	6.004E-07	2.735E-07	1.651E-07	1.134E-07	5.418E-08	1.885E-08	8.286E-09	4.779E-09	3.136E-09
E	1.591E-06	5.435E-07	2.477E-07	1.496E-07	1.027E-07	4.904E-08	1.705E-08	7.492E-09	4.320E-09	2.834E-09
ESE	1.664E-06	5.632E-07	2.569E-07	1.559E-07	1.075E-07	5.172E-08	1.819E-08	8.074E-09	4.686E-09	3.090E-09
SE	2.751E-06	8.936E-07	4.079E-07	2.536E-07	1.787E-07	8.909E-08	3.303E-08	1.525E-08	9.060E-09	6.074E-09
SSE	2.114E-06	6.958E-07	3.188E-07	1.975E-07	1.386E-07	6.866E-08	2.522E-08	1.157E-08	6.853E-09	4.586E-09

Table 2.3-226 (Sheet 10 of 12)
XOQDOQ-Predicted Maximum Annual Average X/Q and D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

RELEASE POINT - GROUND LEVEL - NO INTERMITTENT RELEASES

******************** D/Q - RELATIVE DEPOSITION PER UNIT AREA (M**-2) AT FIXED POINTS BY DOWNWIND SECTORS ********************

DIRECTION	DISTANCES IN MILES										
FROM SITE	.25	.50	.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50
S	2.697E-08	9.120E-09	4.683E-09	2.875E-09	1.433E-09	8.694E-10	5.878E-10	4.259E-10	3.239E-10	2.552E-10	2.066E-10
SSW	2.780E-08	9.401E-09	4.827E-09	2.964E-09	1.478E-09	8.962E-10	6.059E-10	4.391E-10	3.339E-10	2.630E-10	2.129E-10
SW	3.697E-08	1.250E-08	6.418E-09	3.941E-09	1.965E-09	1.192E-09	8.057E-10	5.838E-10	4.439E-10	3.497E-10	2.831E-10
WSW	3.242E-08	1.096E-08	5.628E-09	3.456E-09	1.723E-09	1.045E-09	7.065E-10	5.120E-10	3.893E-10	3.067E-10	2.483E-10
W	2.863E-08	9.681E-09	4.971E-09	3.052E-09	1.522E-09	9.229E-10	6.240E-10	4.522E-10	3.438E-10	2.709E-10	2.193E-10
WNW	2.604E-08	8.805E-09	4.521E-09	2.776E-09	1.384E-09	8.394E-10	5.675E-10	4.113E-10	3.127E-10	2.464E-10	1.994E-10
NW	3.076E-08	1.040E-08	5.340E-09	3.279E-09	1.635E-09	9.914E-10	6.703E-10	4.857E-10	3.694E-10	2.910E-10	2.356E-10
NNW	3.574E-08	1.208E-08	6.205E-09	3.810E-09	1.899E-09	1.152E-09	7.789E-10	5.644E-10	4.292E-10	3.381E-10	2.737E-10
N	3.992E-08	1.350E-08	6.932E-09	4.256E-09	2.122E-09	1.287E-09	8.701E-10	6.305E-10	4.794E-10	3.777E-10	3.058E-10
NNE	4.251E-08	1.438E-08	7.381E-09	4.532E-09	2.260E-09	1.370E-09	9.266E-10	6.714E-10	5.106E-10	4.022E-10	3.256E-10
NE	4.759E-08	1.609E-08	8.264E-09	5.074E-09	2.530E-09	1.534E-09	1.037E-09	7.517E-10	5.716E-10	4.503E-10	3.645E-10
ENE	4.849E-08	1.640E-08	8.419E-09	5.170E-09	2.577E-09	1.563E-09	1.057E-09	7.659E-10	5.823E-10	4.588E-10	3.714E-10
E	4.089E-08	1.383E-08	7.099E-09	4.359E-09	2.173E-09	1.318E-09	8.911E-10	6.457E-10	4.910E-10	3.868E-10	3.132E-10
ESE	3.521E-08	1.191E-08	6.113E-09	3.753E-09	1.871E-09	1.135E-09	7.673E-10	5.560E-10	4.228E-10	3.331E-10	2.697E-10
SE	4.082E-08	1.380E-08	7.087E-09	4.352E-09	2.170E-09	1.316E-09	8.897E-10	6.447E-10	4.902E-10	3.862E-10	3.127E-10
SSE	3.826E-08	1.294E-08	6.643E-09	4.079E-09	2.034E-09	1.233E-09	8.339E-10	6.043E-10	4.595E-10	3.620E-10	2.931E-10

Table 2.3-226 (Sheet 11 of 12)
XOQDOQ-Predicted Maximum Annual Average X/Q and D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

RELEASE POINT - GROUND LEVEL - NO INTERMITTENT RELEASES

********************* D/Q - RELATIVE DEPOSITION PER UNIT AREA (M**-2) AT FIXED POINTS BY DOWNWIND SECTORS *******************

DIRECTION	DISTANCES IN MILES										
FROM SITE	5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
S	1.709E-10	8.374E-11	5.254E-11	2.656E-11	1.607E-11	1.078E-11	7.722E-12	5.798E-12	4.508E-12	3.601E-12	2.940E-12
SSW	1.761E-10	8.631E-11	5.416E-11	2.737E-11	1.657E-11	1.111E-11	7.960E-12	5.977E-12	4.647E-12	3.712E-12	3.030E-12
SW	2.342E-10	1.148E-10	7.202E-11	3.640E-11	2.203E-11	1.477E-11	1.058E-11	7.948E-12	6.180E-12	4.936E-12	4.029E-12
WSW	2.054E-10	1.006E-10	6.315E-11	3.192E-11	1.932E-11	1.295E-11	9.282E-12	6.970E-12	5.419E-12	4.329E-12	3.533E-12
W	1.814E-10	8.889E-11	5.578E-11	2.819E-11	1.706E-11	1.144E-11	8.198E-12	6.156E-12	4.786E-12	3.823E-12	3.121E-12
WNW	1.650E-10	8.085E-11	5.073E-11	2.564E-11	1.552E-11	1.041E-11	7.456E-12	5.599E-12	4.353E-12	3.477E-12	2.838E-12
NW	1.949E-10	9.549E-11	5.992E-11	3.028E-11	1.833E-11	1.229E-11	8.806E-12	6.613E-12	5.141E-12	4.107E-12	3.352E-12
NNW	2.264E-10	1.110E-10	6.962E-11	3.519E-11	2.130E-11	1.428E-11	1.023E-11	7.684E-12	5.974E-12	4.772E-12	3.895E-12
N	2.529E-10	1.240E-10	7.778E-11	3.931E-11	2.379E-11	1.595E-11	1.143E-11	8.583E-12	6.674E-12	5.331E-12	4.351E-12
NNE	2.694E-10	1.320E-10	8.282E-11	4.186E-11	2.534E-11	1.699E-11	1.217E-11	9.140E-12	7.107E-12	5.677E-12	4.634E-12
NE	3.016E-10	1.478E-10	9.272E-11	4.687E-11	2.837E-11	1.902E-11	1.363E-11	1.023E-11	7.956E-12	6.356E-12	5.188E-12
ENE	3.072E-10	1.506E-10	9.447E-11	4.775E-11	2.890E-11	1.938E-11	1.388E-11	1.043E-11	8.106E-12	6.475E-12	5.285E-12
E	2.590E-10	1.269E-10	7.965E-11	4.026E-11	2.437E-11	1.634E-11	1.171E-11	8.791E-12	6.835E-12	5.460E-12	4.456E-12
ESE	2.231E-10	1.093E-10	6.859E-11	3.467E-11	2.098E-11	1.407E-11	1.008E-11	7.569E-12	5.885E-12	4.701E-12	3.837E-12
SE	2.586E-10	1.267E-10	7.952E-11	4.019E-11	2.433E-11	1.631E-11	1.169E-11	8.776E-12	6.824E-12	5.451E-12	4.449E-12
SSE	2.424E-10	1.188E-10	7.454E-11	3.768E-11	2.280E-11	1.529E-11	1.096E-11	8.226E-12	6.396E-12	5.109E-12	4.170E-12

Table 2.3-226 (Sheet 12 of 12)
XOQDOQ-Predicted Maximum Annual Average X/Q and D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries

RELEASE POINT - GROUND LEVEL - NO INTERMITTENT RELEASES

************************* D/Q - RELATIVE DEPOSITION PER UNIT AREA (M**-2) BY DOWNWIND SECTORS ************************

SEGMENT BOUNDARIES IN MILES

DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	4.865E-09	1.503E-09	5.981E-10	3.269E-10	2.077E-10	8.924E-11	2.767E-11	1.097E-11	5.857E-12	3.625E-12
SSW	5.015E-09	1.549E-09	6.166E-10	3.369E-10	2.141E-10	9.198E-11	2.852E-11	1.130E-11	6.037E-12	3.737E-12
SW	6.669E-09	2.060E-09	8.199E-10	4.480E-10	2.848E-10	1.223E-10	3.793E-11	1.503E-11	8.028E-12	4.969E-12
WSW	5.848E-09	1.807E-09	7.190E-10	3.929E-10	2.497E-10	1.073E-10	3.326E-11	1.318E-11	7.040E-12	4.357E-12
W	5.165E-09	1.596E-09	6.350E-10	3.470E-10	2.205E-10	9.473E-11	2.938E-11	1.164E-11	6.217E-12	3.848E-12
WNW	4.698E-09	1.451E-09	5.775E-10	3.156E-10	2.006E-10	8.616E-11	2.672E-11	1.059E-11	5.655E-12	3.500E-12
NW	5.548E-09	1.714E-09	6.821E-10	3.728E-10	2.369E-10	1.018E-10	3.156E-11	1.251E-11	6.679E-12	4.134E-12
NNW	6.447E-09	1.992E-09	7.926E-10	4.331E-10	2.753E-10	1.182E-10	3.667E-11	1.453E-11	7.761E-12	4.804E-12
N	7.202E-09	2.225E-09	8.854E-10	4.839E-10	3.075E-10	1.321E-10	4.096E-11	1.623E-11	8.670E-12	5.366E-12
NNE	7.670E-09	2.370E-09	9.429E-10	5.153E-10	3.275E-10	1.407E-10	4.362E-11	1.729E-11	9.232E-12	5.714E-12
NE	8.586E-09	2.653E-09	1.056E-09	5.768E-10	3.666E-10	1.575E-10	4.883E-11	1.935E-11	1.034E-11	6.397E-12
ENE	8.748E-09	2.703E-09	1.075E-09	5.877E-10	3.735E-10	1.604E-10	4.975E-11	1.972E-11	1.053E-11	6.518E-12
E	7.376E-09	2.279E-09	9.068E-10	4.955E-10	3.149E-10	1.353E-10	4.195E-11	1.663E-11	8.879E-12	5.496E-12
ESE	6.351E-09	1.962E-09	7.808E-10	4.267E-10	2.712E-10	1.165E-10	3.612E-11	1.432E-11	7.645E-12	4.732E-12
SE	7.364E-09	2.275E-09	9.053E-10	4.947E-10	3.144E-10	1.351E-10	4.188E-11	1.660E-11	8.864E-12	5.487E-12
SSE	6.903E-09	2.133E-09	8.486E-10	4.637E-10	2.947E-10	1.266E-10	3.926E-11	1.556E-11	8.309E-12	5.143E-12

**Table 2.3-227 (Sheet 1 of 4)
Tornadoes That Occurred In Counties Surrounding VCSNS (Saluda, Chester, Lancaster, Newberry, Lexington, Kershaw, Richland, Union and Fairfield) During the Period From January 1950 Through August 2003[(a)]**

County	Location or County	Date	Time[(b)]	Magnitude
Saluda	1 SALUDA	3/13/1955	2100	F2
Saluda	2 SALUDA	11/22/1992	1755	F3
Saluda	3 SALUDA	11/22/1992	1800	F2
Saluda	4 Ward	5/7/1998	7:12 PM	F1
Saluda	5 Saluda	6/2/1998	10:28 AM	F0
Saluda	6 Saluda	4/24/1999	3:39 PM	F0
Saluda	7 Ward	5/6/2003	12:45 AM	F0
Chester	1 CHESTER	4/6/1955	1230	F1
Chester	2 CHESTER	5/15/1975	1200	F1
Chester	3 CHESTER	4/19/1981	1845	F1
Chester	4 Lowrys	4/16/1994	0111	F2
Chester	5 Chester	8/16/1994	1755	F1
Chester	6 Chester 9 Wnw	5/1/1995	2305	F0
Chester	7 Richburg	5/29/1996	5:00 PM	F1
Chester	8 Ft Lawn	7/24/1997	12:00 AM	F1
Chester	9 Chester	6/4/1998	5:30 PM	F0
Lancaster	1 LANCASTER	4/5/1957	1930	F1
Lancaster	2 LANCASTER	4/8/1957	1600	F4
Lancaster	3 LANCASTER	10/1/1969	2245	F0[(c)]
Lancaster	4 LANCASTER	3/4/1977	1120	F1
Lancaster	5 LANCASTER	3/28/1984	1725	F4
Lancaster	6 LANCASTER	6/16/1989	1715	F1
Lancaster	7 LANCASTER	9/22/1989	0045	F1
Newberry	1 NEWBERRY	4/5/1957	0714	F1
Newberry	2 NEWBERRY	3/30/1960	1906	F2
Newberry	3 NEWBERRY	4/18/1969	1600	F1
Newberry	4 NEWBERRY	12/13/1973	1425	F3
Newberry	5 NEWBERRY	12/13/1973	1503	F3
Newberry	6 NEWBERRY	12/13/1973	1616	F2
Newberry	7 NEWBERRY	12/13/1973	1645	F2
Newberry	8 NEWBERRY	5/15/1975	1350	F1
Newberry	9 NEWBERRY	3/28/1984	1620	F2
Newberry	10 NEWBERRY	3/28/1984	1645	F3
Newberry	11 NEWBERRY	5/23/1988	1540	F0
Newberry	12 NEWBERRY	11/22/1992	1830	F3

**Table 2.3-227 (Sheet 2 of 4)
Tornadoes That Occurred In Counties Surrounding VCSNS
(Saluda, Chester, Lancaster, Newberry, Lexington, Kershaw, Richland, Union and Fairfield) During the Period
From January 1950 Through August 2003[(a)]**

County	Location or County	Date	Time[(b)]	Magnitude
Newberry	13 NEWBERRY	11/22/1992	1913	F2
Newberry	14 NEWBERRY	8/16/1994	1332	F1
Newberry	15 Prosperity	1/14/1995	0814	F0
Newberry	16 Pomaria	1/14/1995	0829	F0
Newberry	17 ?	5/15/1995	1553	F0
Newberry	18 Chappells	4/24/1999	3:37 PM	F0
Newberry	19 Silverstreet	11/11/2002	6:42 AM	F1
Newberry	20 Pomaria	11/11/2002	7:35 AM	F1
Lexington	1 LEXINGTON	4/5/1957	0645	F2
Lexington	2 LEXINGTON	9/28/1963	1800	F1
Lexington	3 LEXINGTON	1/10/1972	1405	F1
Lexington	4 LEXINGTON	2/22/1974	0400	F1
Lexington	5 LEXINGTON	2/11/1981	0015	F1
Lexington	6 LEXINGTON	2/21/1989	0800	F1
Lexington	7 To 4 Ene	2/22/1993	0115	F1
Lexington	8 Gilbert	8/16/1994	1200	F2
Lexington	9 LEXINGTON	8/16/1994	1216	F0
Lexington	10 Of Lexington	8/16/1994	1227	F2
Lexington	11 Lexington	8/16/1994	1235	F3
Lexington	12 Columbia	8/16/1994	1253	F0
Lexington	13 Lexington	8/16/1994	1335	F3
Lexington	14 Pelion	1/14/1995	1156	F1
Lexington	15 Gaston	11/2/1995	1545	F3[(c)]
Lexington	16 Cayce	11/7/1995	1515	F0
Lexington	17 South Congaree	11/7/1995	1523	F0[(c)]
Lexington	18 Lexington	11/7/1995	1530	F1
Lexington	19 Gaston	7/23/1997	10:53 PM	F2
Kershaw	1 KERSHAW	8/29/1964	1600	F1
Kershaw	2 KERSHAW	8/16/1965	1540	F0[(c)]
Kershaw	3 KERSHAW	4/7/1967	1420	F1
Kershaw	4 KERSHAW	4/18/1969	1345	F1
Kershaw	5 KERSHAW	4/18/1969	1705	F2
Kershaw	6 KERSHAW	5/4/1978	1700	F1
Kershaw	7 KERSHAW	3/6/1983	1800	F1
Kershaw	8 KERSHAW	3/28/1984	1720	F4

**Table 2.3-227 (Sheet 3 of 4)
Tornadoes That Occurred In Counties Surrounding VCSNS (Saluda, Chester, Lancaster, Newberry, Lexington, Kershaw, Richland, Union and Fairfield) During the Period From January 1950 Through August 2003[a]**

County	Location or County	Date	Time[b]	Magnitude
Kershaw	9 KERSHAW	2/16/1990	1324	F0
Kershaw	10 KERSHAW	8/16/1994	1400	F0
Kershaw	11 Camden	3/16/1996	10:38 PM	F0
Kershaw	12 Cassatt	5/29/1996	6:44 PM	F0
Kershaw	13 Camden	7/23/1997	11:48 PM	F2
Kershaw	14 Bethune	7/24/1997	12:20 AM	F1
Richland	1 RICHLAND	6/11/1955	1030	F0
Richland	2 RICHLAND	7/3/1964	0125	F2
Richland	3 RICHLAND	8/29/1964	1515	F2
Richland	4 RICHLAND	3/26/1965	915	F0
Richland	5 RICHLAND	5/29/1967	1800	F2
Richland	6 RICHLAND	11/24/1967	1810	F1
Richland	7 RICHLAND	5/12/1971	1530	F1
Richland	8 RICHLAND	1/10/1972	1405	F1
Richland	9 RICHLAND	11/12/1975	1915	F2
Richland	10 RICHLAND	5/15/1976	130	F2
Richland	11 RICHLAND	6/19/1977	2000	F1
Richland	12 RICHLAND	5/20/1980	1010	F1
Richland	13 RICHLAND	2/11/1981	0000	F1
Richland	14 RICHLAND	4/20/1981	1505	F1
Richland	15 RICHLAND	8/31/1987	1515	F2
Richland	16 RICHLAND	6/16/1989	1500	F0
Richland	17 Mcentire	8/16/1994	1230	F0
Richland	18 Balentine	8/16/1994	1318	F1
Richland	19 Near Ballentine	1/16/1995	2210	F1
Richland	20 Columbia	10/27/1995	1745	F0[c]
Richland	21 Columbia	11/7/1995	1521	F0[c]
Richland	22 Columbia	7/23/1997	11:14 PM	F1
Richland	23 Columbia	7/23/1997	11:32 PM	F0
Richland	24 Ft Jackson	3/16/2000	3:30 PM	F0
Richland	25 Mc Entire Ang	3/16/2000	5:52 PM	F0
Richland	26 Eastover	3/29/2001	4:12 PM	F0
Richland	27 Ft Jackson	6/13/2001	1:22 PM	F0
Union	1 UNION	4/8/1957	1500	F2
Union	2 UNION	8/17/1985	1315	F0

**Table 2.3-227 (Sheet 4 of 4)
Tornadoes That Occurred In Counties Surrounding VCSNS (Saluda, Chester, Lancaster, Newberry, Lexington, Kershaw, Richland, Union and Fairfield) During the Period From January 1950 Through August 2003[a]**

County	Location or County	Date	Time[b]	Magnitude
Union	3 UNION	6/4/1992	1050	F0
Union	4 UNION	6/4/1992	1115	F0
Union	5 Southside To	4/15/1993	1626	F2
Union	6 Union	7/26/1996	4:25 PM	F0
Union	7 Carlisle	6/6/1998	4:10 PM	F1
Union	8 Adamsburg	5/25/2000	7:00 PM	F1
Union	9 Carlisle	6/9/2001	2:15 PM	F0
Fairfield	1 FAIRFIELD	3/6/1983	1730	F1
Fairfield	2 FAIRFIELD	3/28/1984	1653	F3
Fairfield	3 FAIRFIELD	3/28/1984	1700	F4
Fairfield	4 FAIRFIELD	11/22/1992	1945	F0
Fairfield	5 FAIRFIELD	11/22/1992	2012	F0
Fairfield	6 FAIRFIELD	5/4/1993	1745	F0
Fairfield	7 Strother To	8/16/1994	1343	F0
Fairfield	8 Ridgeway	8/16/1994	1530	F2
Fairfield	9 Winnsboro	8/6/1994	1644	F0
Fairfield	10 Centerfield	1/6/1995	2214	F1
Fairfield	11 Ridgeway	3/16/1996	10:17 PM	F0
Fairfield	12 Jenkinsville	7/22/2000	1:15 PM	F0

(a) The period from June 1, 1995, when the KCAE Columbia Doppler radar was commissioned through August 31, 2003 represents 26.6% of the 124 total tornado occurrences, even though this is only 15.4% of the total time period. This causes a strong spatial and temporal bias of detection towards the Doppler radar.

(b) Times in the NCDC Storm Events database are in Central Standard Time for 1950 through 1995. After 1996, the database switches to using Local Standard Time.

(c) Values were modified to reflect magnitudes cited in FSAR Reference 212 that were not available from the NCDC Storm Events Database.

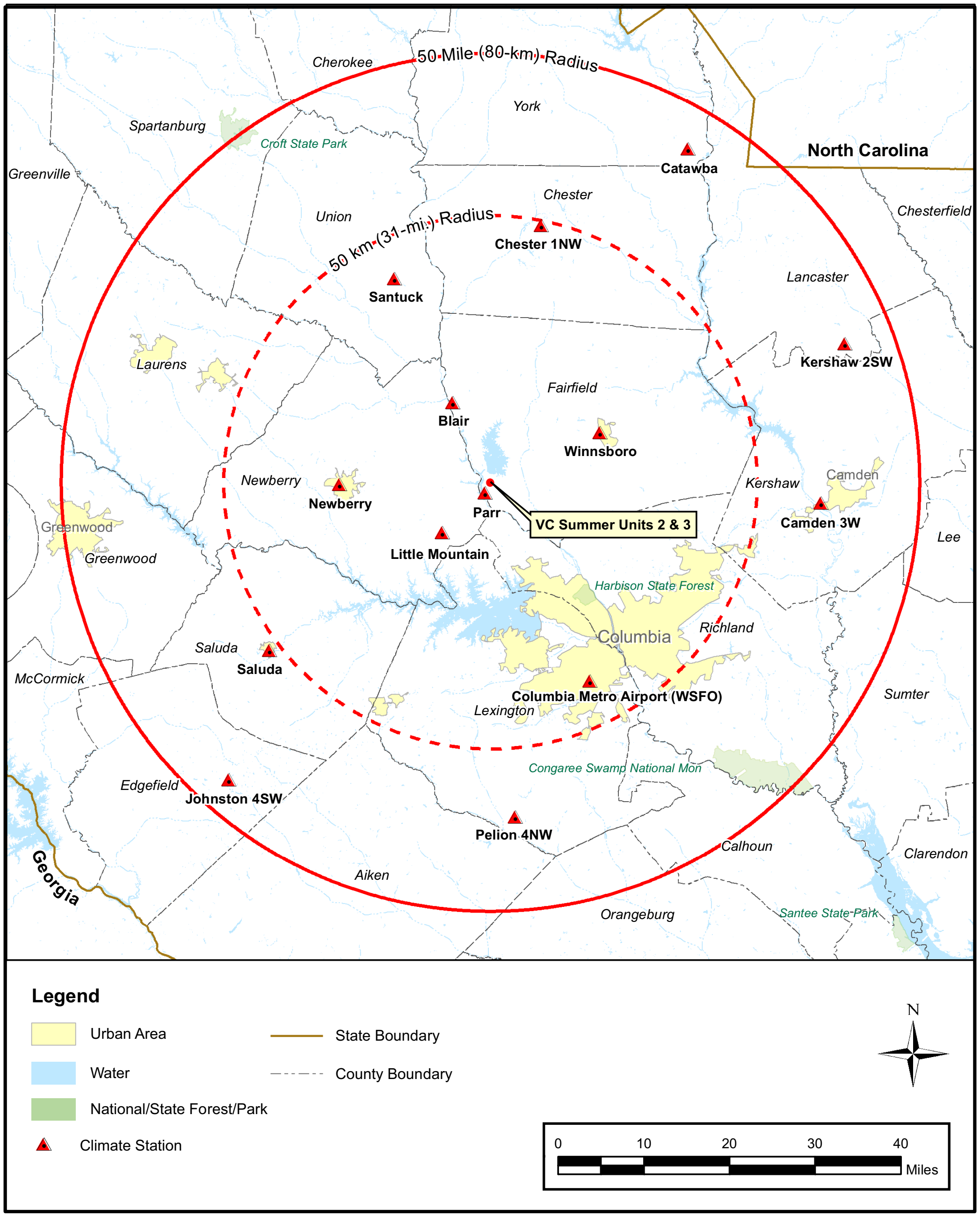


Figure 2.3-201. Climatological Observing Stations Near the VCSNS Site

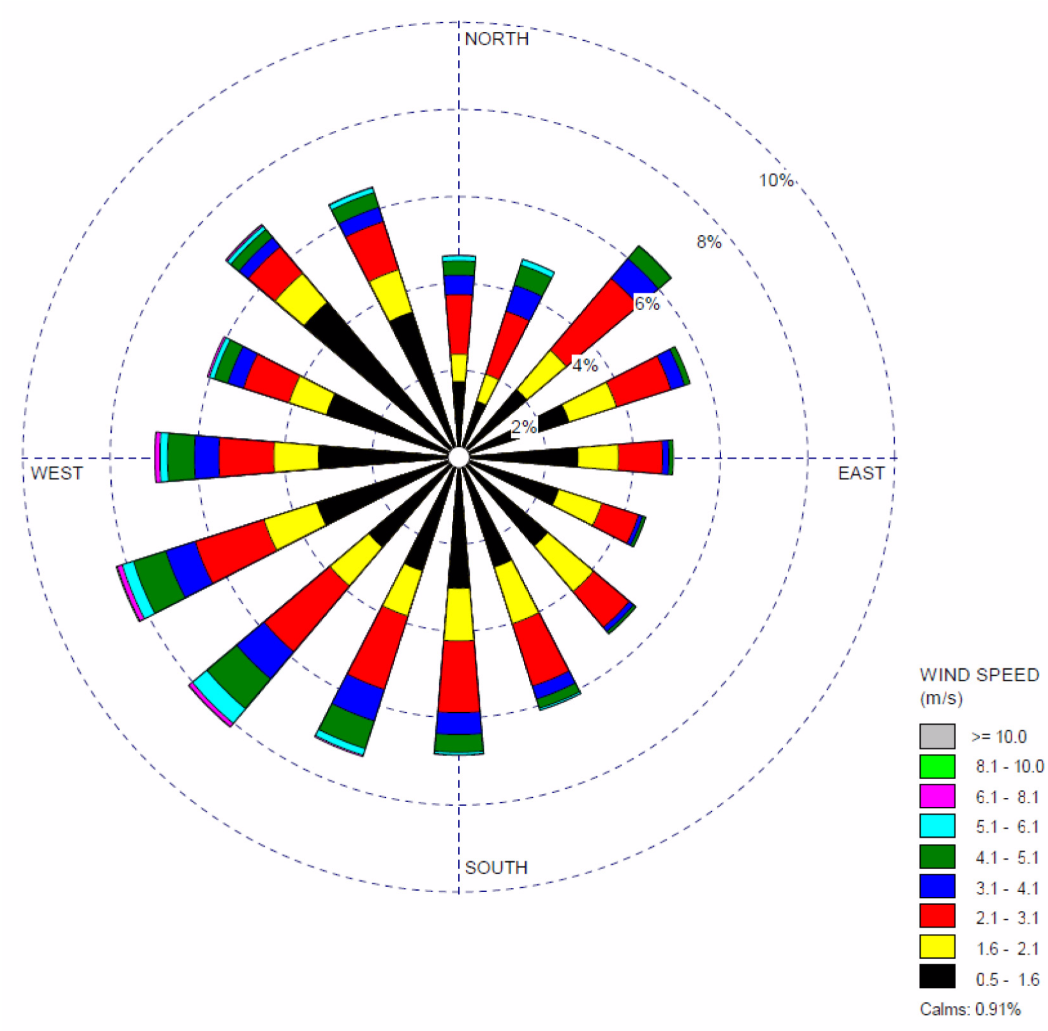


Figure 2.3-202. 10-Meter Level Composite Wind Rose for the Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008) — Annual

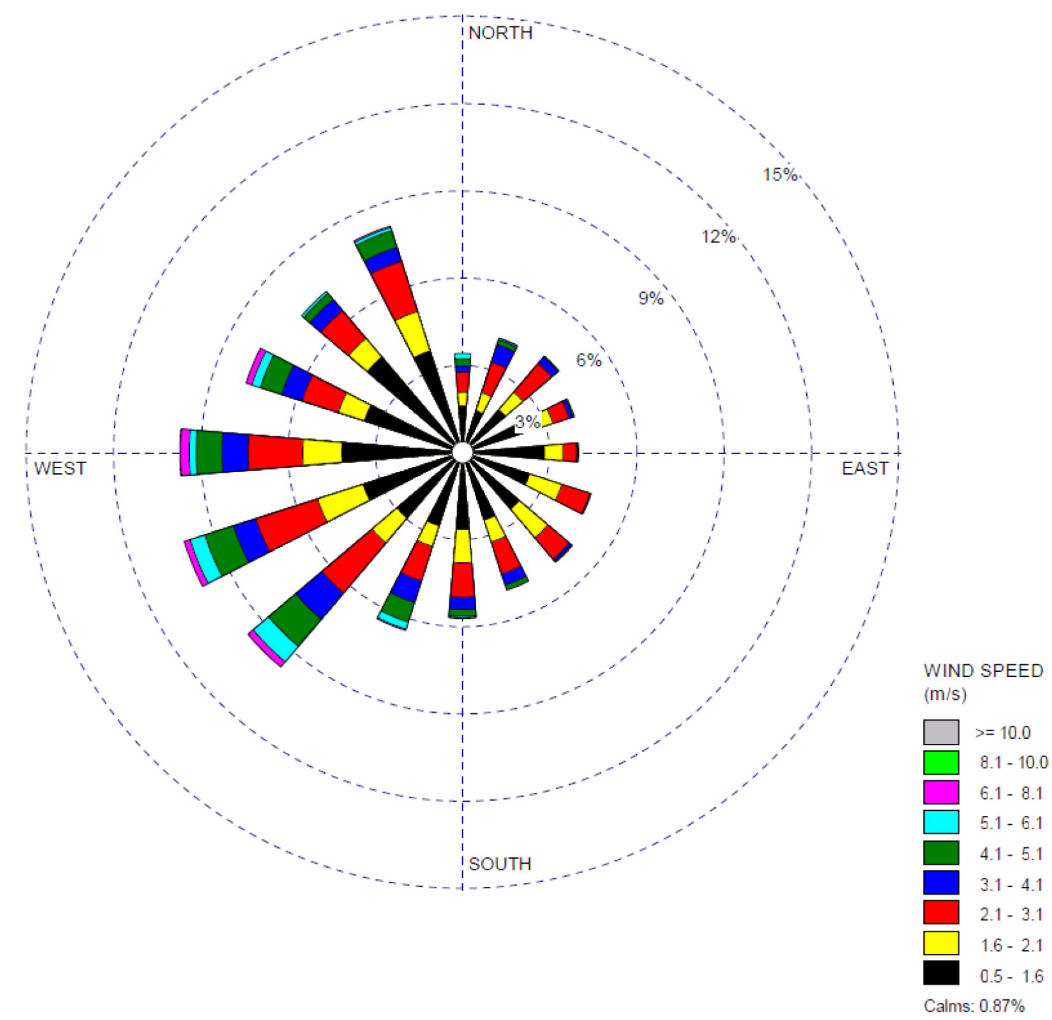


Figure 2.3-203. 10-Meter Level Composite Wind Rose for the Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008) — Winter

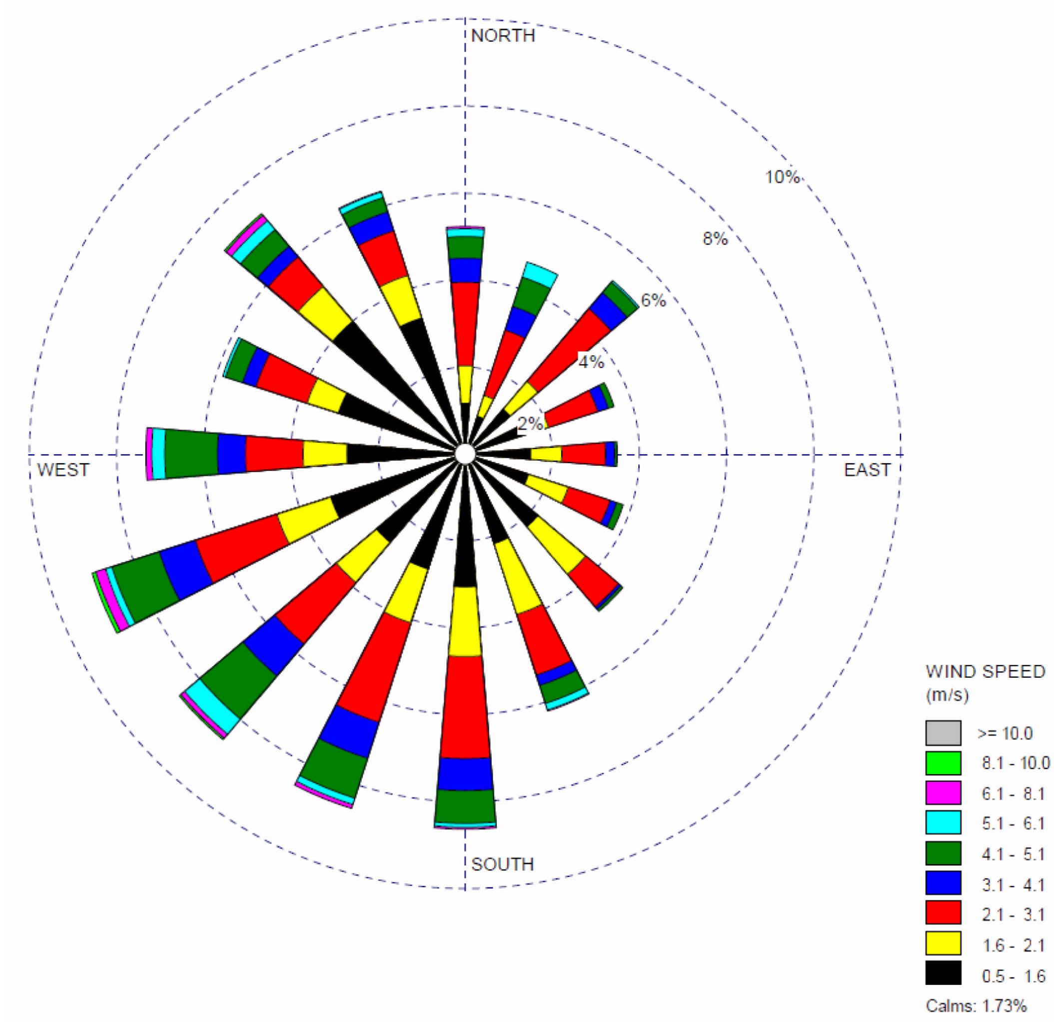


Figure 2.3-204. 10-Meter Level Composite Wind Rose for the Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008) — Spring

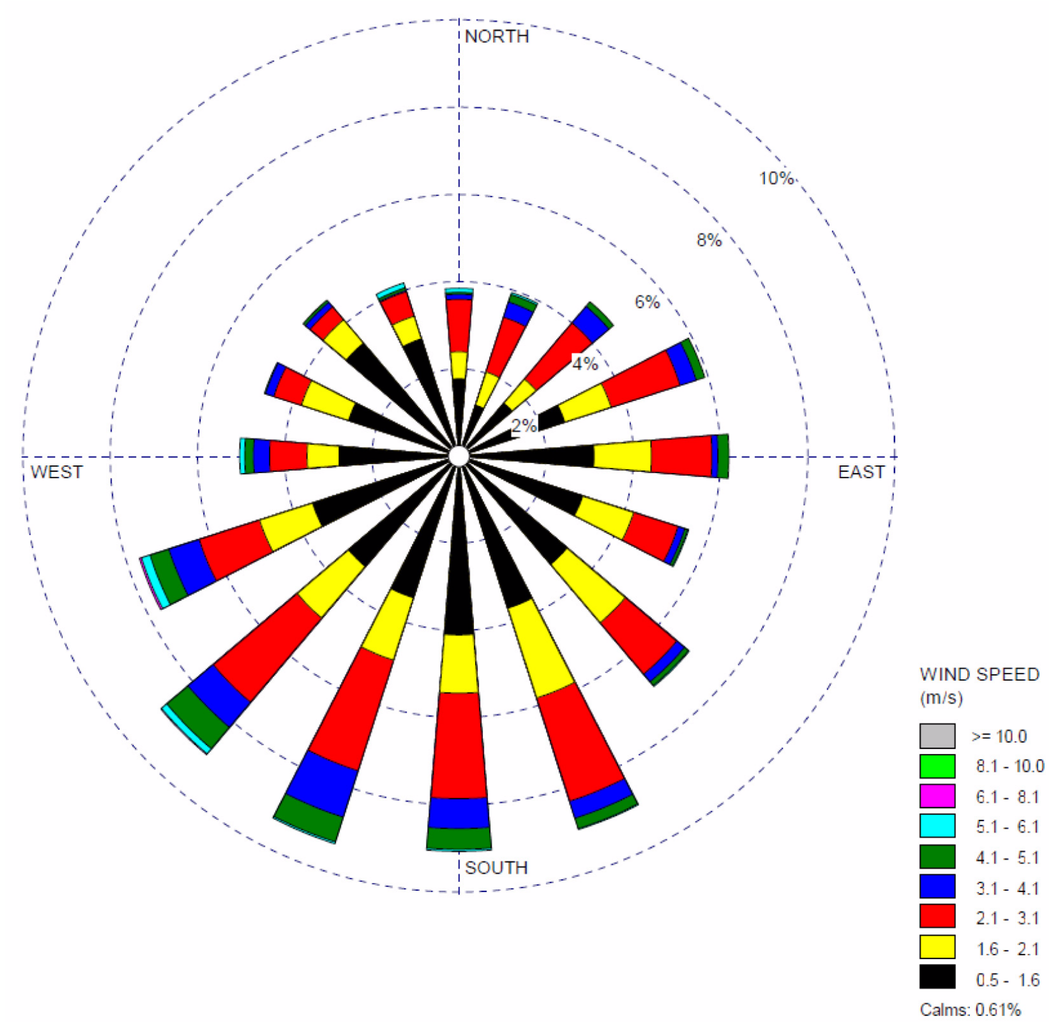


Figure 2.3-205. 10-Meter Level Composite Wind Rose for the Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008) — Summer

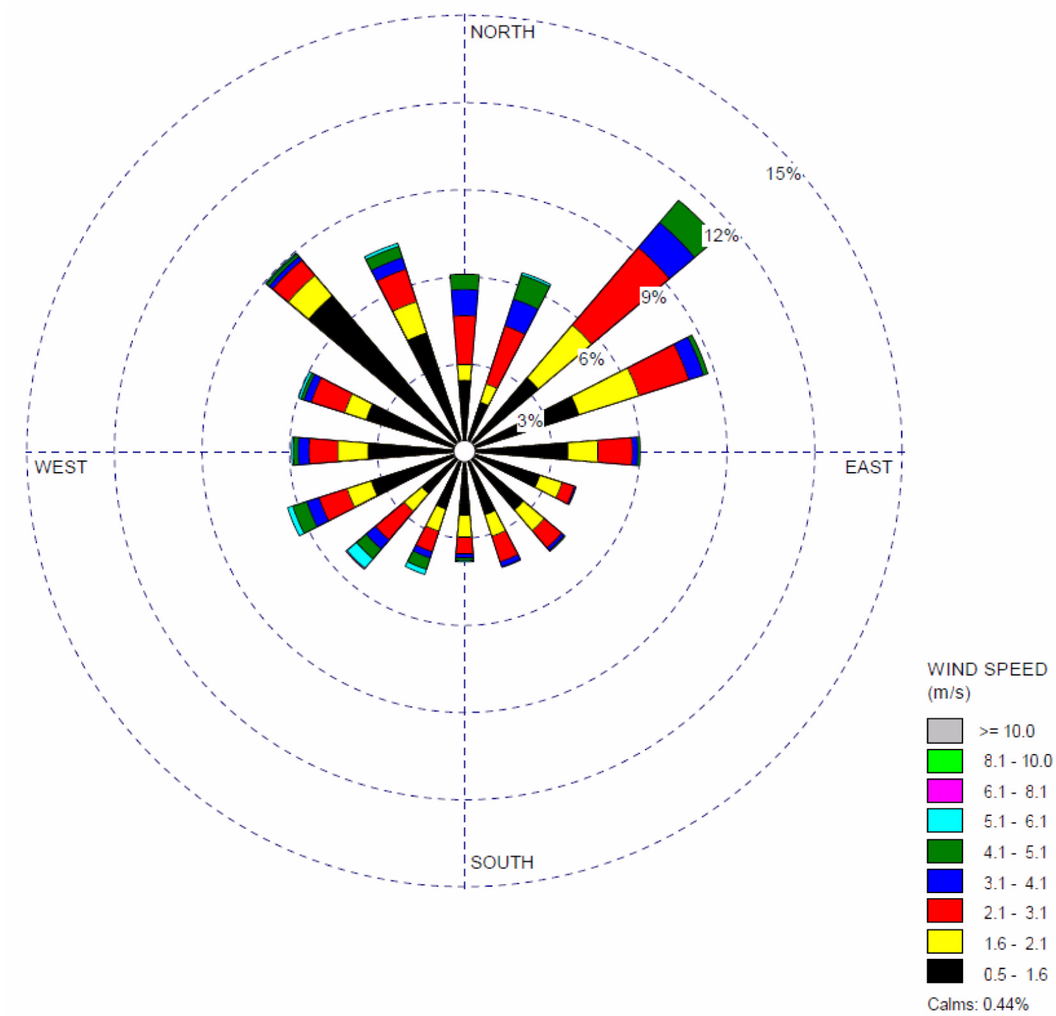


Figure 2.3-206. 10-Meter Level Composite Wind Rose for the Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008) — Autumn

Figure 2.3-207. DELETED (12 sheets)

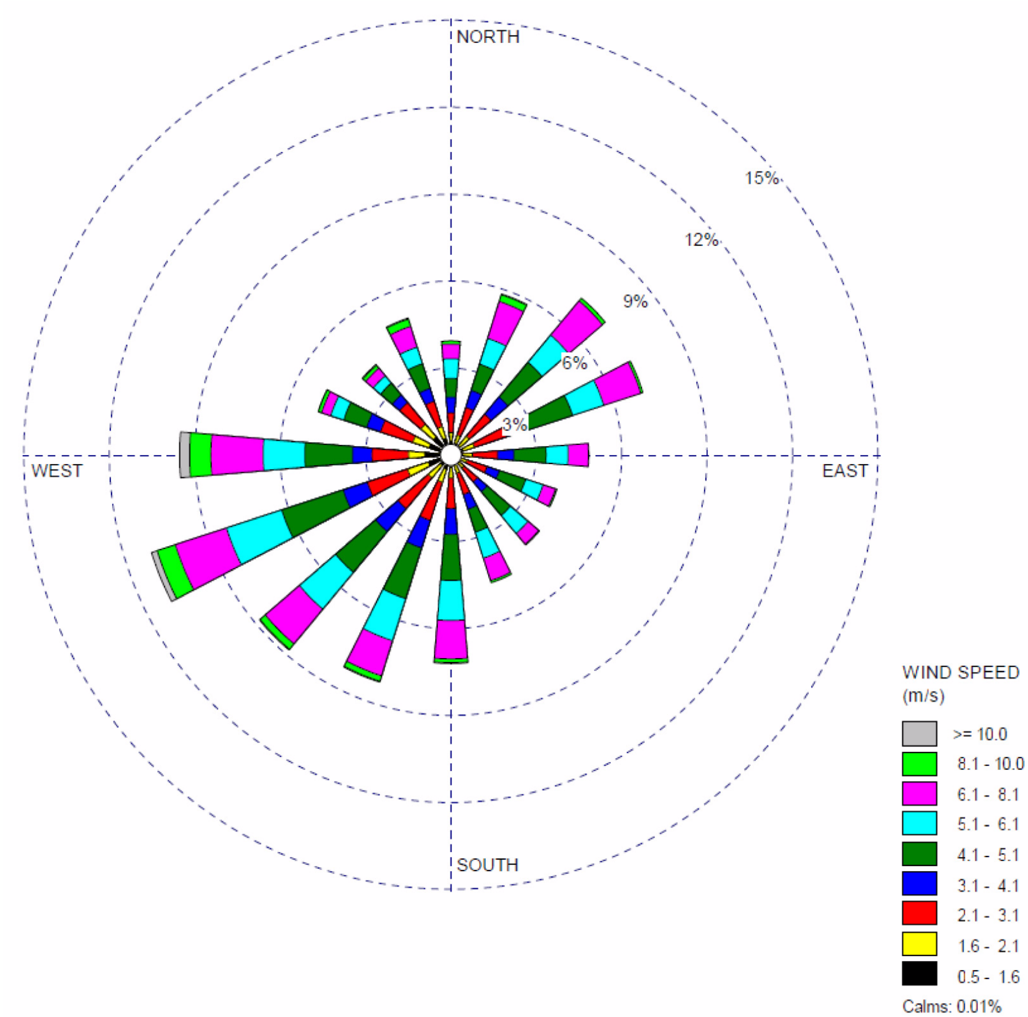


Figure 2.3-208. 60-Meter Level Composite Wind Rose for the Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008) — Annual

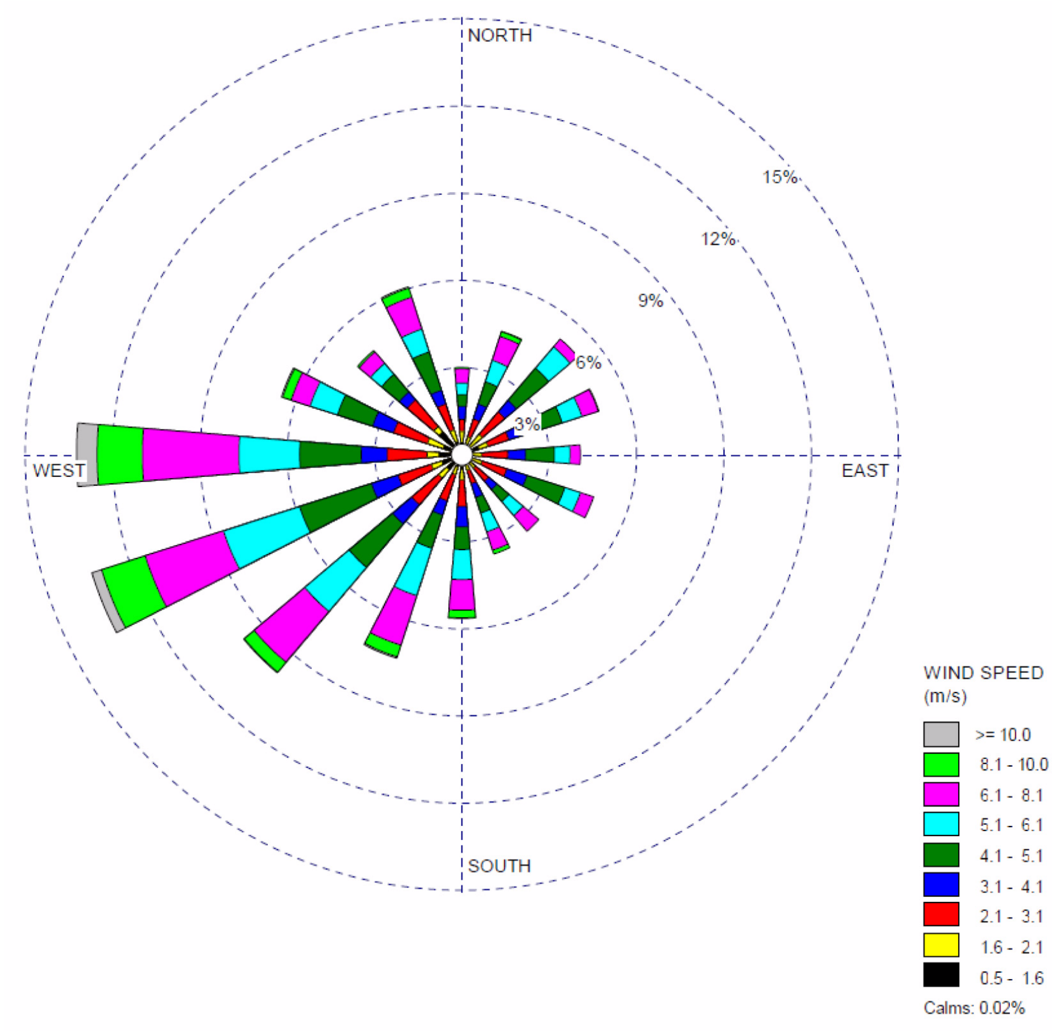


Figure 2.3-209. 60-Meter Level Composite Wind Rose for the Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008) — Winter

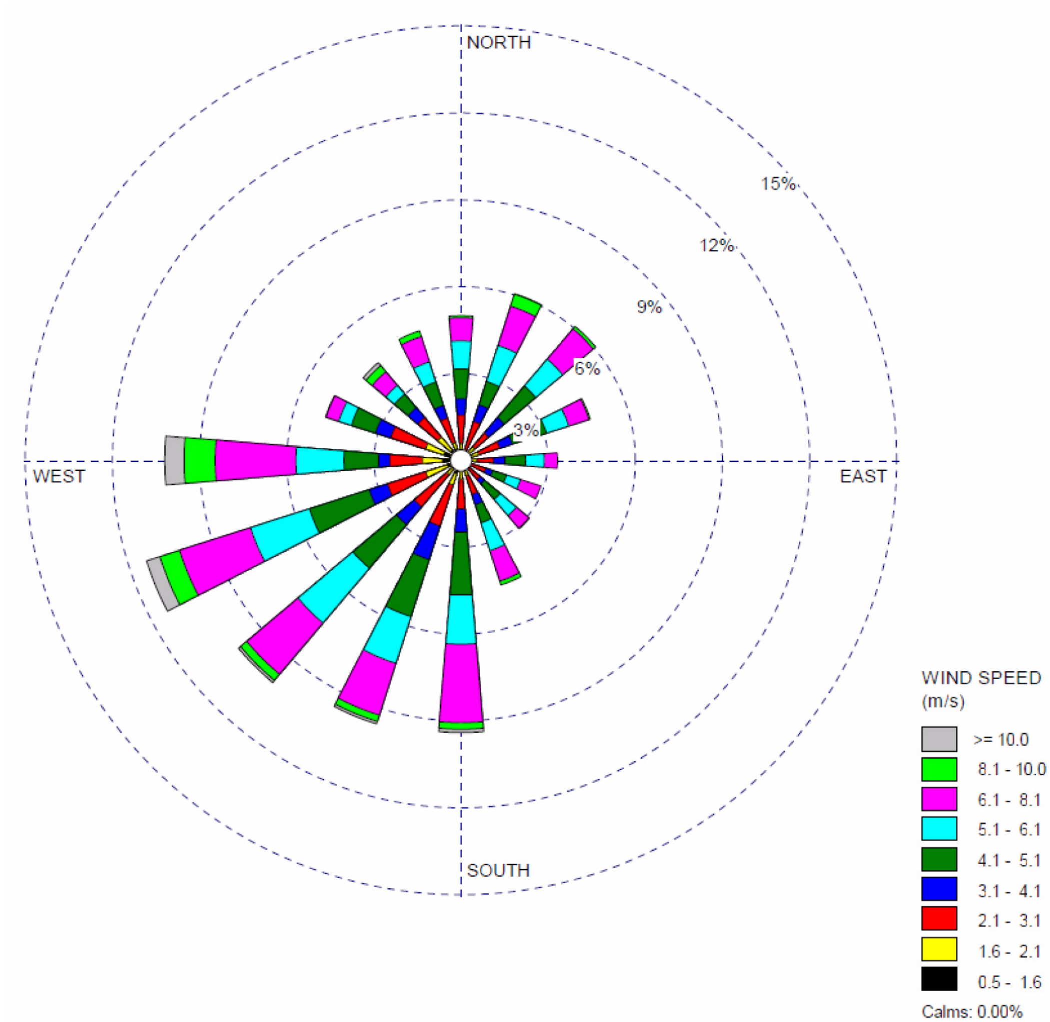


Figure 2.3-210. 60-Meter Level Composite Wind Rose for the Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008) — Spring

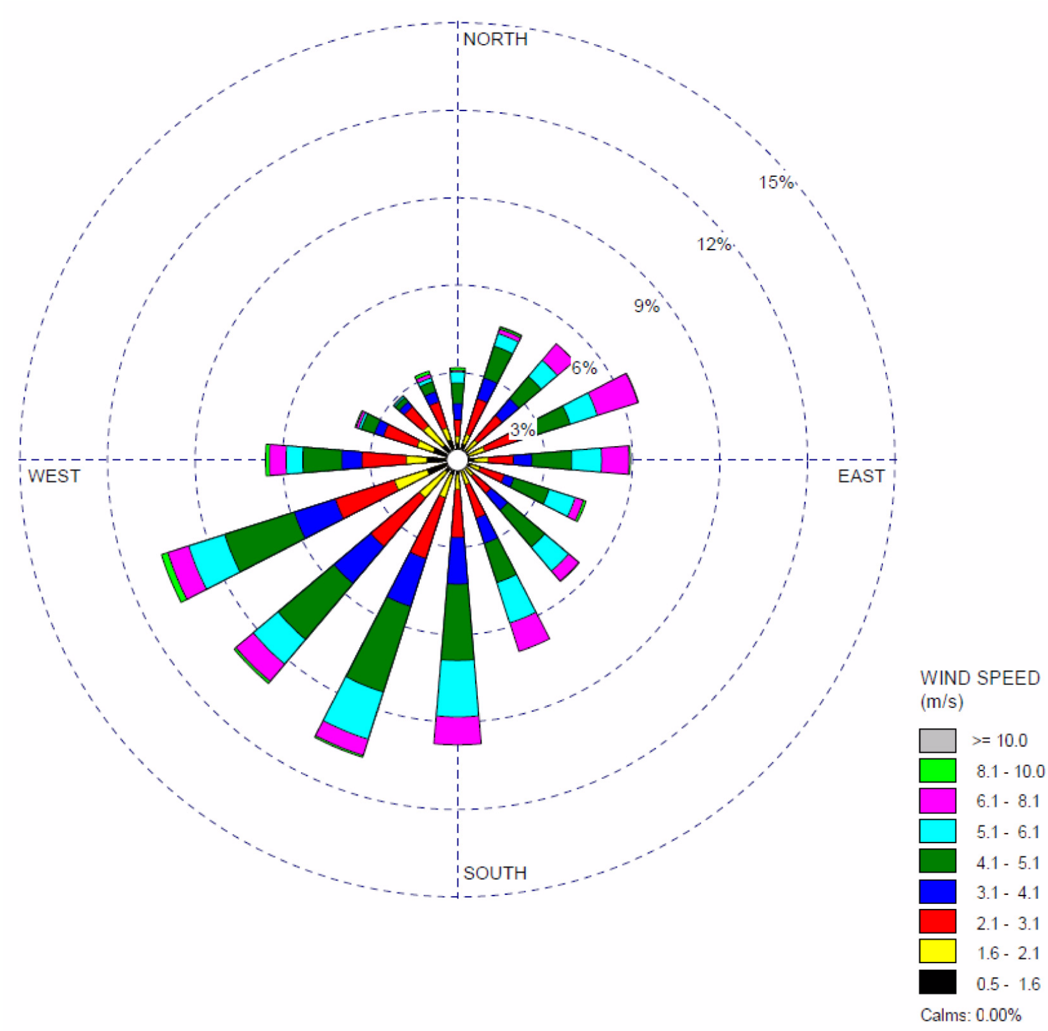


Figure 2.3-211. 60-Meter Level Composite Wind Rose for the Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008) — Summer

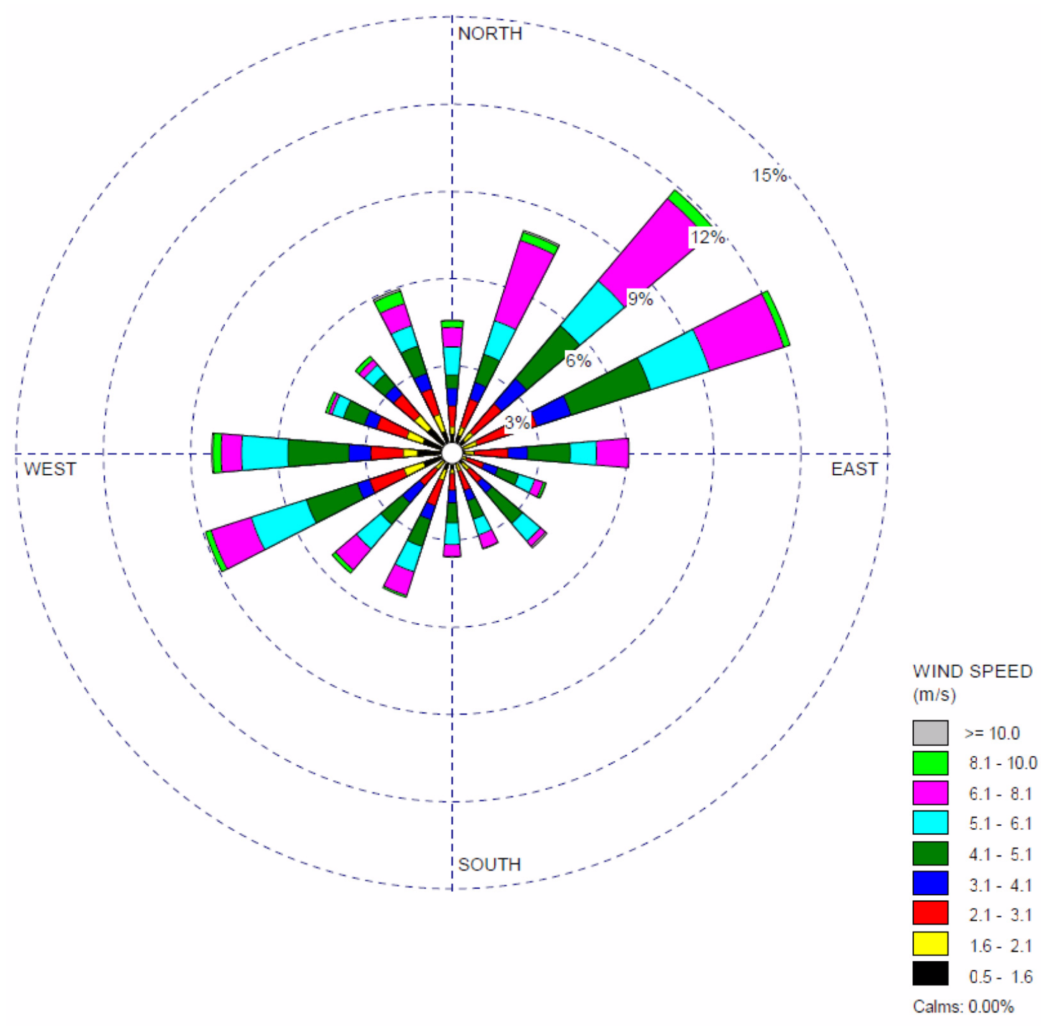


Figure 2.3-212. 60-Meter Level Composite Wind Rose for the Units 2 and 3 Monitoring Program (January 1, 2007–December 31, 2008) — Autumn

Figure 2.3-213. DELETED (12 Sheets).

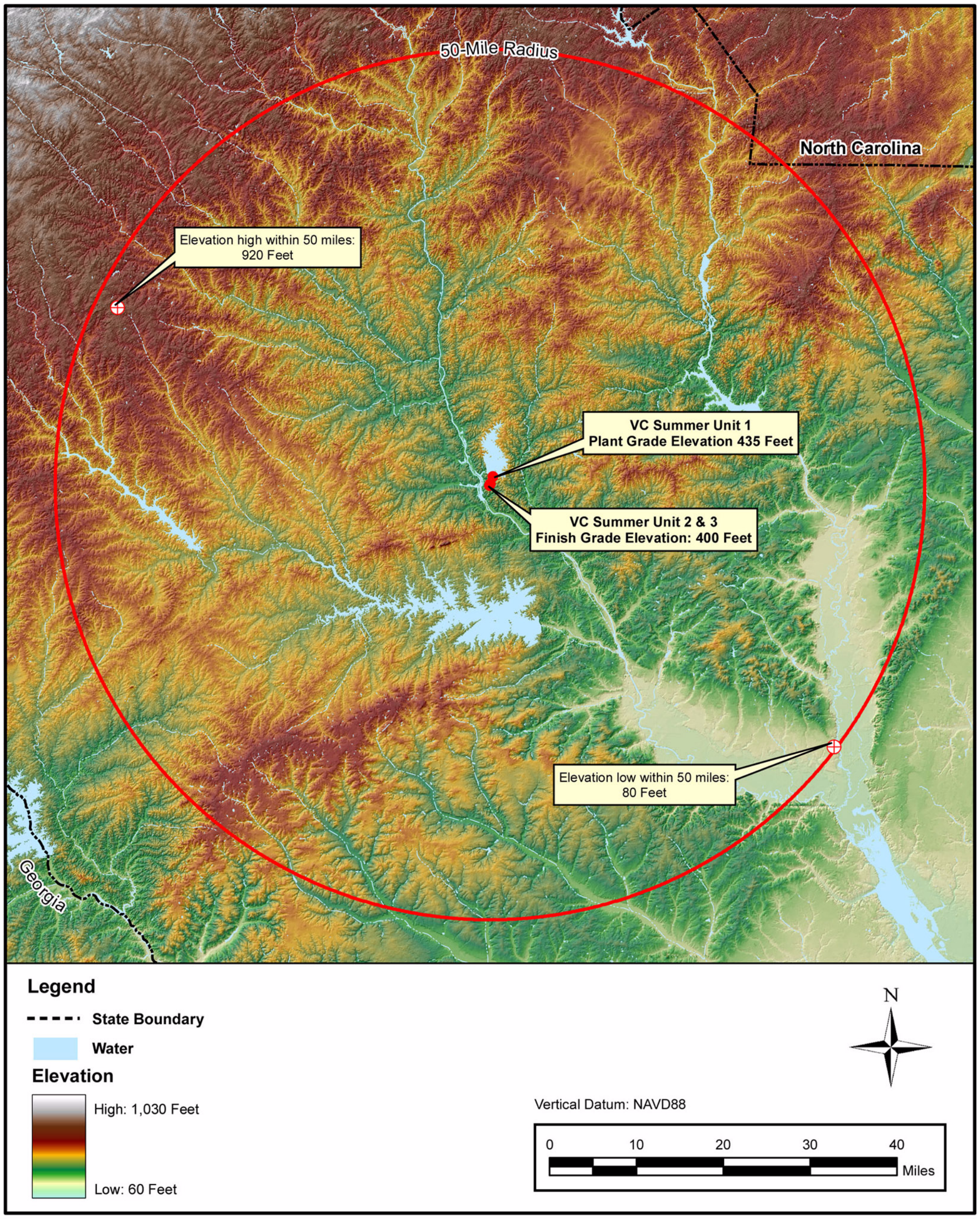
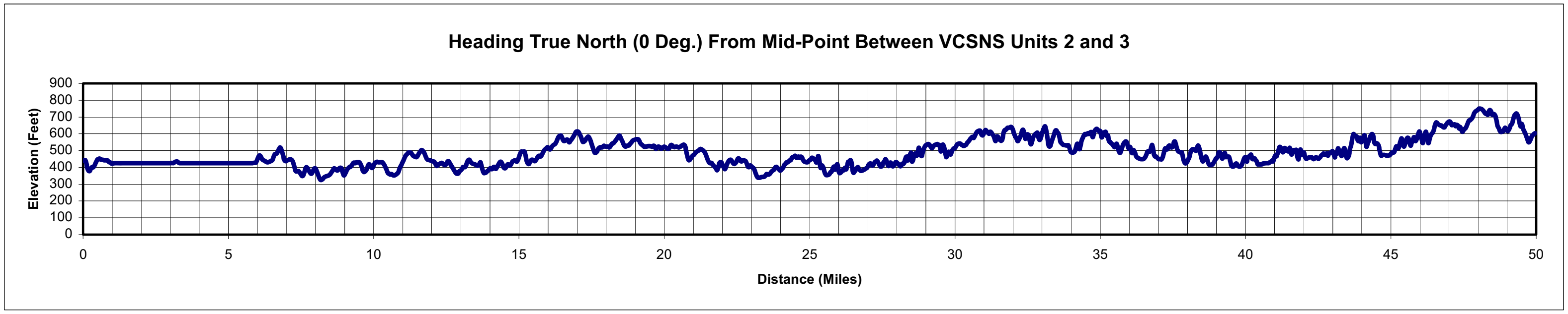
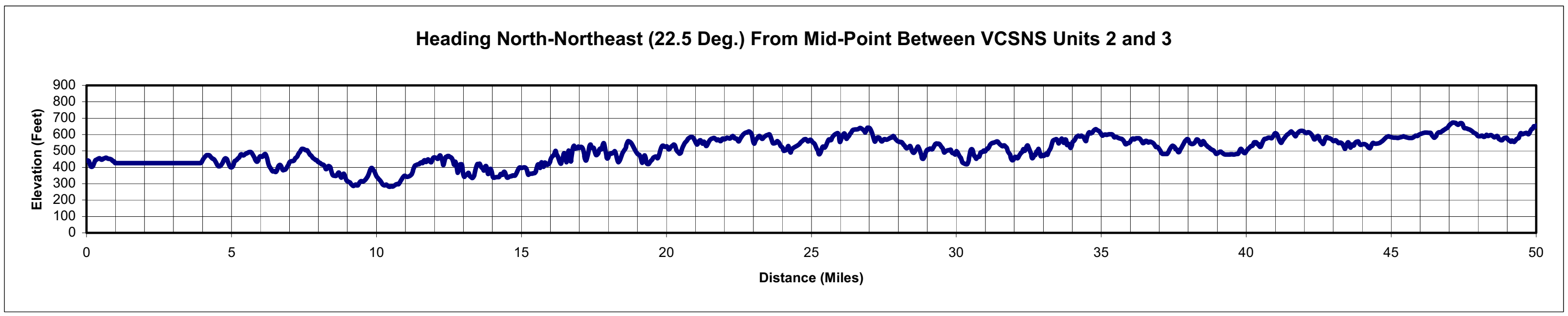
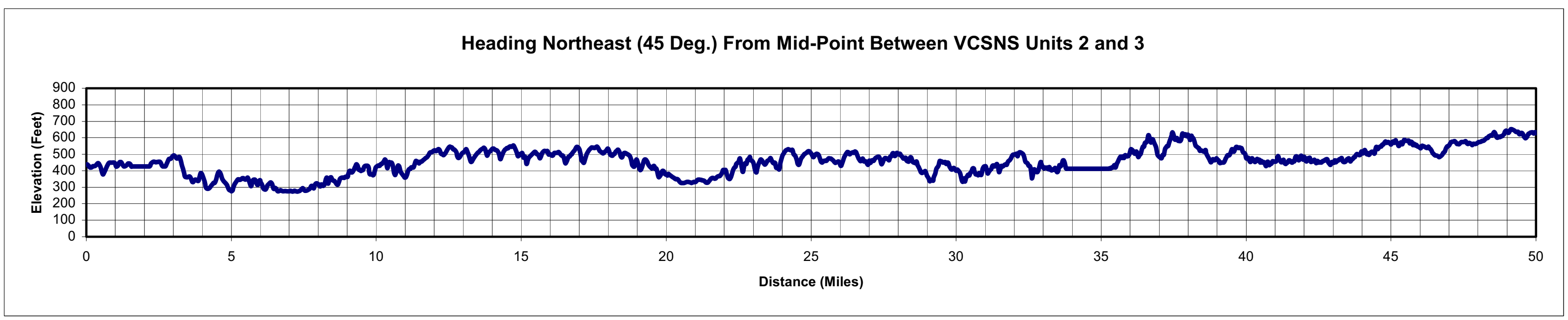


Figure 2.3-214. Site Area Map (50-Mile Radius)

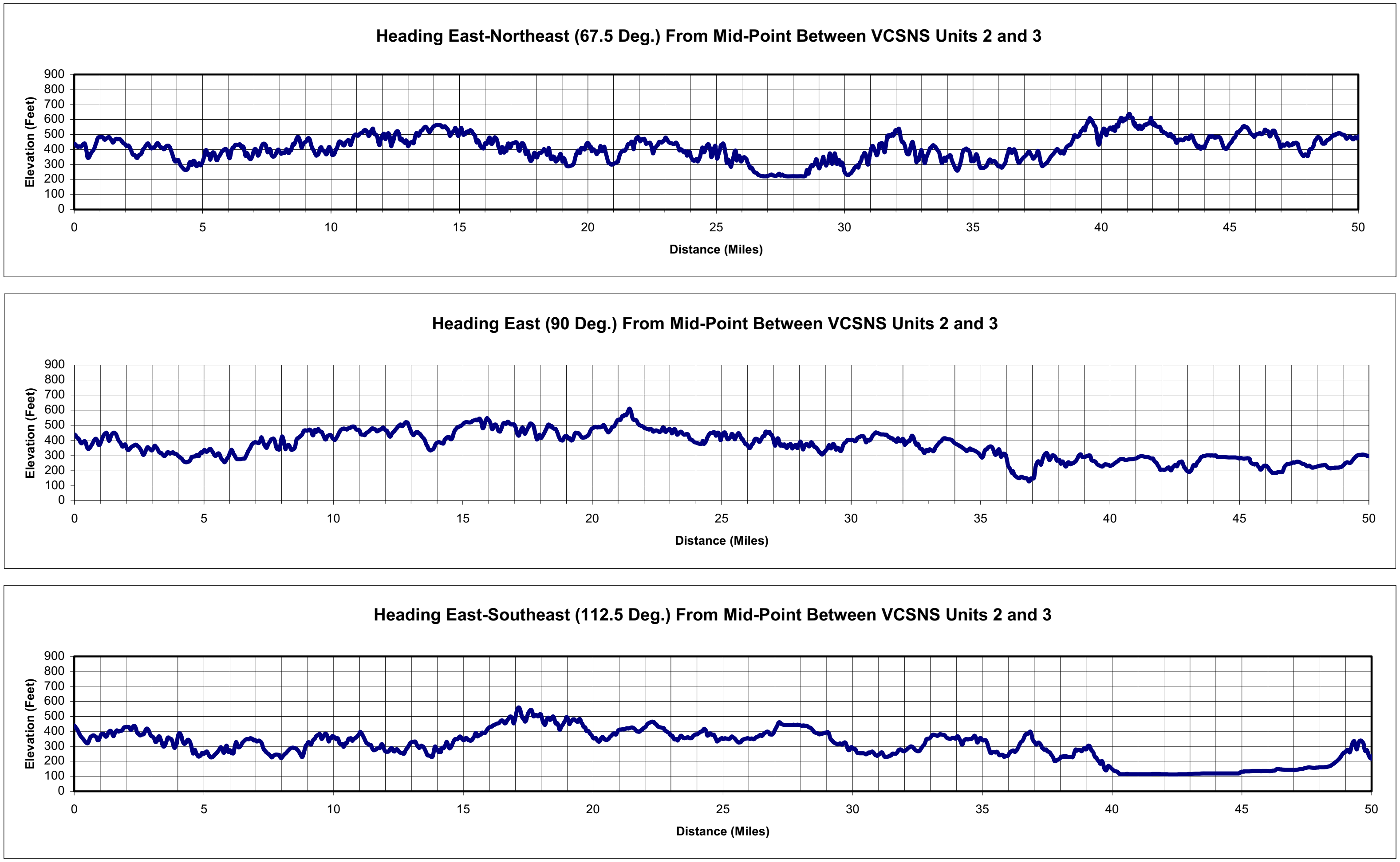






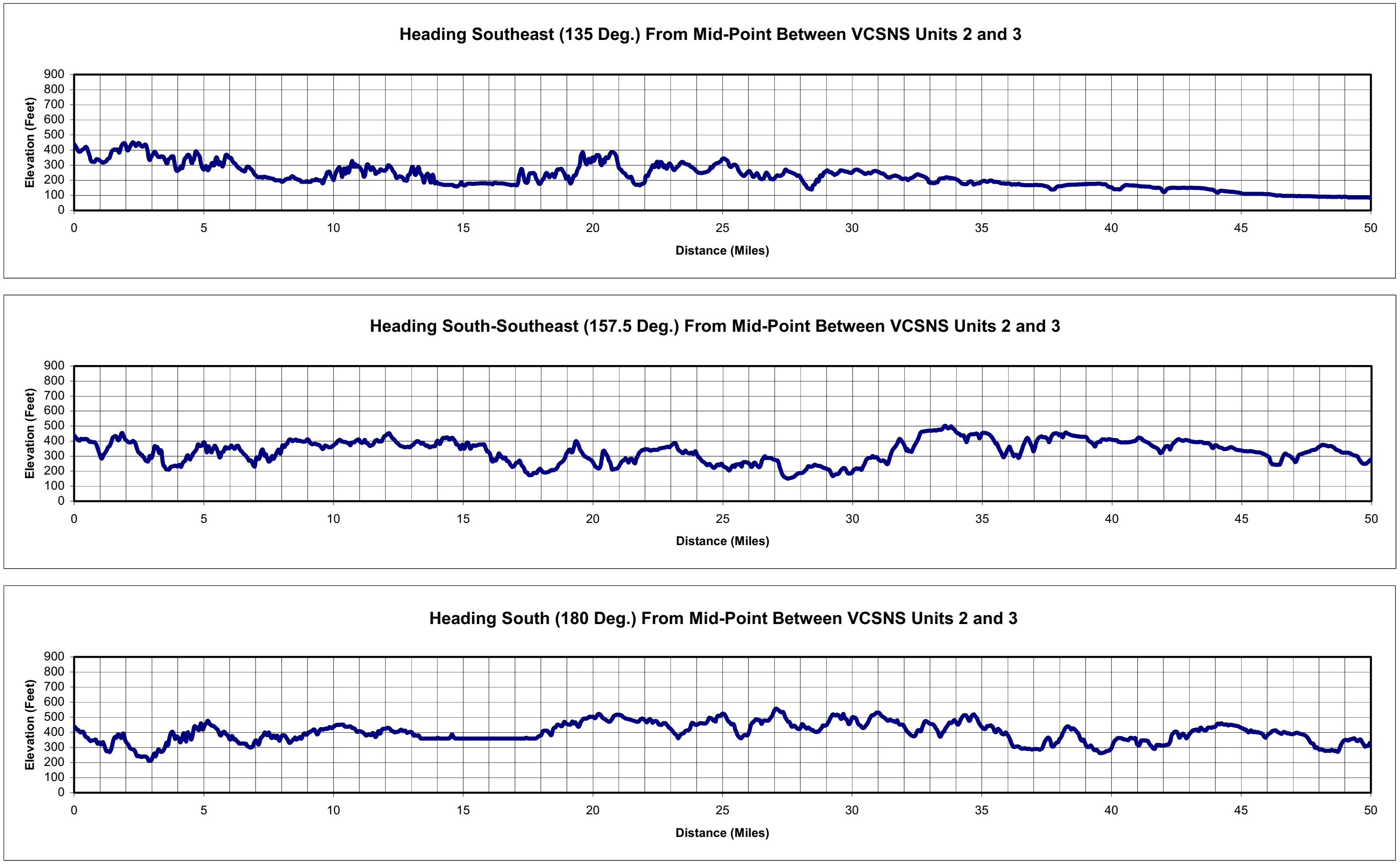
Nominal Plant Grade Elevation = 400 Feet

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



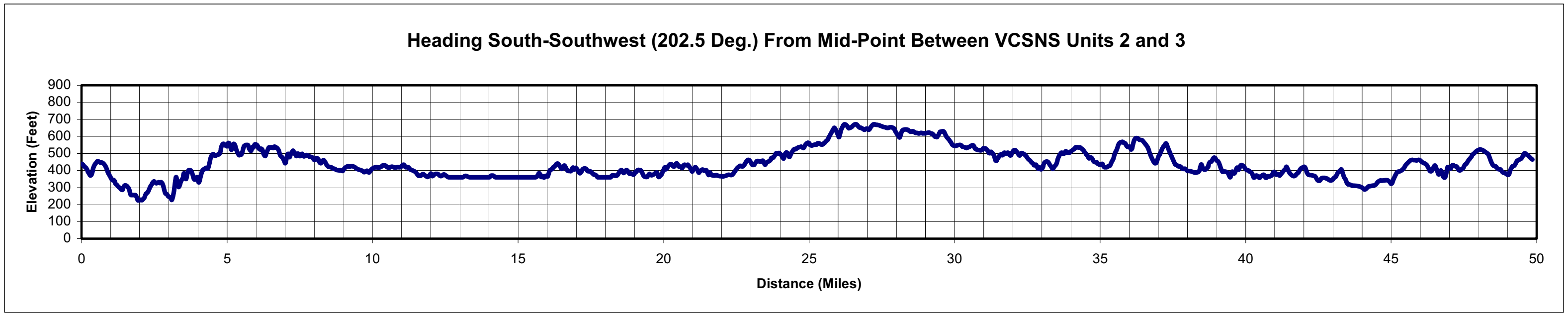
Nominal Plant Grade Elevation = 400 Feet

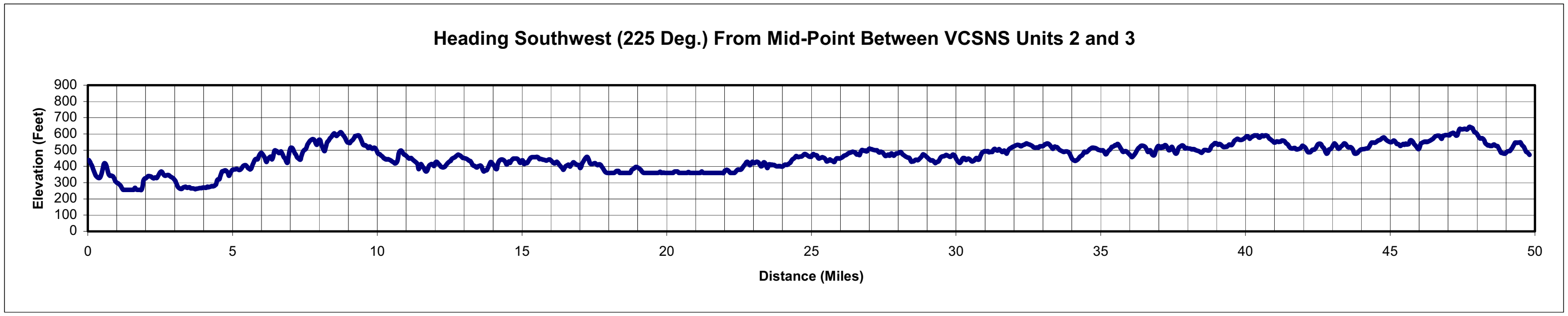
Figure 2.3-215. Terrain Elevation Profiles Within 50 Miles of the Site for Units 2 and 3 (Sheet 2 of 6)

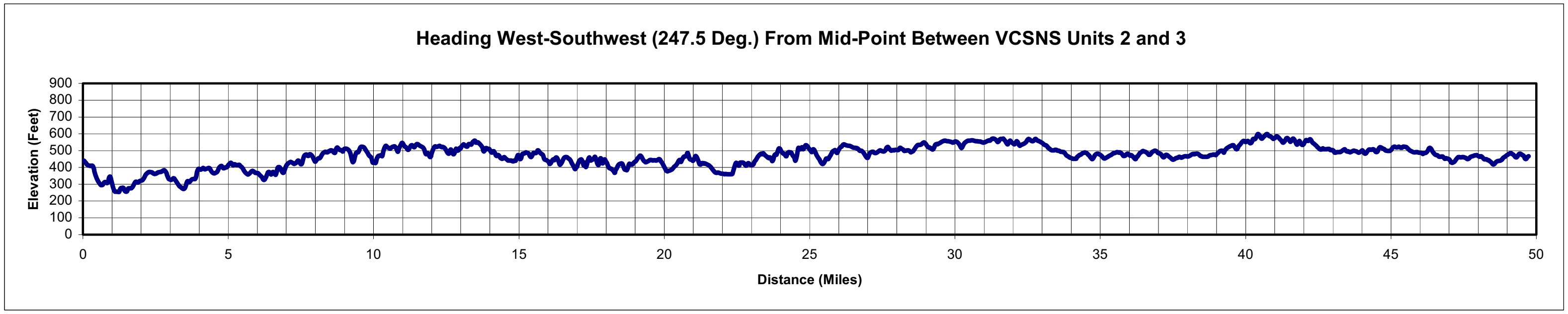


Nominal Plant Grade Elevation = 400 Feet

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

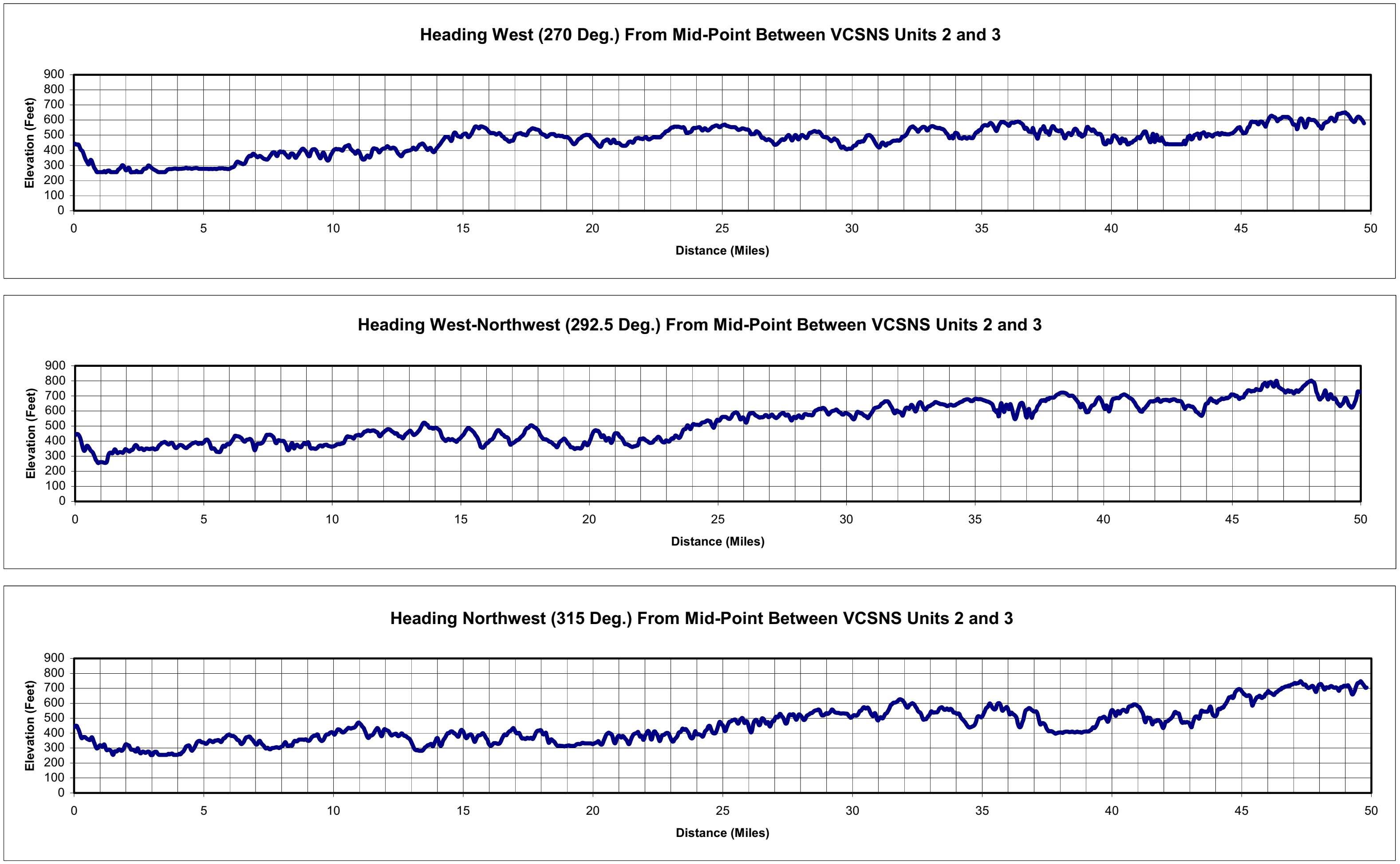






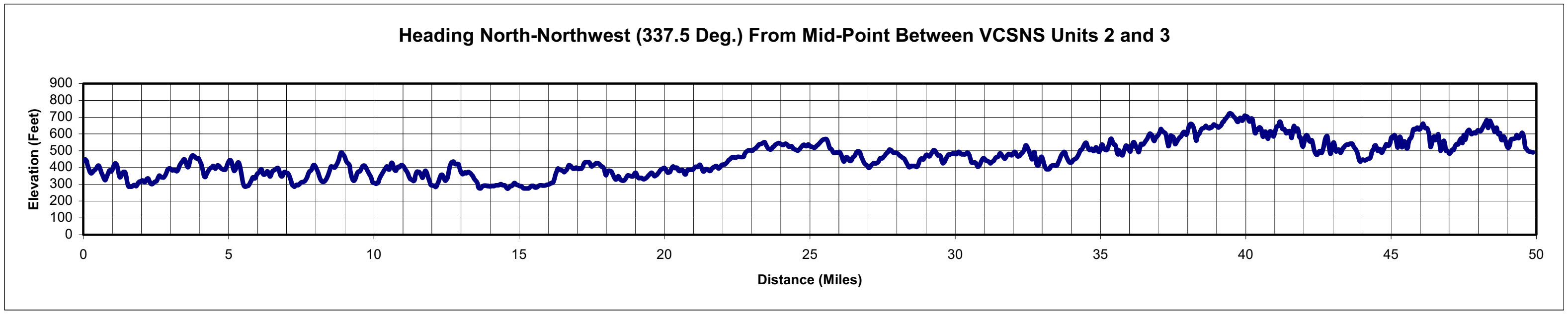
Nominal Plant Grade Elevation = 400 Feet

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)

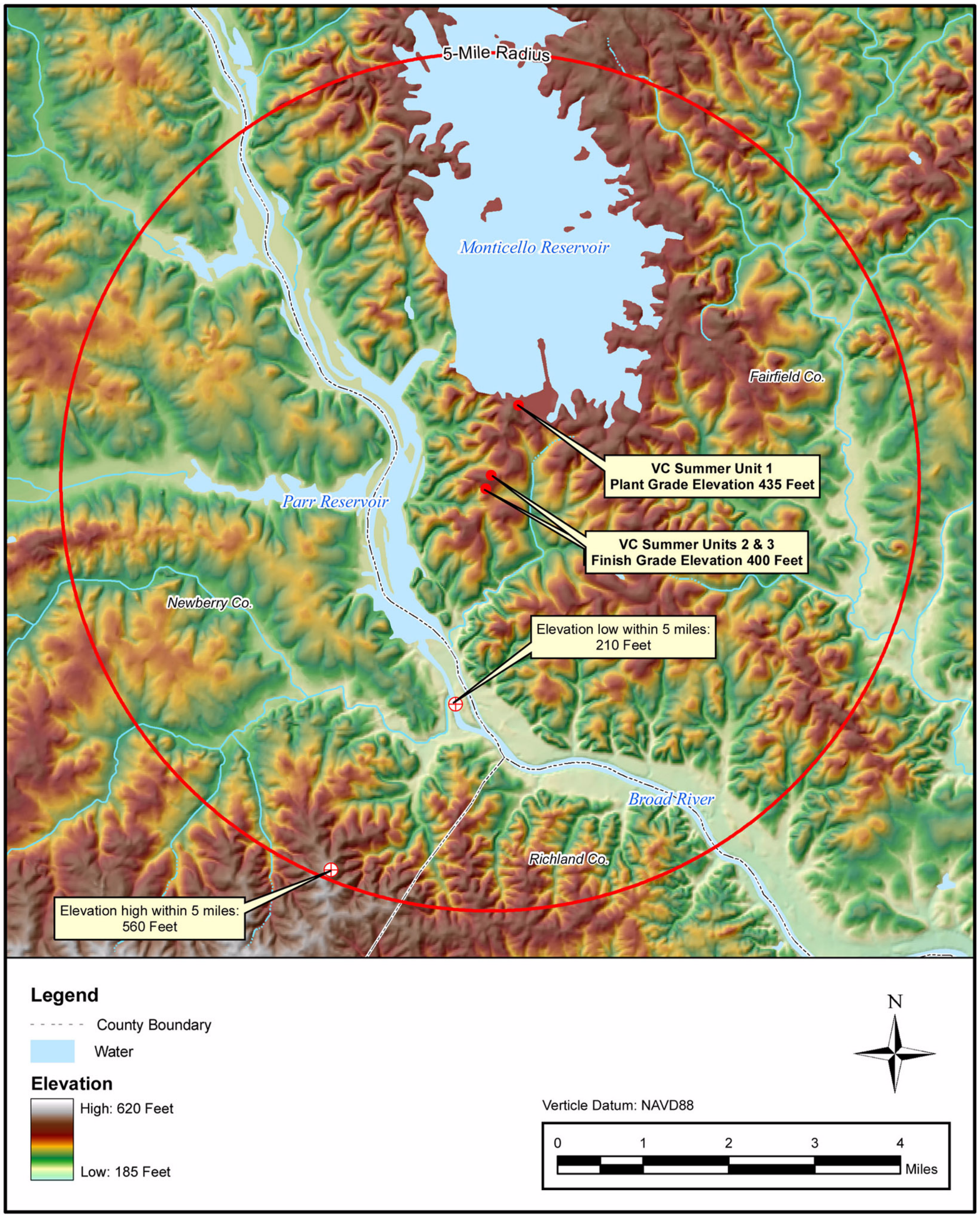


Figure 2.3-216. Site and Vicinity Map (5-Mile Radius)

Figure 2.3-217. Deleted

Figure 2.3-218. Deleted

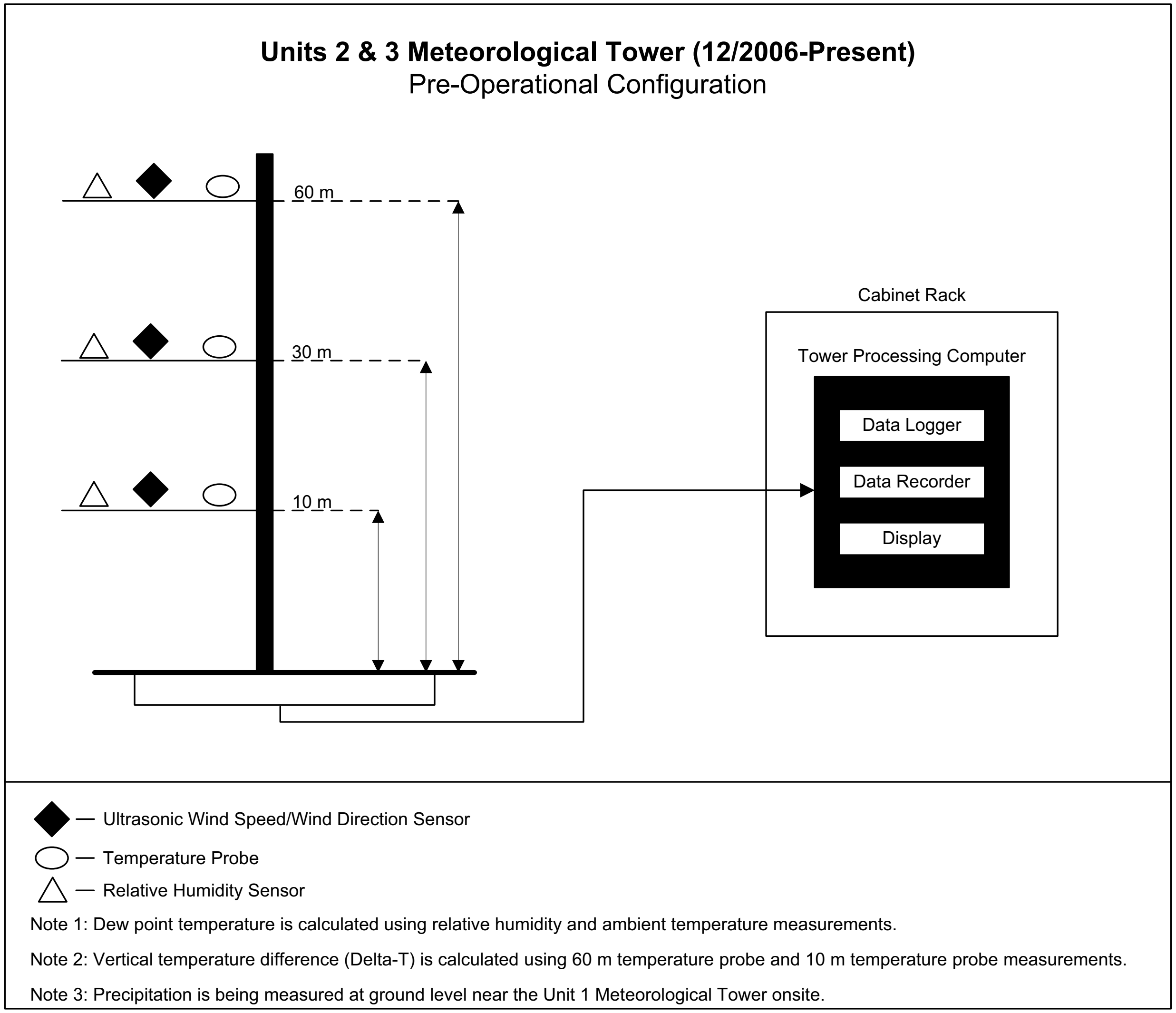
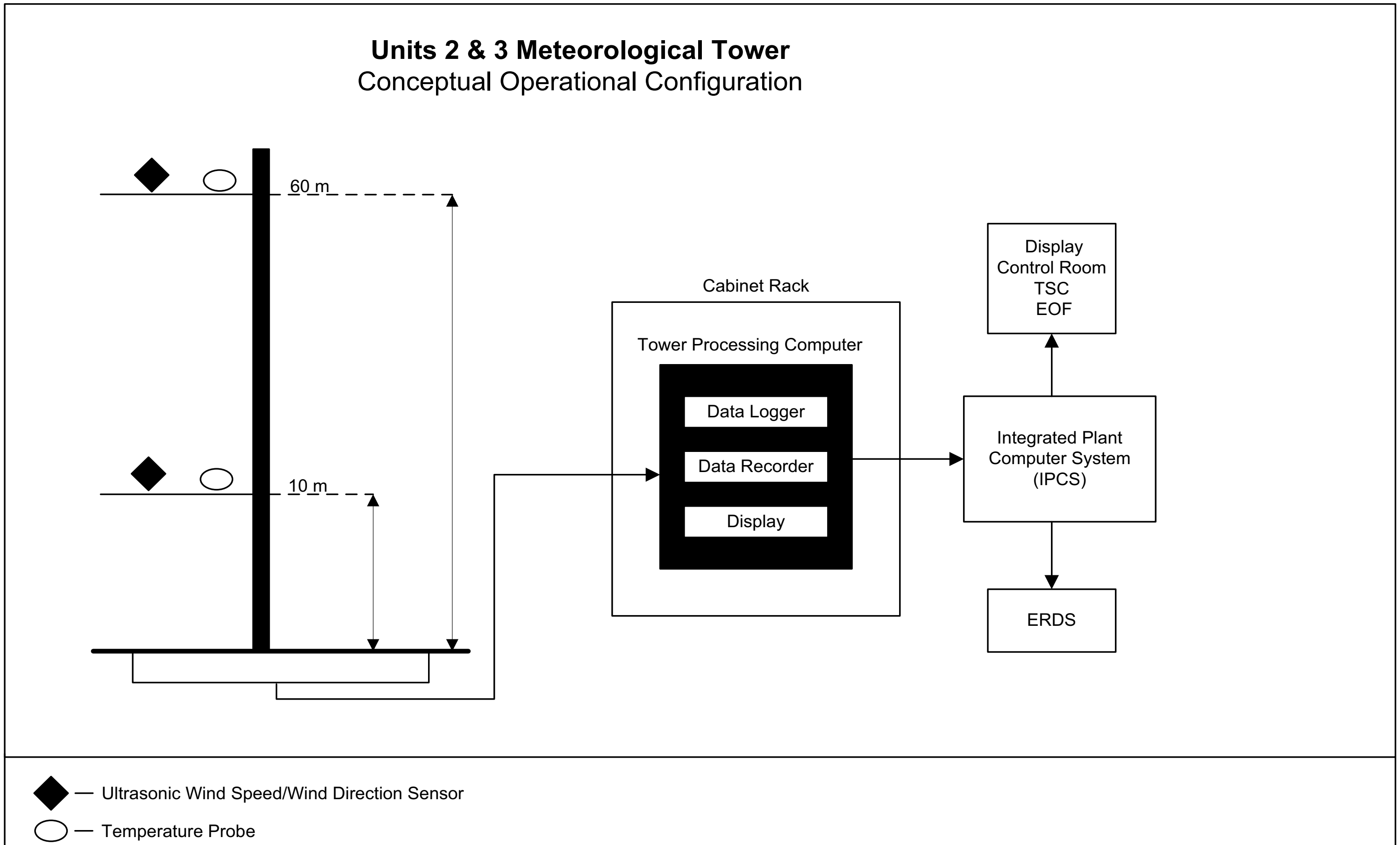


Figure 2.3-219. Units 2 and 3 Meteorological Tower System Block Diagram — Preoperational Configuration



Note 1: Vertical temperature difference (Delta-T) is calculated using 60 m temperature probe and 10 m temperature probe measurements.

Note 2: Precipitation is being measured at ground level near the Unit 1 Meteorological Tower onsite.

Note 3: ERDS is a computerized system used to provide the Nuclear Regulatory Commission with selected real-time meteorological data.

Note 4: TSC is the Technical Support Center; and EOF is the Emergency Operations Facility.

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

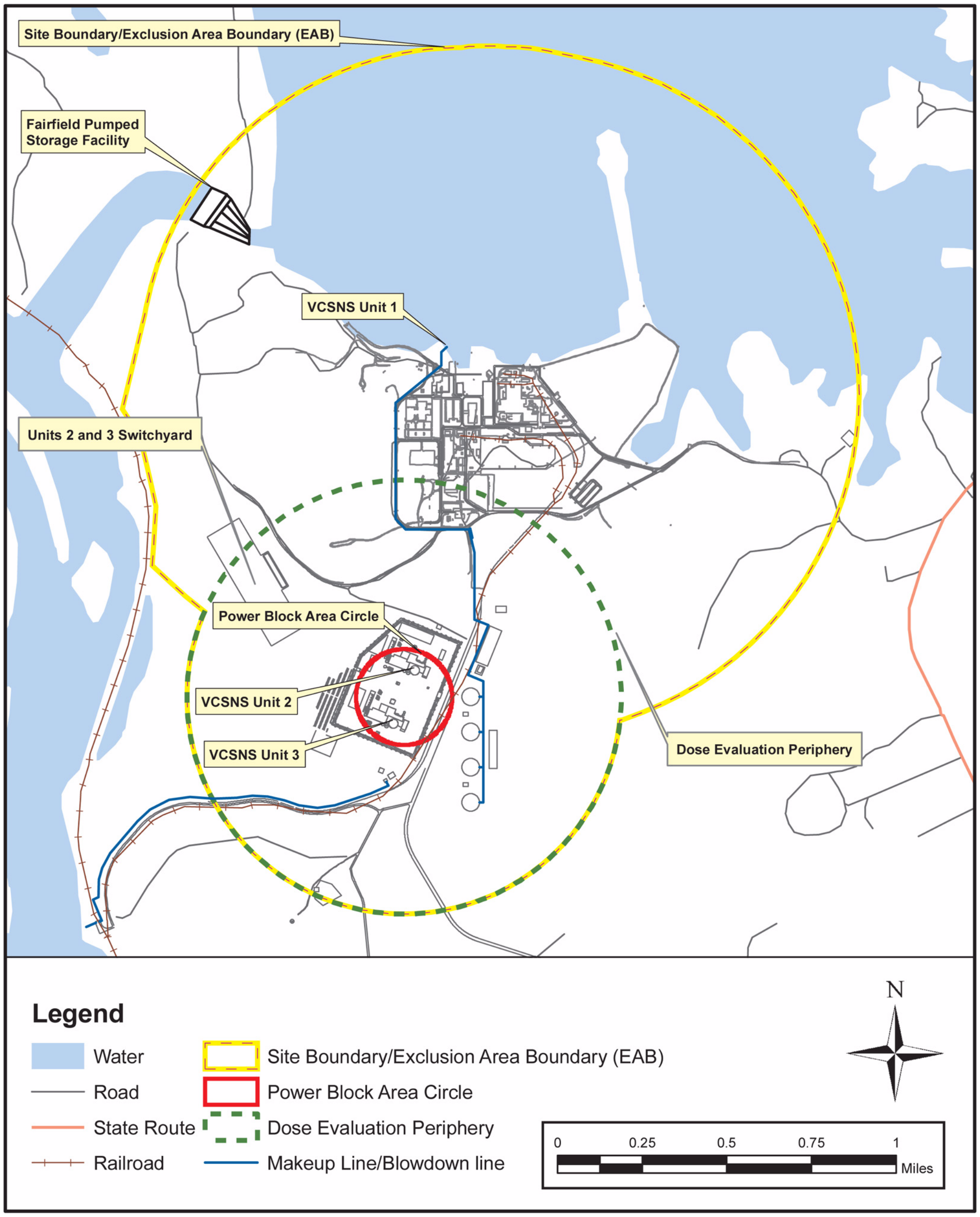


Figure 2.3-221. Site Boundary/Exclusion Area Boundary, Dose Evaluation Periphery, and Power Block Area Circle