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2.3 Local Meteorology

2.3.1 Regional Climatology

This subsection addresses various aspects of the climate in the site region and area around the VCS site. Subsection 2.3.1.1 identifies data sources used to characterize regional climatological conditions pertinent to the VCS site and vicinity. Subsection 2.3.1.2 describes large-scale general climatic features and their relationship to conditions in the site area and vicinity.

Severe weather phenomena are presented in Subsection 2.3.1.3.1 through 2.3.1.3.7.

- Subsection 2.3.1.3.1: Extreme winds
- Subsection 2.3.1.3.2: Tornados
- Subsection 2.3.1.3.3: Tropical Cyclones
- Subsection 2.3.1.3.4: Precipitation Extremes
- Subsection 2.3.1.3.5: Hail, snowstorms, and ice storms
- Subsection 2.3.1.3.6: Thunderstorms and lightning
- Subsection 2.3.1.3.7: Droughts and dust (sand) storms

Subsection 2.3.1.4 describes the meteorological conditions that would form the basis for the ultimate heat sink (UHS) design. Subsection 2.3.1.5 provides the design basis dry bulb and wet bulb temperature statistics.

Subsection 2.3.1.6 characterizes climatological conditions in the site area and region that may affect atmospheric dispersion. Finally, Subsection 2.3.1.7 addresses climate changes in the context of the sites' design bases and expected 40-year operating license period 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 70 to 80 years, and the occurrences of severe weather events in the site and region.

2.3.1.1 Data Sources

Several sources of data are used to characterize regional climatological conditions pertinent to the VCS site. This includes data acquired by the National Weather Service (NWS) at its Victoria and Palacios, Texas, first-order stations 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 Matagorda, Bee, Calhoun, DeWitt, Jackson, Lavaca, Aransas, Goliad, San Patricio, Refugio, Karnes, and Victoria counties, Texas. Table 2.3.1-1 identifies the specific stations and lists their approximate distance and direction from the power block at the site. Figure 2.3.1-1 illustrates these station locations relative to the VCS site.

The objective of selecting nearby, offsite climatological monitoring stations is to demonstrate that the mean and extreme values measured at those locations are reasonably representative of conditions that might be expected to be observed at the VCS site. The 50-mile radius circle shown in Figure 2.3.1-1 provides a relative indication of the distance between the climate observing stations and the VCS site.

The identification of stations to be included is 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 is included if it contributed one or more extreme conditions (e.g., rainfall, snowfall, maximum, or minimum temperatures) for that general direction or added context for variation of conditions over the site area.

If an overall extreme precipitation or temperature condition is identified for a station located within a reasonable distance beyond the nominal 50-mile radius and that event is considered to be reasonably representative for the site area, such stations are also included, regardless of directional coverage.

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

- *2007 Local Climatological Data, Annual Summary with Comparative Data for Victoria, Texas* (Reference 2.3.1-1)
- *Climatography of the United States, No. 20, 1971–2000, Monthly Station Climate Summaries* (Reference 2.3.1-2)
- *Climatography of the United States, No. 81, 1971–2000, U.S. Monthly Climate Normals* (Reference 2.3.1-3)
- *Utah Climate Center, Utah State University, Climate Data Base for Texas* (Reference 2.3.1-4)

- *Cooperative Summary of the Day, TD3200, Period of Record Through 2001, for the Central United States* (Reference 2.3.1-5)
- *U.S. Summary of Day Climate Data (DS 3200/3210), Period of Record, 2002–2005* (Reference 2.3.1-6)
- *U.S. Snow Climatology* (Reference 2.3.1-30)

First-order NWS stations also record measurements, typically every hour, 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 2.3.1-2 presents the long-term characteristics of these parameters, excerpted from the 2007 local climatological data (LCD) summary for the Victoria, Texas, NWS station.

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

- *Solar and Meteorological Surface Observation Network*, *1961–1990*, *Volume 2, Central U.S.* (Reference 2.3.1-7)
- *Hourly United States Weather Observations, 1990–1995* (Reference 2.3.1-8)
- *Integrated Surface Hourly Data, Central United States, 1995–1999* (Reference 2.3.1-9)
- *Hourly Weather Data for Victoria Regional Airport, Texas (1996–2000)*, *NCDC hourly data obtained through Weather Warehouse, Weather Source, LLC* (Reference 2.3.1-10)
- *2005 ASHRAE Handbook, Chapter 28, "Climatic Design Conditions"* (Reference 2.3.1-11)
- *Minimum Design Loads for Buildings and Other Structures* (Reference 2.3.1-12)
- *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 2.3.1-13)
- *Historical Hurricane Tracks Storm Query, extending from 1851,* (Reference 2.3.1-14)
- *The Climate Atlas of the United States* (Reference 2.3.1-15)
- *Storm Events for Texas, Hail, Snow and Ice, Tornado, Hurricane and Tropical Storm, and Dust Storm Event Summaries* (References 2.3.1-16, 2.3.1-17, and 2.3.1-29)

- *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 2.3.1-17)
- *Air Stagnation Climatology for the United States (1948–1998)* (Reference 2.3.1-18)
- *Ventilation Climate Information System* (References 2.3.1-19 and 2.3.1-26)
- *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 2.3.1-20)

2.3.1.2 General Climate

The VCS site is located in the south-central Texas Coastal Plain, situated approximately 35 miles to the northwest of the Gulf of Mexico (see Figure 2.3.1-1). Topographic features within 5 miles and 50 miles of the site are addressed in Subsection 2.3.2.3. Terrain in the site area is generally flat to gently rolling. Elevations range from 0 feet above MSL to the south to 550 feet above MSL to the west and northwest of the site.

The state of Texas is divided into 10 climate divisions. A climate division represents a region within a state that is as climatically homogeneous as possible. Division boundaries generally coincide with county boundaries except in the western United States. The VCS site is located near the boundaries of two separate climate divisions within the state of Texas. It is physically situated in the western portion of Climate Division TX-08 (upper coast), but also lies directly adjacent to the eastern extent of the southern portion of Climate Division TX-07 (south central) (Reference 2.3.1-20).

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

The regional climate is influenced by a semipermanent, subtropical high-pressure system over the North Atlantic Ocean—the Bermuda High (also known as the western extent of the Azores High). Due to the clockwise circulation around this high-pressure system, maritime tropical air mass characteristics prevail much of the year, especially during the summer when the Bermuda High is well developed. The Bermuda High can extend westward into the Gulf of Mexico at this time of year and, when it does, a synoptic weather type referred to as a Gulf High is said to be present (Reference 2.3.1-32).

Collectively, these systems govern late spring and summer temperature and precipitation patterns. However, the influence of this macroscale circulation feature is also evident during the transitional seasons (spring and autumn), although relatively less so during the autumn months (in terms of the wind distribution turning more easterly) when it is disrupted by the passage of relatively smaller synoptic- and meso-scale weather systems from the north. Wind direction and speed conditions for the site and surrounding area are described in more detail in Subsection 2.3.2.2.

This macro-circulation feature also has an effect on the frequency of high air pollution potential in the VCS site region. These characteristics and their relationship to the Bermuda High, especially during the summer and early autumn, are addressed in Subsection 2.3.1.6.

During winter, cold air masses increasingly 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, pick up moisture-laden air due to southeasterly airflow in advance of the system, and result in a variety of precipitation events that include rain, sleet, freezing rain, or mixtures, depending on the temperature characteristics of the weather system itself and the temperature of the underlying air (see Subsection 2.3.1.3.5).

Larger and relatively more persistent outbreaks of cold, dry air, associated with high-pressure systems that move southward out of Canada, also occasionally affect the site region. These weather conditions are moderated by the Gulf of Mexico immediately to the south and due to surface heating (during the day) as the air mass passes over the land.

The Gulf High synoptic weather type can also occur during the winter and spring when continental polar high-pressure systems move southward over eastern Texas or Louisiana (Reference 2.3.1-32) bringing modified polar air with southerly to southeasterly wind flows in the VCS site area.

Monthly precipitation exhibits a cyclical pattern, with the predominant maximum period occurring from late spring into early summer, and a secondary maximum period from early to mid-autumn (see Table 2.3.1-2). The late spring/early summer maximum is due primarily to thunderstorm activity. The early to mid-autumn secondary maximum is associated with thunderstorms and heavy rains which accompany tropical systems that occasionally move through the region (see Subsection 2.3.1.3.3). The VCS site is located close enough to the Gulf of Mexico that the strong winds associated with tropical cyclones can also have a significant effect on the site area.

2.3.1.3 Severe Weather

2.3.1.3.1 Extreme Winds

The frequency of peak wind speed gusts can be characterized from information in the *Climate Atlas of the United States* (Reference 2.3.1-15), which is based on observations made over the 30-year period of record from 1961 to 1990. Frequencies of occurrence were developed from values reported as the 5-second peak gust for the day. Mean annual occurrences of peak gusts greater than or equal to 50 miles per hour (mph), 40 mph, and 30 mph in the VCS site area range between 1.5 and 2.4 days per year, 9.5 and 20.4 days per year, and 60.5 and 80.4 days per year, respectively.

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 2.3.1-12).

The "basic" windspeed is approximately 113 mph, as estimated by linear interpolation from the plot of basic wind speeds in Figure 6-1A of ASCE 7-05 (Reference 2.3.1-12) for that portion of the United States that includes the VCS site. The site is located in a hurricane-prone region as defined in Section 6.2 of the ASCE-SEI design standard. This value is associated with a mean recurrence interval of 50 years. Section C6.0 (Table C6-3) of the ASCE-SEI design standard provides conversion factors for estimating the 3-second gust wind speeds for other recurrence intervals (Reference 2.3.1-12). Based on this guidance, the 100-year return period value is determined by multiplying the 50-year return period value by a factor of 1.07, which yields a 100-year return period 3-second gust wind speed for the site of approximately 121 mph.

The National Oceanic and Atmospheric Administration's Coastal Services Center (NOAA-CSC) provides a comprehensive historical database of tropical cyclone tracks, extending from 1851, based on information compiled by the National Hurricane Center. This database indicates that a total of 62 tropical cyclone storm tracks have passed within a 100-nautical-mile radius of the VCS site during this historical period (Reference 2.3.1-14). The maximum wind speed observed in the site region was from an unnamed storm in 1886. The peak 1-minute wind speed for the storm is reported as 155 mph. This was converted, using the method detailed in Reference 2.3.1-38, to an equivalent peak 3-second gust of 160 mph for the VCS site. This wind speed accounts for the change in roughness as the hurricane makes landfall and is representative of the transition that all hurricanes undergo as they move inland. This is similar to peak winds observed inland during Hurricane Carla (September 1961) and Hurricane Celia (180 mph adjusted for increased surface roughness to 154 mph inland, August 1970) (References 2.3.1-14, 2.3.1-17, and 2.3.1-28).

2.3.1.3.2 Tornadoes

The design basis tornado characteristics applicable to structures, systems, and components (SSCs) important to safety include the following parameters as identified in RG 1.76 (Reference 2.3.1-21):

- Maximum wind speed
- Translational speed
- Maximum rotational speed

- Radius of maximum rotational speed
- Pressure drop
- Rate of pressure drop

Based on Figure 1 of RG 1.76, the VCS site is located within Tornado Intensity Region II. Accordingly, the tornado-related site characteristics for VCS are:

- Maximum wind speed = 200 mph
- Translational speed = 40 mph
- Maximum rotational speed = 160 mph
- Radius of maximum rotational speed = 150 feet
- Pressure drop = 0.9 pounds per square inch (psi)
- Rate of pressure drop = 0.4 psi/sec

Revision 1 of RG 1.76 retains the 10^{-7} exceedance probability for tornado wind speeds, the same as the original version of that regulatory guide. Revision 2 of NUREG/CR-4461 (Reference 2.3.1-22) describes the relationship between the 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. That document is the basis for most of the technical revisions to RG 1.76.

Tornadoes observed within a 2-degree latitude and longitude square, centered on the VCS site, are used to characterize their frequency of occurrence from a climatological standpoint. The data was obtained from the NCDC *Storm Events* database of tornado occurrences by location, date, and time, starting and ending coordinates, Fujita-scale wind speed classification (or F-scale), Pearson-scale path length and path-width dimensions (or P-scale), and other storm-related statistics (Reference 2.3.1-27).

The 2–degree square area for this evaluation includes all or portions of 25 counties in Texas. All tornado occurrences for a given county are included even if some portion of the county was not within the 2–degree latitude/longitude square. Through the nearly 58-year period from 1950 through September 2007, the records in the database indicate that a total of 784 tornadoes occurred in these counties (Reference 2.3.1-27).

Tornado F-scale classifications and respective frequencies of occurrence are as follows:

- F5 = 0
- F4 = 1
- F3 = 23
- F2 = 81
- F1 = 230
- F0 = 372

An additional 77 tornadoes were not assigned an F-scale in the *Storm Events* database and are assumed to be comparable to an F0 classification (Reference 2.3.1-27).

Tornadoes have occurred in the VCS site area during all months of the year with nearly identical peak frequencies in the autumn and spring (approximately 36 and 33 percent, respectively). On a monthly basis, the greatest number of events has been recorded in September (i.e., 160) followed by the second-highest count during the month of May (i.e., 146), together accounting for 39 percent of the tornadoes that occur in the site area on an annual basis. Less than 10 percent of all tornadoes have occurred during the winter months (Reference 2.3.1-27).

2.3.1.3.3 Tropical Cyclones

Tropical cyclones include not only hurricanes and tropical storms, but systems classified as tropical depressions, subtropical storms, subtropical depressions, and extratropical storms. 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 and extreme wind events as they travel through the site region.

The National Oceanic and Atmospheric Administration’s Coastal Services Center (NOAA-CSC) provides a comprehensive historical database of tropical cyclone tracks based on information compiled by the National Hurricane Center. This database indicates that a total of 62 tropical cyclone centers or storm tracks have passed within a 100-nautical-mile radius of the VCS site, during this historical period (Reference 2.3.1-14). Storm classifications and respective frequencies of occurrence over this 158-year period of record (1851–2008) are as follows:

- Hurricanes — Category 5 (1), Category 4 (5), Category 3 (5), Category 2 (6), Category 1 (16)
- Tropical storms — 24

- Tropical depressions — 5
- Subtropical storms — 0
- Subtropical depressions — 0
- Extratropical storms — 0

Wind speeds (1-minute average) corresponding to each of the Saffir-Simpson Hurricane Categories are listed below:

Tropical cyclones within this 100-nautical-mile radius have occurred as early as June and as late as October, with the highest frequency (19 out of 62 events) recorded during September, including all classifications at and above tropical depression status. June, July, and August account for 14, 12, and 13 events, respectively. Tropical storms have occurred in all months from June to October. During the months of June through September, hurricanes occur with similar frequency (7, 6, 8, and 9, respectively). The only Category 5 hurricane to track within 100 nautical miles of the VCS site was Hurricane Carla in September 1961. Of the five Category 4 hurricanes that have occurred within this radial distance, four were recorded in August and one in September. Two Category 3 hurricanes occurred in September and one each in July, August, and October. Most major hurricanes in the site area have occurred from mid- to late-summer (Reference 2.3.1-14).

Tropical cyclones are responsible for at least 16 separate rainfall records among the 15 NWS and cooperative observer network stations listed in Table 2.3.1-1—four 24-hour (daily) rainfall totals and 12 monthly rainfall totals (see Table 2.3.1-3). In late June 1960, two 24-hour records were set at the Maurbro and Point Comfort cooperative observing stations due to an unnamed tropical storm—14.80 inches and 14.65 inches, respectively. Rainfall associated with Hurricane Beulah in late September 1967, whose track did not pass within 100 nautical miles of the VCS site, nevertheless, resulted in historical 24-hour maximum totals of 10.61 inches at the Beeville 5 NE station and 9.16 inches at the Goliad observing station (References 2.3.1-2, 2.3.1-4, 2.3.1-5, and 2.3.1-14).

Monthly station records were established due to partial contributions from the following tropical cyclones (References 2.3.1-1, 2.3.1-4, 2.3.1-5, 2.3.1-14, and 2.3.1-33):

- Hurricane Fern in September 1971 (26.30 inches at Refugio)
- Hurricane Beulah in September 1967 (25.59 inches at Sinton, 22.62 inches at Beeville 5 NE, 22.60 inches at Karnes City 2N, 22.19 inches at Goliad, 21.27 inches at Cuero, and 20.85 inches at Rockport)

- An unnamed tropical storm in June 1960 (25.24 inches at Point Comfort and 22.47 inches at Maurbro)
- An unnamed hurricane in October 1949 (24.28 inches at Palacios Municipal Airport)
- Tropical Storm Erin in July 2007 (22.65 inches at Aransas Wildlife Refuge and 20.35 inches at the Victoria Regional Airport)

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 VCS site, are:

- Hurricane Carla (September 1961). The storm remained at hurricane strength as it crossed the area within 100 nautical miles of the VCS site. Carla rapidly decreased in intensity after moving onshore (having reached Category 5 status while offshore, but decreasing to a Category 3 hurricane at landfall). The storm was downgraded to tropical storm status just northeast of Austin, Texas. (References 2.3.1-14, 2.3.1-17, and 2.3.1-28)
- Hurricane Celia (August 1970). Celia crossed the Texas coastline approximately 50 miles south-southwest of the VCS site, between Corpus Christi and Aransas Pass. It remained a Category 3 hurricane for approximately 40 miles inland, decreasing to a Category 1 storm as it traversed the remainder of the area within 100 nautical miles of the site. Celia was downgraded to tropical storm status approximately 135 miles inland from the coast. (References 2.3.1-14 and 2.3.1-17)
- Hurricane Claudette (July 2003). Hurricane Claudette (Category 1) struck the middle Texas coast near Port O'Connor with sustained winds estimated around 90 mph. At Point Comfort, the Formosa Plant measured sustained winds of 80 mph with a gust to 100 mph. Claudette continued moving inland across Victoria, Goliad, and Bee counties, eventually weakening to a tropical storm. Maximum rainfall measurements were recorded in Bee, Goliad, and Refugio counties (References 2.3.1-14 and 2.3.1-29).

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 vary from station to station. Assessing the variability of precipitation extremes over the VCS site area, in an effort to evaluate whether the available long-term data is representative of conditions at the site, largely depends on station coverage.

Historical precipitation extremes (rainfall and snowfall) are presented in Table 2.3.1-3 for the 15 nearby climatological observing stations listed in Table 2.3.1-1. Based on the maximum 24-hour and monthly precipitation totals recorded among these stations in the VCS site area 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 VCS site.

As indicated in Subsection 2.3.1.3.3, most of the individual station monthly rainfall records (and to a lesser extent the 24-hour record totals) were established as a result of precipitation associated with tropical cyclones. Of those records, half were due to tropical cyclones that passed within a 100-nautical-mile radius of the VCS site. The other half (i.e., 6 monthly totals and two 24-hour totals) were attributable to the expansive influence of Hurricane Beulah which did not pass within that radial distance of the site.

However, the highest 24-hour rainfall total in the site area, 17.58 inches, on October 18, 1994, at the Edna Highway 59 Bridge cooperative observing station (Reference 2.3.1-4), approximately 32 miles northeast of the VCS site, was not directly associated with a tropical cyclone. Rather, this extreme rainfall event was one of many over southeast Texas caused by a synoptic situation that included a steady stream of tropical moisture into the region in the wake of former Pacific Hurricane Rosa (which crossed into Mexico, moved through Texas, and slowed after entering the Mississippi Valley), and a quasi-stationary frontal boundary along the Texas Coast that provided a source of lift and supported widespread and continual thunderstorm development (Reference 2.3.1-17).

The highest monthly rainfall total in the site area, 26.30 inches during September 1971, was recorded at the Refugio cooperative observing station (References 2.3.1-4 and 2.3.1-33), located approximately 25 miles to the southwest of the VCS site.

In general, when monthly rainfall records were established at a given observing station, regardless of their cause(s), significant amounts of precipitation were usually measured at most of the other stations in the site area, particularly when associated with the passage of tropical cyclones. This is usually not the case for maximum 24-hour rainfall records because of the occurrence of more local-scale events such as thunderstorms and because of the intense nature of these storms in this coastal area. However, there does not appear to be any clear relationship between the rainfall recorded during such extreme events, whether on a 24-hour or monthly basis, and the distance inland within the area considered around the VCS site (see Figure 2.3.1-1). Therefore, based on the range of the maximum recorded 24-hour and monthly rainfall totals among these stations, the areal distribution of these climatological observing stations around the site, and their proximity to the site, the data suggests that rainfall extremes close to the upper limits of the respective maxima can reasonably be expected to occur at the VCS site.

Although the disruptive effects of any winter storm accompanied by frozen precipitation can be significant in South Texas, storms that produce measurable amounts of snow are rare. As Table 2.3.1-3 indicates, 24-hour and monthly maximum snowfall records were established over a number of years based on the available periods of record. The most recent event, the Christmas Storm of 2004 (December 25, 2004), was responsible for the overall highest 24-hour and monthly totals recorded for the site area (12 inches, in both cases) measured at the Goliad cooperative observing station, approximately 22 miles west of the VCS site (References 2.3.1-4, 2.3.1-6, and 2.3.1-33). Twenty-four hour snowfall records set at six other nearby observing stations on this date (see Table 2.3.1-3) range from 4.5 inches at Beeville 5 NE, approximately 42 miles to the west-southwest, to 9.5 inches at Refugio 2 NW, approximately 25 miles to the southwest (References 2.3.1-4 and 2.3.1-6).

Estimation of design basis snow load on the roofs of safety-related structures considers the following climate-related components as described in Interim Staff Guidance, Assessment of Normal and Extreme Winter Precipitation Loads on the Roofs of Seismic Category Structures (Reference 2.3.1-23):

Normal Winter Precipitation Events are selected from the highest of:

- 100-year return snowpack (snow cover)
- Historical snowpack (snow cover)
- 100-year return snowfall event
- Historical maximum snowfall event

Extreme Frozen Precipitation Events are selected from the highest of:

- 100-year return snowfall event
- Historical maximum snowfall event

Extreme Liquid Winter Precipitation Event is:

- 48-hour Probable Maximum Winter Precipitation (PMWP) depth

Table 2.3.1-3 presents the climatic parameters used to evaluate the winter precipitation loads as described below.

Based on Figure 7-1 of the ASCE-SEI design standard, *Minimum Design Loads for Buildings and Other Structures* (Reference 2.3.1-12), the 50-year return period ground-level snowpack for the VCS site area is 0 pounds per square foot. Section C7.0 of this design standard provides conversion factors for estimating ground-level snowpack values for other recurrence intervals. A 100-year return period value is determined by dividing the 50-year ground-level snowpack by a factor of 0.82. In this case, however, the 50-year and the 100-year return period values would both be 0 pounds per square foot.

In lieu of a 100-year return period ground-level snowpack value based on the ASCE-SEI design standard, the weight of the overall maximum snowfall event recorded in the VCS site area has been estimated. As indicated previously, the highest 24-hour snowfall total (12 inches) occurred on December 25, 2004, at the Goliad cooperative observing station. It is assumed that all snow remained on the ground for an extended period of time and that a nominal snow density (i.e., the ratio of the volume of melted snow to the volume of snow) of 0.15 applies (Reference 2.3.1-23). This ratio represents the maximum value recommended in estimating liquid precipitation equivalents during snowfall events. Therefore, the liquid equivalent for this maximum snowfall event would be 1.8 inches of water. Based on the relationship of 1 inch of water being equivalent to 5.2 pounds per square foot, the estimated weight of the maximum recorded snowfall event would be 9.4 pounds per square foot.

The 48-hour PMWP component (unadjusted) for evaluating extreme live loads (as indicated above) is derived from plots of 6-, 24- and 72-hour, 10-square mile area, monthly probable maximum precipitation (PMP) estimates as presented in NUREG/CR-1486 (Reference 2.3.1-13). The highest winter season (December through February) PMP values for the VCS site region occur in January–February and are approximately 17, 28, and 36 inches, respectively, for these time intervals (Figures 16, 26, and 36 of Reference 2.3.1-13).

The 48-hour PMWP value (unadjusted), estimated by logarithmic interpolation on the curve defined by the 6-, 24-, and 72-hour PMP values for January–February, is 34.0 inches liquid depth, which is equivalent to 177 pounds per square foot.

According to the Interim Staff Guidance (Reference 2.3.1-23), the extreme winter precipitation event snow load is the sum of (a) the normal winter precipitation and extreme frozen precipitation or (b) the sum of the normal winter precipitation and extreme liquid winter precipitation, whichever is higher. As a result, the extreme winter precipitation snow load is either 18.8 pounds per square foot or 186.4 pounds per square foot, respectively, depending upon the roof design. With 18.8 pounds per square foot load applied to designs that can demonstrate that the water would not accumulate on the roof, and 186.4 pounds per square foot for those designs that cannot demonstrate that the roof can drain in extreme winter conditions.

2.3.1.3.5 Hail, Snowstorms, and Ice Storms

Frozen precipitation in the VCS site region typically occurs in the form of hail, snow, sleet, and freezing rain. The frequency of occurrence and characteristics of these types of weather events are based on the following two references: the latest version of *The Climate Atlas of the United States*

(Reference 2.3.1-15), which has been developed from observations made over the 30-year period of record from 1961 to 1990, and the NCDC *Storm Events* database for Texas (Reference 2.3.1-16) based on observations over the period of January 1950 to March 2007.

Hail can occur at any time of the year in the site area and is associated with intense thunderstorms. It has been observed primarily during the late winter through early summer months (February through June), reaching a peak during May and April, and occurring least often from mid-summer into early autumn (July through September) (Reference 2.3.1-16).

The *Climate Atlas* (Reference 2.3.1-15) indicates that the northern two-thirds of Victoria County and most of DeWitt County to the northwest can expect, on average, hail with diameters of 0.75 inch or greater approximately 1 to 2 days per year. The *Climate Atlas* also shows a similar frequency in smaller portions of the adjacent or nearby counties of Goliad, Karnes, Jackson, Bee, and San Patricio. However, a relatively lower frequency of occurrence is indicated for most of the area in these counties; that is, approximately 1 day per year for hail 0.75 inch or greater in diameter. Other nearby counties of Matagorda, Calhoun, Refugio, and Aransas, which are directly adjacent to the Gulf of Mexico, can also expect 0.75-inch or greater hail approximately 1 day or less per year. The *Climate Atlas* indicates that the occurrence of hail with diameters greater than or equal to 1.0 inch is relatively less frequent over the site area (Reference 2.3.1-15).

Hailstorm events are point observations and somewhat dependent on population density. This may explain the areal extent of higher frequencies around Victoria and the eastern half of DeWitt County, and what could be interpreted as generally lower frequencies of occurrence in the other nearby counties not directly adjacent to the Gulf of Mexico. A decrease in frequency of occurrence towards the coast appears to be reasonable. The slightly higher annual mean frequency of approximately 1 to 2 days per year with hail greater than or equal to 0.75 inch in diameter is considered to be a representative indicator for the VCS site.

Hailstorm events within Victoria and surrounding counties have generally reported maximum hailstone diameters ranging between 2.0 and 4.5 inches. Golfball-size hail (approximately 1.75 inches in diameter) is not a rare occurrence, having been observed numerous times in the site area. However, in terms of extreme hailstorm events, the NCDC *Storm Events* database indicates that grapefruit- to softball-size hail (approximately 4.0 to 4.5 inches in diameter, respectively) was observed on three occasions within 50 miles of the VCS site:

- April 11, 1995 (4.5 inches), in Calhoun County, approximately 30 miles to the southeast of the VCS site
- February 19, 1991 (4.5 inches), in DeWitt County, approximately 45 miles to the north-northwest

- May 25, 1961 (4.0 inches), in Lavaca County approximately 40 miles to the north-northwest

From central Texas southward, most winters bring no accumulation of snowfall. Freak snowstorms occur only once every few decades, but no corner of the state is immune (Reference 2.3.1-16). Any accumulation of snow is a rare occurrence in the upper coast climate division where the VCS site is located, with normal annual totals at all observing stations averaging less than 0.5 inch. Historical records for the site area indicate that maximum 24-hour and monthly snowfalls have occurred during the months of November through February (see Table 2.3.1-3). The *Climate Atlas* (Reference 2.3.1-15) indicates that the occurrence of snowfalls 0.1 inch or greater in the VCS site area average less than 1 day per year (see also Table 2.3.1-2). Additional details regarding maximum 24-hour and cumulative monthly record snowfall totals are given in Subsection 2.3.1.3.4.

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 VCS site region. In most cases, freezing rain results from the process of warm moist air "overrunning" colder air and is caused by rain falling into a relatively shallow layer of cold air with temperatures either at or just below the freezing point. Arctic air masses that reach the upper coast climate division in the winter season are typically very shallow and have been known to produce ice storms. The *Climate Atlas* (Reference 2.3.1-15) indicates that, on average, freezing precipitation occurs approximately 3 to 5 days per year in the area that includes the VCS site.

From an operational standpoint, ice storm effects often include hazardous driving conditions, and occasionally downed trees and power lines due to ice buildup on these surfaces. The NCDC *Storm Data* and *Storm Events* summaries (References 2.3.1-17 and 2.3.1-16, respectively) for the VCS site area frequently do not include statements of ice accumulation which suggests that the amounts are light. The effects of winter precipitation have been addressed in the preceding subsection from a design basis perspective.

2.3.1.3.6 Thunderstorms and Lightning

Thunderstorms can occur in the VCS site area at any time during the year. Based on a 48-year period of record, Victoria, Texas, averages approximately 56 thunderstorm-days (i.e., days on which thunder is heard at an observing station) per year. On average, August has the highest monthly frequency of occurrence—approximately 10 days. Annually, more than half (approximately 57 percent) of thunderstorm-days are recorded between early summer and early autumn (i.e., from June through September). From November through February, a thunderstorm might be expected to occur approximately 2 days per month (Reference 2.3.1-1).

The mean frequency of lightning strokes to earth can be estimated using a method attributed to the Electric Power Research Institute, as reported by the U.S. Department of Agriculture Rural Utilities Service in the publication titled *Summary of Items of Engineering Interest* (Reference 2.3.1-24). This methodology assumes a relationship between the average number of thunderstorm-days per year (T) and the number of lightning strokes to earth per square mile per year (N), where:

$$N = 0.31T$$

Based on the average number of thunderstorm-days per year at Victoria, Texas (i.e., approximately 56; see Table 2.3.1-2), the frequency of lightning strokes to earth per square mile is approximately 17 per year for the VCS site area. This frequency is essentially equivalent to the mean of the 10-year (1989 to 1999) lightning flash density for the area that includes the VCS site, as reported by the NWS—6 to 8 flashes per square kilometer per year (Reference 2.3.1-25)—and, therefore, is considered to be a reasonable indicator.

The VCS power block area is shown in Figure 2.3.3-1 as a rectangular area encompassing both units and covering 77.9 acres or approximately 0.122 square miles. Given the estimated annual average frequency of lightning strokes to earth in the VCS site area, the frequency of lightning strokes in the power block area can be estimated as follows:

(17 lightning strokes/square miles/year) x (0.122 square miles) = 2.07 lightning strokes/year, or approximately twice each year.

2.3.1.3.7 Droughts and Dust (Sand) Storms

Droughts are prolonged periods of very dry weather, which cause serious water imbalances in the affected area. The Upper Coast climate division, where the VCS site is located, is commonly affected by drought conditions. However, the most severe droughts occur in west and northwestern Texas where the southwestern desert of the United States extends (Reference 2.3.1-34). Subsection 2.4.11 describes the effect of droughts on the VCS cooling system (water sources such as the Guadalupe River). Subsection 2.4.11.3 describes historical low water conditions from droughts and their frequencies in the past.

Dust storms predominantly originate in normally arable regions during periods of drought where dust and sand layers are loosened. Dust storms in the upper coastal region of Texas are very rare due to the lush grasslands and small interspersed pine and oak thickets. Severely reduced visibilities due to large-scale dust storms in Texas occur on average only once every 3 to 5 years (Reference 2.3.1-34). The NCDC *Storm Events* database indicates no occurrences of dust storms near the VCS site since 1993 (Reference 2.3.1-29).

2.3.1.4 Meteorological Data for Evaluating the Ultimate Heat Sink

A number of the designs being evaluated at the VCS site include an ultimate heat sink (UHS) that uses a mechanical draft cooling tower to release heat to the atmosphere following a LOCA.

Each UHS water storage basin will be sized for a water volume sufficient to meet the cooling requirements for 30 days following a design basis accident with no makeup water and without exceeding temperature limits. The primary makeup water source to the UHS water storage basin would be the approximately 4900-acre cooling basin. Makeup water to the cooling basin is provided from the Guadalupe River.

The maximum 30-day cumulative evaporation and associated worst-case meteorological conditions will be determined at the time of the COL application, if required by the selected design

2.3.1.5 Site Characteristic Dry and Wet Bulb Temperatures

Long-term, engineering-related climatological data summaries, prepared by the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) for the Victoria Regional Airport observing station (Reference 2.3.1-11) are used to develop the normal site characteristic dry and wet bulb temperatures for the VCS site. These characteristics include:

- Maximum ambient threshold dry bulb temperatures at annual exceedance probabilities of 2.0, 1.0, and 0.4 percent, 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 percent (interpreted as the minimum dry bulb temperatures with values that are lower only 1.0 and 0.4 percent of the time, respectively)
- Maximum ambient threshold wet bulb temperatures at annual exceedance probabilities of 2.0, 1.0, and 0.4 percent (noncoincident)

Based on a 30-year period of record from 1972 to 2001 for Victoria, Texas, the maximum dry bulb temperature with a 2.0 percent annual exceedance probability is 92.9°F, with a mean coincident wet bulb temperature of 76.6°F. The maximum dry bulb temperature with a 1.0 percent annual exceedance probability is 94.4°F, with a mean coincident wet bulb temperature of 76.5°F. The maximum dry bulb temperature with a 0.4 percent annual exceedance probability is 96.2°F with a corresponding mean coincident wet bulb temperature value of 76.3°F (Reference 2.3.1-11).

For the same period of record, the minimum dry bulb temperatures with 99.0 and 99.6 percent annual exceedance probabilities are 33.3°F and 29.1°F, respectively (Reference 2.3.1-11).

The same ASHRAE summary for Victoria lists the maximum noncoincident wet bulb temperature with a 2.0 percent annual exceedance probability as 78.7°F. The maximum noncoincident wet bulb temperature with a 1.0 percent annual exceedance probability is 79.3°F; and the maximum noncoincident wet bulb temperature with a 0.4 percent annual exceedance probability is 80.0°F (Reference 2.3.1-11).

The most extreme (0 percent exceedance) site characteristic safety temperature values represent the historical high and low temperatures for the site. Based on a 30-year period of record (1971–2000) of sequential hourly data for the NWS station at Victoria Regional Airport (the closest station to the site at which coincident dry and wet bulb temperature measurements are made), the 0 percent exceedance historical maximum dry bulb temperature for the VCS site is 109.4°F with a coincident wet bulb temperature of 75.2°F (References 2.3.1-7, 2.3.1-8, 2.3.1-9, and 2.3.1-10). Over this same period of record, the 0 percent exceedance historical maximum noncoincident wet bulb temperature is 84.4°F; the 0 percent exceedance historical minimum dry bulb temperature is 10°F at this station (References 2.3.1-7, 2.3.1-8, 2.3.1-9, and 2.3.1-10).

Record minimum temperatures observed in the VCS site area are presented in Table 2.3.1-3 and summarized in Subsection 2.3.2.2.4. Among the NWS and cooperative observer network stations listed in Table 2.3.1-3, the overall lowest temperature recorded is 6°F at a station (Yoakum) (References 2.3.1-2, 2.3.1-5, and 2.3.1-4) 46 miles north of the site.

The data summaries from which the preceding statistical values are obtained do not include calculated 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 are calculated through linear regression using annual maximum and minimum dry bulb temperatures and annual maximum wet bulb temperatures recorded over the 30-year period from 1971 to 2000 at the Victoria Regional Airport NWS station (References 2.3.1-7, 2.3.1-8, 2.3.1-9, and 2.3.1-10).

Based on the linear regression analyses of these data sets for a 100-year return period, the maximum dry bulb temperature is estimated to be approximately 111.3°F, the minimum dry bulb temperature is estimated to be approximately 3.6°F, and the maximum noncoincident wet bulb temperature is estimated to be approximately 86.1°F.

The dry bulb temperature component of the maximum dry bulb and coincident wet bulb temperature site characteristic pair is represented by the 100-year return period maximum dry bulb value (i.e., 111.3°F) reported above. Because this 100-year return period dry bulb value is extrapolated from a regression curve on a single parameter, there is no corresponding mean coincident wet bulb temperature. As a result, the coincident wet bulb temperature component is derived based on a characteristic relationship between concurrent dry bulb and wet bulb temperatures—that is, as the dry bulb temperature continues to increase, there is a point at which the concurrent wet bulb temperature reaches a maximum and thereafter changes little or even decreases. This characteristic is not unique to this location or climatological setting.

This relationship is exhibited by the annual percent frequency distribution of wet bulb temperature depression for the Victoria, Texas, NWS station, as reported in the International Station Meteorological Climate Summary (Reference 2.3.1-31), over the 43-year period from 1953 through 1995. This type of summary is a bivariate distribution of dry bulb temperatures in 2-degree ranges by wet bulb depression (i.e., the difference between concurrent dry bulb and wet bulb observations), also in 2-degree ranges.

For the Victoria NWS station, this threshold dry bulb temperature occurs at approximately 88°F. A cubic polynomial curve was fit to the concurrent maximum dry bulb and maximum wet bulb temperature pairs extracted from this bivariate distribution at and above this threshold dry bulb value. The equation of the curve is an estimation of the trend where the maximum coincident wet bulb temperature can then be determined as a function of the maximum dry bulb temperature in this upper range of dry bulb values. Based on a 100-year return period maximum dry bulb temperature of 111.3°F, the corresponding wet bulb temperature is estimated to be 70.7°F.

2.3.1.6 Restrictive Dispersion Conditions

Atmospheric dispersion can be described as the transport and diffusion of pollutants released into the atmosphere. Horizontal and along-wind dispersion is controlled primarily by wind direction variation, wind speed, and atmospheric stability. Subsection 2.3.2.2.1 addresses wind characteristics for the VCS site vicinity based on measurements from the pre-application phase, onsite meteorological monitoring program. The persistence of those wind conditions is presented in Subsection 2.3.2.2.2.

In general, lower wind speeds have less turbulence, which is restrictive to both horizontal and vertical dispersion. Wind direction tends to be more variable under lower wind speed conditions (which normally increases horizontal dispersion), however, air parcels containing pollutants are often recirculated within a limited area, thereby increasing cumulative exposure.

Major air pollution episodes are usually related to the presence of stagnating high-pressure weather systems (anti-cyclones) that influence a region with light and variable wind conditions for 4 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 (Reference 2.3.1-18). In this study, stagnation conditions were defined as 4 or more consecutive days when meteorological conditions were conducive to poor dispersion. Although interannual frequency varies, the data in Figures 1 and 2 of that report indicate that on average, the VCS site region can expect approximately 30 days per year with stagnation conditions, or approximately 5 to 6 cases per year, with a mean duration of approximately 5 days for each case (Reference 2.3.1-18).

Air stagnation conditions primarily occur during an “extended” summer season (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 2.3.1-18*,* Figures 17 to 67, the highest incidence of air stagnation is recorded between July and September, typically reaching its peak during August, when the Bermuda High pressure system has become established. As the LCD summary for Victoria, Texas, in Table 2.3.1-2 indicates, this 3-month period coincides with the lowest monthly mean wind speeds during the year. Air stagnation is at a relative minimum within this "extended" summer season during May and June (Reference 2.3.1-18).

The dispersion of air pollutants is also a function of the mixing height. The mixing height (or depth) is defined as the height above the surface through which vertical mixing takes place. Lower mixing heights (and wind speeds), therefore, are a relative indicator of more restrictive dispersion conditions (Reference 2.3.1-18).

An interactive, spatial database developed by the U.S. Department of Agriculture-Forest Service, referred to as the Ventilation Climate Information System, is readily available and provides monthly and annual graphical and tabular summaries of relevant dispersion-related characteristics (e.g., morning and afternoon modeled mixing heights, modeled surface wind speeds, and resultant ventilation indices) (Reference 2.3.1-19). The system, although developed primarily for fire management and related air quality purposes, provides a period of record of climatologically representative durations of 30 to 40 years depending on the parameter.

Table 2.3.1-4 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 VCS site area. As atmospheric sounding measurements are still only made from a relatively small number of observation stations, these statistics represent model-derived values within the interactive data base for a specific location (Reference 2.3.1-26)—in this case, the VCS site. The seasonal and annual values listed in Table 2.3.1-4 are derived as weighted means based on the corresponding monthly values.

From a climatological standpoint, the lowest morning mixing heights occur in the autumn, and the highest morning mixing heights occur during the spring. As might be expected, the afternoon mixing heights reach a seasonal minimum in the winter and a maximum during the summer due to more intense summertime heating.

The wind speeds listed in Table 2.3.1-4, representing the VCS site area, are reasonably consistent with the LCD summary for Victoria, Texas (Table 2.3.1-2) although approximately 1 meter per second (m/sec) lower. Relatively lower daily mean wind speeds (i.e., the average of the morning and afternoon mean values in Table 2.3.1-4) are shown to generally occur during the summer and autumn as in the LCD (References 2.3.1-19 and 2.3.1-1). This period of minimum wind speeds also coincides with the "extended" summer season described by Wang and Angell (Reference 2.3.1-18) 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. It uses surface winds instead of higher level winds, so the index values represent conservative estimates of ventilation potential. This is more indicative of the dispersion potential near the ground and, therefore, directly relevant to the release heights of the sources evaluated in Subsections 2.3.4 and 2.3.5.

Based on the classification system for ventilation indices (Reference 2.3.1-26), the morning ventilation indices for the VCS site area indicate “marginal” ventilation potential on an annual average basis with conditions rated as “fair” during the spring and marginal for the other three seasons (Reference 2.3.1-19); again, consistent with the characteristics reported by Wang and Angell (Reference 2.3.1-18).

Ventilation indices markedly improve during the afternoon with conditions rated as “good” on an annual average basis and for all seasons except the winter which is classified as “fair” (Reference 2.3.1-19). Mean wind speeds do not vary significantly in the site area over the course of the year. As a result, the relatively better ventilation index classifications are attributable to the higher mixing height values, which for the summer and autumn seasons tends to mask the general potential for more restrictive dispersion conditions during the “extended” summer referred to by Wang and Angell (Reference 2.3.1-18). Nevertheless, the decrease in the ventilation index values between the summer and autumn is still evident and consistent with the monthly variations for air stagnation potential described previously.

Ambient air quality conditions in the site area are presented in Subsection 2.3.2.5.

2.3.1.7 Climate Changes

Climatic conditions change over time and these 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, and are even more so for specific areas or locations.

With regard to the expected 40-year operating license period for the VCS, 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 (the last 70 to 80 years), and the occurrences of severe weather events, in the context of the plant’s design bases.

Trends of temperature and rainfall normals 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 2.3.1-20). The publication summarizes these observations for the 344 climate divisions in the 48 contiguous states.

As Subsection 2.3.1.2 indicates, the VCS site is located near the boundaries of two separate climate divisions within the State of Texas. It is physically situated in the western portion of Climate Division TX-08 (upper coast), but also lies directly adjacent to the eastern extent of the southern portion of Climate Division TX-07 (south central) (Reference 2.3.1-20).

Summaries of successive annual temperature and rainfall normals as well as the composite 70-year average are provided below for these climate divisions (Reference 2.3.1-20).

Period	Temperature (°F)		Rainfall (inches)	
	TX-07	TX-08	TX-07	TX-08
1931–2000	69.2	69.3	34.45	47.75
1931–1960	69.5	69.5	33.20	46.19
1941–1970	69.3	69.4	32.99	46.41
1951–1980	69.1	69.1	33.97	45.93
1961–1990	68.9	68.9	34.48	47.63
1971–2000	69.1	69.2	36.21	50.31

This data indicates a slight cooling trend in these climate divisions over most of the 70-year period, with a slight increase of approximately 0.2°F to 0.3°F during the most recent normal period (although still slightly less than the composite 70-year average). In general, total annual rainfall varied only slightly (i.e., less than 1 inch) between the 1931–1960 and the 1951–1980 normal periods. Since then, it has trended upward in these divisions ranging from approximately 2.2 inches in Climate Division TX-07 to approximately 4.4 inches in Climate Division TX-08. Similar trends are observable for all of the other climate divisions in Texas (Reference 2.3.1-20).

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 approximately 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 VCS site area (see Table 2.3.1-3).

Individual station records for maximum temperature have been set between 1939 and 2000 (the overall highest value for the site area having been recorded in 2000); that is, no discernable trend for these extremes in the site area. Similarly, record-setting 24-hour rainfall totals were established between 1930 and 1994, with station records for total monthly rainfall being set between 1949 and 2007—again, no clear trend. Cold air outbreaks that result in overall extreme low temperatures occur infrequently; record-setting snowfalls are even more rare events. Nevertheless, station records set for these weather types span a range of 41 years (i.e., 1949 to 1989) and 76 years (i.e., 1929 to 2004), respectively (see Table 2.3.1-3).

The occurrence of tropical cyclones within a 100-nautical-mile radius of the VCS site has been somewhat cyclical over the available 158-year period of record when considered on a decadal (10-year basis), having reached a peak of seven such storms during the 1940s, with secondary peaks of six tropical cyclone events in the 1930s and 1880s. Both the frequency and intensity of hurricanes passing within 100 nautical miles of the site have generally decreased since the peak period from 1940 to 1949. The frequency of tropical storms has been fairly steady since the 1930s, generally totaling between two and three such storms each decade; this is more frequent than in the decades preceding 1930. Many of the 24-hour and monthly total rainfall records identified in Table 2.3.1-3 and described in Subsection 2.3.1.3.3 are associated with these tropical cyclone events (Reference 2.3.1-14).

Predictions of global and U.S. climatic changes expected during the period of reactor operation are very general and uncertain on the regional scale. The VCS site region is between portions of the United States that forecasts show little agreement between modeling scenarios (Reference 2.3.1-35). It is unclear and speculative as to how the general large-scale trends in these climatic quantities would translate to regional design criteria, specifically with respect to extreme values. Until higher resolution, more sophisticated Global Climate Models (GCMs) can be developed, there will be a high degree of uncertainty in the forecasts used to determine the changes that will occur in the climate in the site region. Many of the environmental quantities used for design purposes are not reported in the literature from GCM output. The hierarchies of GCM forecasts have little certainty with respect to many forecast parameters that would impact plant operations. Current GCMs output that has been downsized to regional scale is highly speculative.

Forecasts of climate for the site region would potentially impact environmental conditions. The median temperature rises (from multiple GCM model scenarios) are approximately 5.8°F (3.2°C) based on regional temperature rises from a baseline of 1980–1999 to the period of 2080–2099 (page 894 of Reference 2.3.1-35).

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 expected 40-year operating license period of the units. The site 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 VCS site region.

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Table 2.3.1-1
NWS and Cooperative Observing Stations Near the VCS Site

Station[(a)]	County	Approximate Distance (Miles)	Direction Relative to Site	Elevation (feet)
Palacios Municipal Airport[(b)]	Matagorda	48	E	12
Beeville 5 NE	Bee	42	WSW	255
Port O’ Connor	Calhoun	39	ESE	5
Point Comfort	Calhoun	29	E	20
Cuero	De Witt	37	NNW	178
Maurbro	Jackson	40	ENE	30
Yoakum	Lavaca	46	N	295
Edna Highway 59 Bridge	Jackson	32	NE	68
Rockport	Aransas	40	S	9
Goliad	Goliad	22	W	142
Sinton	San Patricio	50	SW	53
Aransas Wildlife Refuge	Aransas	25	SE	15
Victoria Regional Airport[(b)]	Victoria	17	NNE	104
Refugio 2 NW	Refugio	25	SW	45
Karnes City 2N	Karnes	55	WNW	450

(a) Numeric and letter designators following a station name (e.g., Beeville 5 NE) indicate the station’s approximate distance in miles (e.g., 5) and direction (e.g., northeast) relative to the place name (e.g., Beeville).
(b) National Weather Service First-Order Station.

Table 2.3.1-2
Local Climatological Data Summary for Victoria, Texas

NORMALS, MEANS, AND EXTREMES
VICTORIA (KVCT)

LATITUDE: 28 ° 51'N LONGITUDE: -96 ° 55'W ELEVATION (FT): GRND: 113 BARO: 106 TIME ZONE: CENTRAL (UTC -6) WBAN: 12912

	ELEMENT	POR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE °F	NORMAL DAILY MAXIMUM	30	62.8	66.6	73.4	79.2	85.1	90.3	93.4	93.7	89.9	83.0	73.0	65.2	79.6
	MEAN DAILY MAXIMUM	51	63.9	67.4	74.0	80.4	85.9	90.8	93.6	94.1	89.8	83.0	73.6	66.5	80.3
	HIGHEST DAILY MAXIMUM	47	88	95	97	98	101	106	104	107	111	99	93	88	111
	YEAR OF OCCURRENCE		1971	1986	1989	1963	1964	1998	1964	1962	2000	1991	1988	1964	SEP 2000
	MEAN OF EXTREME MAXS.	51	79.4	82.2	86.3	89.6	92.8	96.0	98.3	99.5	96.5	92.1	86.2	81.2	90.0
	NORMAL DAILY MINIMUM	30	43.6	46.7	53.9	60.1	68.1	73.3	75.0	74.6	70.3	61.6	52.3	45.2	60.4
	MEAN DAILY MINIMUM	51	43.7	46.7	53.4	61.1	68.0	73.1	75.0	74.6	70.5	61.6	52.4	45.5	60.5
	LOWEST DAILY MINIMUM	47	14	19	21	33	45	59	62	62	48	31	24	9	9
	YEAR OF OCCURRENCE		1982	1985	2002	1987	2005	1984	1967	2004	2000	1993	1976	1989	DEC 1989
	MEAN OF EXTREME MINS.	51	26.2	30.0	34.9	44.6	56.1	65.3	70.5	69.8	57.8	45.1	35.1	28.3	47.0
	NORMAL DRY BULB	30	53.2	56.7	63.7	69.7	76.6	81.8	84.2	84.2	80.1	72.3	62.7	55.2	70.0
	MEAN DRY BULB	51	53.8	57.0	63.7	70.8	77.0	82.1	84.3	84.4	80.2	72.3	63.0	56.0	70.4
	MEAN WET BULB	24	49.7	52.7	58.0	64.0	70.8	75.0	76.1	76.0	72.6	65.9	57.8	51.2	64.2
	MEAN DEW POINT	24	46.4	49.4	54.6	60.7	68.5	72.8	73.6	73.5	69.9	63.1	54.6	47.8	61.2
	NORMAL NO. DAYS WITH:														
	MAXIMUM >= 90	30	0.0	0.1	0.4	0.8	6.3	20.2	28.0	27.9	18.5	4.9	0.1	0.0	107.2
	MAXIMUM <= 32	30	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4
	MINIMUM <= 32	30	4.1	2.2	0.5	0.0	0.0	0.0	0.0	0.0	0.0	*	0.6	3.1	10.5
	MINIMUM <= 0	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H/C	NORMAL HEATING DEG. DAYS	30	372	249	113	28	1	0	0	0	1	22	145	317	1248
	NORMAL COOLING DEG. DAYS	30	18	26	84	181	368	514	601	597	454	248	83	29	3203
RH	NORMAL (PERCENT)	30	77	76	75	74	78	77	74	75	76	76	77	77	76
	HOUR 00 LST	30	85	85	84	85	89	90	89	88	88	88	87	85	87
	HOUR 06 LST	30	88	88	88	89	92	93	93	94	93	91	90	88	91
	HOUR 12 LST	30	65	63	60	59	62	60	55	56	59	58	61	64	60
	HOUR 18 LST	30	69	64	63	62	67	66	60	62	65	67	71	71	66
S	PERCENT POSSIBLE SUNSHINE														
W/O	MEAN NO. DAYS WITH:														
	HEAVY FOG (VISBY <= 1/4 MI)	43	7.2	5.5	5.3	4.1	2.5	0.8	0.5	0.6	1.4	3.7	6.3	6.4	44.3
	THUNDERSTORMS	48	1.6	1.7	3.2	3.7	6.2	6.8	7.6	9.7	7.9	3.9	2.1	1.5	55.9
CLOUDINESS	MEAN:														
	SUNRISE-SUNSET (OKTAS)				6.4			4.0							
	MIDNIGHT-MIDNIGHT (OKTAS)														
	MEAN NO. DAYS WITH:														
	CLEAR	1	3.0	5.0	8.0		5.0	9.0							
	PARTLY CLOUDY			1.0	3.0		9.0	6.0							
	CLOUDY	1	1.0	3.0	10.0		3.0	5.0							
PR	MEAN STATION PRESSURE (IN)	24	30.02	29.96	29.90	29.84	29.81	29.81	29.87	29.86	29.84	29.90	29.97	30.01	29.90
	MEAN SEA-LEVEL PRES. (IN)	24	30.14	30.08	30.02	29.96	29.93	29.93	29.99	29.98	29.96	30.02	30.09	30.14	30.02
WINDS	MEAN SPEED (MPH)	24	9.9	10.4	10.9	11.0	10.5	9.3	8.5	8.0	8.2	8.7	9.2	9.4	9.5
	PREVAIL.DIR (TENS OF DEGS)	28	36	36	17	17	17	17	19	19	14	36	36	36	17
	MAXIMUM 2-MINUTE:														
	SPEED (MPH)	12	43	43	45	47	41	43	62	43	41	43	41	40	62
	DIR. (TENS OF DEGS)		17	15	03	11	07	32	05	26	04	35	31	33	05
	YEAR OF OCCURRENCE		1996	2001	2006	2004	1999	2005	2003	1996	1998	1998	2006	1997	JUL 2003
	MAXIMUM 5-SECOND														
	SPEED (MPH)	12	52	52	55	64	59	51	83	45	53	52	51	47	83
	DIR. (TENS OF DEGS)		30	15	03	11	22	32	04	27	12	35	30	33	04
	YEAR OF OCCURRENCE		1998	2001	2006	2004	2004	2005	2003	1996	2001	1998	2003	1997	JUL 2003
PRECIPITATION	NORMAL (IN)	30	2.44	2.04	2.25	2.97	5.12	4.96	2.90	3.05	5.00	4.26	2.64	2.47	40.10
	MAXIMUM MONTHLY (IN)	47	7.76	9.08	11.61	11.70	14.66	13.50	20.34	8.97	19.05	12.44	16.14	6.97	20.34
	YEAR OF OCCURRENCE		1991	1992	1997	1997	1993	2004	2007	2001	1978	1997	2004	1975	JUL 2007
	MINIMUM MONTHLY (IN)	47	0.02	0.23	0.18	T	0.01	T	0.05	0.34	1.11	0.34	0.02	0.34	T
	YEAR OF OCCURRENCE		1971	1988	1971	1987	1998	1980	1997	2006	1982	1987	1981	2007	APR 1987
	MAXIMUM IN 24 HOURS (IN)	47	4.70	3.21	5.04	9.87	8.45	9.30	8.41	6.14	8.51	8.15	9.20	6.12	9.87
	YEAR OF OCCURRENCE		1991	1992	1997	1991	1972	1977	1990	1964	1967	1994	2004	1975	APR 1991
	NORMAL NO. DAYS WITH:														
	PRECIPITATION >= 0.01	30	8.8	7.3	6.9	6.4	7.4	8.4	7.2	8.8	9.9	7.3	7.5	8.1	94.0
	PRECIPITATION >= 1.00	30	0.6	0.6	0.7	0.8	1.7	1.7	0.9	0.9	1.5	1.3	0.6	0.6	11.9
SNOWFALL	NORMAL (IN)	30	0.1	0.*	0.*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.*	0.*	0.1
	MAXIMUM MONTHLY (IN)	36	2.1	1.0	T	0.0	T	0.0	0.0	T	0.0	0.0	0.2	T	2.1
	YEAR OF OCCURRENCE		1985	1973	1990		1993			1994			1976	1990	JAN 1985
	MAXIMUM IN 24 HOURS (IN)	36	2.1	1.0	T	0.0	T	0.0	0.0	T	0.0	0.0	0.2	T	2.1
	YEAR OF OCCURRENCE'		1985	1973	1990		1993			1994			1976	1990	JAN 1985
	MAXIMUM SNOW DEPTH (IN)	39	2	3	0	0	0	0	0	0	0	0	0	0	3
	YEAR OF OCCURRENCE		1985	1958											FEB 1958
	NORMAL NO. DAYS WITH:														
	SNOWFALL >= 1.0	30	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2

published by: NCDC Asheville, NC 3 30 year Normals (1971-2000)

Table 2.3.1-3 (Sheet 1 of 2)
Climatological Extremes at Selected NWS and Cooperative Observing Stations in the VCS Region

Station	Maximum Temperature (°F)	Minimum Temperature (°F)	Maximum 24- hr Rainfall (Inches)	Maximum Monthly Rainfall (Inches)	Historical Snowpack (Inches)[m]	100-year Return Snowfall (Inches)[m]	Maximum 24- hr Snowfall (Inches)	Maximum Monthly Snowfall (Inches)
Palacios Municipal Airport	107 [(a),(b),(c)] (09/05/2000)	9[(a),(b),(c)] (12/23/1989)	9.65[(a),(b),(c)] (05/07/1951)	24.28[(b),(c)] (10/1949)	NA	NA	4.0[(b),(c)] (02/12/1958)	4.0[(b),(c)] (02/1958)
Beeville 5 NE	111[(a),(b),(c)] (07/09/1939)	8[(a),(b),(c)] (12/25/1983)	10.61[(a),(b),(c)] (09/22/1967)	22.62[(b),(c)] (09/1967)	NA	NA	4.5[(b),(c)] (12/25/2004)[(e)]	6.5[(b),(c)] (01/1926)
Port O' Connor	105[(a),(b),(c)] (09/06/2000)	10[(a),(b),(c)] (12/23/1989)	12.50[(a),(b),(c)] (07/10/1976)	24.51[(n)] (10/1984)	0	NA	1.3[(a),(b),(c)] (02/09/1973)	1.3[(a),(b),(c)] (02/1973)
Point Comfort	107[(a),(b),(c)] (09/06/2000)	9[(a),(b),(c)] (12/23/1989)	14.65[(a),(b),(c)] (06/26/1960)	25.24[(b),(c)] (06/1960)	0	NA	Trace[(a),(b)] (11/28/1976)	Trace[(a),(b)] (11/1976)
Cuero	113[(a),(b),(c)] (09/05/2000)	7[(a),(b),(c)] (12/23/1989)	12.40[(a),(b),(c)] (06/30/1940)	21.27[(b),(c)] (09/1967)	4.0 (1/31/1949)	NA	6.5[(b),(c)] (02/13/1960)	6.5[(b),(c)] (02/1960)
Maurbro	107[(b),(c)] (07/27/1954)	8[(b),(c)] (01/31/1949)	14.80[(b),(c)] (06/26/1960)	22.47[(b),(c)] (06/1960)	Station Not Available	Station Not Available	4.0[(b),(c)] (02/13/1960)	4.0[(b),(c)] (02/1960)
Yoakum	111[(a),(b),(c)] (09/06/2000)[(f)]	6[(a),(b),(c)] (12/23/1989)	10.70[(a),(b),(c)] (04/25/1938)	18.33[(a),(b),(c)] (10/1994)	NA	NA	2.5[(b),(c)] (12/21/1929)	2.5[(b),(c)] (12/1929)
Edna Highway 59 Bridge	105[(n)] (08/12/1969)	17[(n)] (01/12/1973)	17.58[(b),(c)] (10/18/1994)	20.97[(b),(c)] (10/1994)	0	NA	0.0[(c)] (NA)	0.0[(c)] (NA)
Rockport	105[(a),(b),(c)] (09/06/2000)	12[(a),(b),(c)] (12/25/1983)	8.15[(a),(b),(c)] (09/19/1979)	20.85[(b),(c)] (09/1967)	0	NA	6.0[(b),(c)] (12/25/2004)	6.0[(b),(c)] (12/2004)
Goliad	112[(a),(b),(c)] (06/14/1998)[(g)]	7[(a),(b),(c)] (01/12/1962)	9.16[(a),(b),(c)] (09/21/1967)	22.19[(b),(c)] (09/1967)	4.0 (2/9/1973)	NA	12.0[(b),(c)] (12/25/2004)	12.0[(b),(c),(d)] (12/2004)
Sinton	109[(a),(b),(c)] (09/06/2000)	10[(a),(b),(c)] (12/23/1989)	12.35[(a),(b),(c)] (04/28/1930)	25.59[(b),(c)] (09/1967)	2.0 (2/9/1973)	NA	7.0[(b),(c)] (12/25/2004)	7.0[(b),(c)] (12/2004)
Aransas Wildlife Refuge	103[(b),(l)] (08/30/1954)[(h)]	9[(a),(b),(c)] (12/23/1989)	14.25[(a),(b),(c)] (11/01/1974)	22.65[(d)] (07/2007)	0	NA	5.5[(b),(c),(d)] (12/25/2004)	5.5[(b),(c),(d)] (12/2004)
Victoria Regional Airport	111[(a),(b),(c)] (09/05/2000)	9[(a),(b),(c)] (12/23/1989)	9.87[(a),(b),(c)] (04/05/1991)	20.34[(c)] (07/2007)	NA	NA	3.3[(a),(b),(c)] (02/12/1958)	3.4[(a),(b),(c)] (02/1958)
Refugio 2 NW	112[(b),(c)] (09/05/2000)	8[(b),(c)] (01/12/1962)[(j)]	13.38[(b),(c)] (10/16/1960)[(i)]	26.30[(b),(c)] (09/1971)[(i)]	2.0 (2/12/1960)	NA	9.5[(b),(c)] (12/25/2004)	9.5[(b),(c)] (12/2004)

Table 2.3.1-3 (Sheet 2 of 2)
Climatological Extremes at Selected NWS and Cooperative Observing Stations in the VCS Region

Station	Maximum Temperature (°F)	Minimum Temperature (°F)	Maximum 24- hr Rainfall (Inches)	Maximum Monthly Rainfall (Inches)	Historical Snowpack (Inches)[m]	100-year Return Snowfall (Inches)[m]	Maximum 24- hr Snowfall (Inches)	Maximum Monthly Snowfall (Inches)
Karnes City 2N	111[b],[c] (09/06/2000)	7[b],[c] (12/23/1989)	11.00[b],[c] (08/31/1981)	22.60[b],[c] (09/1967)	2.0 (1/11/1973)	NA	5.0[b],[c] (12/25/2004)	5.0[b],[c] (12/2004)[k]

(a) NCDC Monthly Station Climate Summaries, Climatography of the United States No. 20 1971-2000 (References 2.3.1-2).
(b) NCDC Cooperative Summaries of the Day TD 3200 & DS 3200 & 3200/3210 (Reference 2.3.1-5 and 2.3.1-6).
(c) Utah State University Climate Center (Reference 2.3.1-4).
(d) NCDC Cooperative Observer Records for Texas (Reference 2.3.1-33).
(e) Occurs on multiple dates: 01/23/1926, 12/25/2004, (most recent date shown in table).
(f) Occurs on multiple dates: 06/15/1998, 09/06/2000; (most recent date shown in table).
(g) Occurs on multiple dates: 07/09/1939, 08/13/1962, 06/14/1998; (most recent date shown in table).
(h) Occurs on multiple dates: 06/27/1953, 08/301954; (most recent date shown in table).
(i) Occurred at retired Refugio Co-op observing station (#417529), period of record Jan 1, 1948 – Nov 30, 1984.
(j) Not reported here. Less than 6 years of data available.
(k) Occurs for multiple months: 12/2004, 01/1926; (most recent month shown in table).
(l) Occurred at retired Arkansas Wildlife Refuge Co-op observing station (#410437), period of record Jun 1, 1940 – Dec 31, 1970.
(m) NCDC United States Snow Climatology.
(n) NCDC Climate Data Online (Reference 2.3.1-36).
NA — No value calculated in database

Table 2.3.1-4
Morning and Afternoon Mixing Heights, Wind Speeds, and Ventilation Indices for the VCS Site Area

Period	Statistic[a]	Mixing Height (m, AGL)[b]		Wind Speed — (m/sec)		Ventilation Index - (m^2/sec)[c]	
		AM	PM	AM	PM	AM	PM
January	Min	275	586	2.9	2.5	914 (P)	1273 (M)
	Max	561	1134	4.0	3.5	2374 (F)	3754 (G)
	Mean	430	881	3.6	3.2	1628 (M)	2800 (F)
February	Min	305	765	2.7	2.4	1096 (P)	2259 (M)
	Max	590	1289	4.1	3.6	2269 (M)	4082 (G)
	Mean	448	1011	3.6	3.2	1707 (M)	3138 (F)
March	Min	290	931	3.2	2.7	1018 (P)	3235 (F)
	Max	802	1552	4.2	3.8	3193 (F)	4999 (G)
	Mean	544	1168	3.8	3.4	2167 (M)	3857 (G)
April	Min	312	916	3.4	2.9	1217 (M)	3280 (F)
	Max	922	1562	4.2	4.2	4035 (G)	5518 (G)
	Mean	642	1182	3.9	3.6	2688 (F)	4171 (G)
May	Min	401	894	3.3	2.6	1394 (M)	3140 (F)
	Max	972	1638	4.6	4.3	4062 (G)	5857 (G)
	Mean	640	1251	3.9	3.6	2668 (F)	4353 (G)
June	Min	213	1090	3.2	2.6	643 (P)	3625 (G)
	Max	1132	1929	4.5	3.9	4307 (G)	7006 (G)
	Mean	490	1458	3.7	3.4	1961 (M)	4916 (G)
July	Min	196	1149	2.9	3.0	640 (P)	3757 (G)
	Max	670	2020	4.5	4.0	2594 (F)	7766 (G)
	Mean	367	1597	3.5	3.4	1308 (M)	5428 (G)
August	Min	200	1247	2.5	2.7	537 (P)	3776 (G)
	Max	658	2151	4.0	4.0	2302 (M)	7669 (G)
	Mean	356	1647	3.3	3.3	1205 (M)	5502 (G)
September	Min	182	1116	2.7	2.8	538 (P)	3236 (F)
	Max	650	1852	4.2	4.0	2690 (F)	6924 (G)
	Mean	363	1433	3.3	3.3	1273 (M)	4679 (G)
October	Min	194	1001	2.4	2.5	648 (P)	3171 (F)
	Max	567	1759	4.3	3.9	2414 (F)	5643 (G)
	Mean	348	1314	3.4	3.2	1282 (M)	4046 (G)
November	Min	287	764	3.0	2.6	976 (P)	2552 (F)
	Max	587	1345	4.1	3.7	2352 (F)	4470 (G)
	Mean	418	1085	3.5	3.2	1578 (M)	3477 (F)
December	Min	275	594	3.0	2.4	1075 (P)	1751 (M)
	Max	631	1129	4.1	3.5	2775 (F)	3702 (G)
	Mean	405	891	3.5	3.1	1526 (M)	2819 (F)
Winter	Mean	428	928	3.6	3.2	1620 (M)	2919 (F)
Spring	Mean	609	1200	3.9	3.5	2508 (F)	4127 (G)
Summer	Mean	404	1567	3.5	3.4	1491 (M)	5282 (G)
Autumn	Mean	376	1277	3.4	3.3	1378 (M)	4067 (G)
Annual	Mean	454	1243	3.6	3.4	1749 (M)	4099 (G)

Sources: References 2.3.1-19 and 2.3.1-26

(a) Monthly minimum, maximum and mean values are based directly on summaries available from USDA - Forest Service Ventilation Climate Information System (VCIS) (Reference 2.3.1-19). 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).

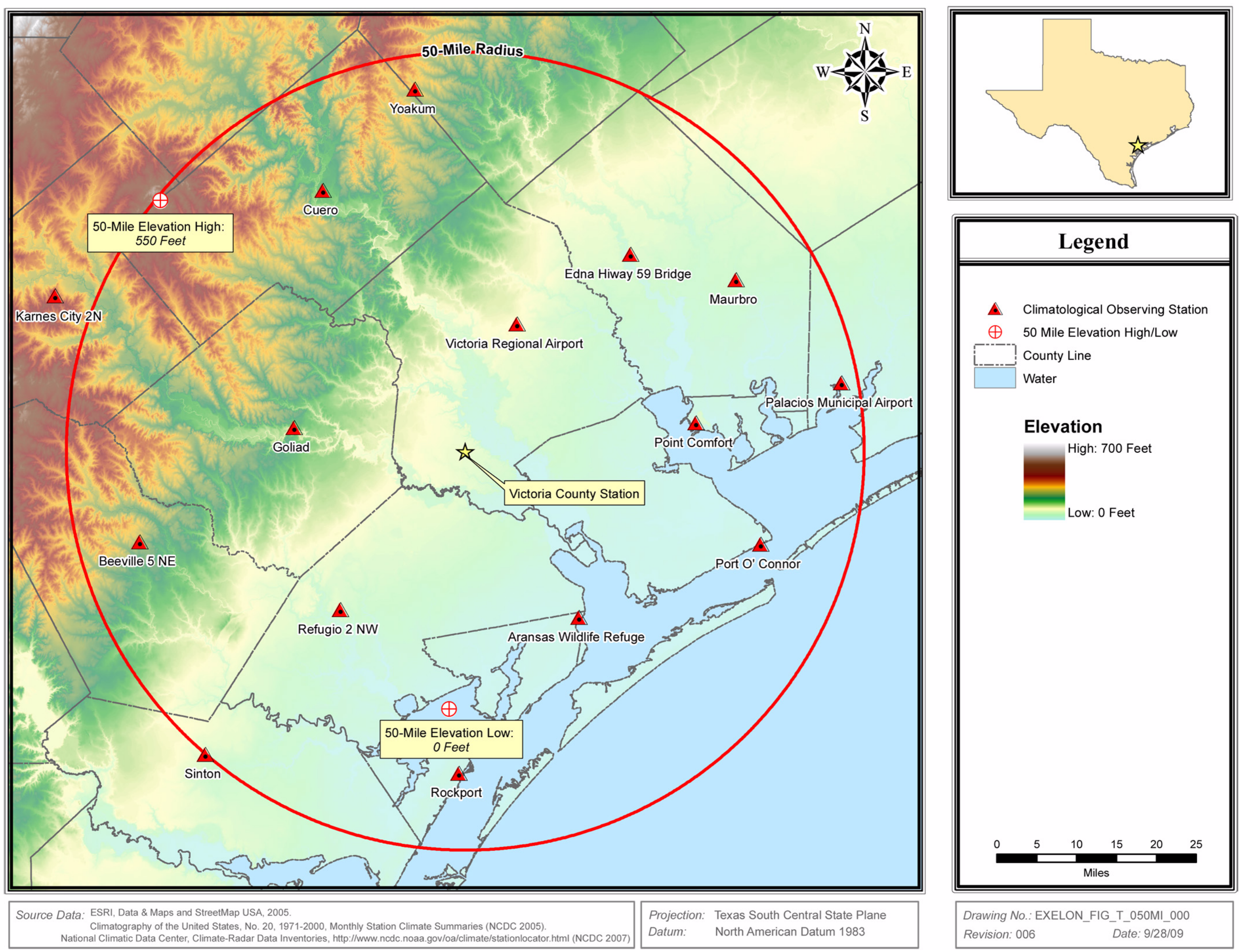


Figure 2.3.1-1 Climatological Observing Stations Near the Victoria County Station

2.3.2 Local Meteorology

This subsection addresses various meteorological and climatological characteristics of the site and vicinity around the VCS site. 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.

Subsection 2.3.2.2 focuses on the site-specific characteristics related to atmospheric transport and diffusion, based on measurements from the pre-application onsite meteorological monitoring program. This subsection also addresses climatological normals, means, and extremes for the VCS site based on long-term records from nearby observing stations.

Subsection 2.3.2.3 describes topographic features in the site region. Within the context of the meteorological and climatological conditions considered to be representative of the VCS site, and taking into consideration the terrain around the site, Subsection 2.3.2.4 follows by addressing the potential influence on these normal, mean, and extreme conditions due to construction, presence, and operation of the plant and its related facilities.

Finally, Subsection 2.3.2.5 describes current ambient air quality conditions in the site 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.

Climate-related site characteristics considered in facility design (other than those associated with atmospheric dispersion) are presented in Subsection 2.3.1.

2.3.2.1 Data Sources

The data used to characterize local meteorological and climatological conditions representative of the VCS site include long-term records for the first-order National Weather Service (NWS) stations at Victoria and Palacios, Texas, and 13 other nearby cooperative network observing stations. Table 2.3.1-1 identifies the offsite observing stations and provides the approximate distance and direction of each station relative to the VCS site (see Figure 2.3.1-1).

The NWS and cooperative observing station summaries were used to characterize climatological normals (30-year averages), and period-of-record means and extremes of temperature, rainfall, and snowfall in the VCS site area. First-order NWS stations record measurements 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). This information is based on the following resources:

- *2007 Local Climatological Data, Annual Summary with Comparative Data for Victoria, Texas* (Reference 2.3.2-1)
- *Climatography of the United States, No. 20, 1971–2000, Monthly Station Climate Summaries* (Reference 2.3.2-2)
- *Climatography of the United States, No. 81, 1971–2000, U.S. Monthly Climate Normals* (Reference 2.3.2-3)
- Utah *Climate Center*, Utah State University, *Climate Data Base for Texas* (Reference 2.3.2-4)
- *Cooperative Summary of the Day, TD3200, Period of Record Through 2001, For the Central United States* (Reference 2.3.2-5)
- *U.S. Summary of Day Climate Data (DS 3200/3210), POR 2002–2005* (Reference 2.3.2-6)

Measurements from the tower-mounted meteorological monitoring system that currently supports the pre-application phase of the VCS site (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 include measurements taken over the 2-year period of record from July 1, 2007 through June 30, 2009.

Refer to Subsections 2.3.3.2 and 2.3.3.3 for a discussion of relevant details about this pre-application phase monitoring program.

2.3.2.2 Normal, Mean, and Extreme Values of Meteorological Parameters

Wind and atmospheric stability characteristics, based on meteorological data obtained from the pre-application phase monitoring program in support of the VCS site, are described in Subsection 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 (Subsections 2.3.4 and 2.3.5).

This subsection 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 (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

Long-term average wind motions at the macro- and synoptic scales (on the order of thousands to hundreds of kilometers) are influenced by the general circulation patterns of the atmosphere at the macroscale and by large-scale topographic features (i.e., land-water interfaces such as coastal areas). These characteristics are presented in Subsection 2.3.1.2.

Site-specific or microscale (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; by meso- or regional-scale (up to approximately 200 kilometers), topographic features. Wind measurements at these smaller scales are currently available from the onsite, pre-application phase meteorological monitoring program operated in support of the VCS site and, for comparison, from data recorded at the nearby Victoria, Texas, NWS station.

Subsection 2.3.3.2 and 2.3.3.3 describe the pre-application monitoring program. Wind direction and wind speed measurements are made at two levels on a 60-meter instrumented tower (at 10 meters and at 60 meters). The monitoring program began operation on June 28, 2007. Figures 2.3.2-1 through 2.3.2-5 present annual and seasonal wind rose plots for the 10-meter level based on measurements over the 2-year period of record from July 1, 2007 through June 30, 2009.

The wind direction distribution at the 10-meter level indicates a prevailing wind from the south-southeast on an annual basis, with approximately 50 percent of the winds blowing from the southeast quadrant (see Figure 2.3.2-1). Winds from the north and north-northeast sectors occur approximately 18 percent of the time annually.

On a seasonal basis, winds from the southeast quadrant appear to predominate throughout the year, but especially during the spring and summer (see Figures 2.3.2-3 and 2.3.2-4). During the winter, winds from the north sector become more prevalent (see Figure 2.3.2-2). Autumn represents a transitional season in that winds from the northeast and southeast quadrants occur with approximately the same frequency as north to northeasterly flow increases due to cold frontal passages (see Figure 2.3.2-5); winds from the north sector increase in frequency during this season as well. Plots of individual monthly wind roses at the 10-meter measurement level are presented in Figure 2.3.2-6 (Sheets 1 to 12).

Annual and seasonal wind rose plots at the 60-meter level are shown in Figures 2.3.2-7 through 2.3.2-11. By comparison, wind direction distributions for the 60-meter level are similar to the 10-meter level wind roses on an annual basis, and for the winter, spring, and summer seasons in terms of the predominant directional quadrants and variation over the course of the year. Autumn differs in that winds from the southeast quadrant occur more often at the 60-meter level than at the 10-meter level where the aggregate frequencies from the northeast and southeast quadrants appear to be similar. Plots of individual monthly wind roses at 60 meters are presented in Figure 2.3.2-12 (Sheets 1 to 12).

Wind data summarized in the local climatological data (LCD) summary for the Victoria, Texas, NWS station (see Table 2.3.1-2) indicates a prevailing south-southeasterly wind direction on an annual basis, as well as seasonal variations (Reference 2.3.2-1), that appear to be reasonably similar to the 10-meter level wind flow at the VCS site. Differences between the two wind direction distributions are attributable to several factors: topographic setting; sensor exposure; instrument starting threshold, and period of record.

Table 2.3.2-1 summarizes seasonal and annual mean wind speeds based on measurements from the upper and lower levels of the onsite meteorological tower over the 2-year period from July 1, 2007 through June 30, 2009, and from wind instrumentation at the Victoria, Texas, NWS station based on a 24-year period of record (Reference 2.3.2-1). The height of the instrumentation at the Victoria NWS station is comparable to the lower (10-meter) level measurements at the VCS site.

On an annual basis, mean wind speeds at the 10- and 60-meter levels are 4.0 and 6.1 meters per second, respectively, at the VCS site. The annual mean wind speed at Victoria (4.2 meters per second) is similar to the 10-meter level at the VCS site; differing by only 0.2 meters per second. Seasonal average wind speeds are similar throughout the year except during autumn when speeds average approximately 0.7 meters per second lower at the VCS site than at Victoria. Seasonal mean wind speeds for both locations follow the same pattern described 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 are only 33 occurrences of calm wind conditions recorded by the onsite meteorological monitoring system at the 10-meter level and only 6 occurrences at the 60-meter level, over the 2-year period from July 1, 2007 through June 30, 2009.

2.3.2.2.2 Wind Direction Persistence

Wind direction persistence is an indicator of the duration of atmospheric transport from a specific sector to a corresponding downwind sector that is 180 degrees opposite. Atmospheric dilution is proportional to the wind speed. When combined with wind speed, a wind direction persistence/wind speed distribution further indicates the downwind sectors with relative dilution potential (higher or lower wind speeds, respectively) associated with a given wind direction.

Tables 2.3.2-2 and 2.3.2-3 present wind direction persistence/wind speed distributions based on measurements from the VCS pre-application phase monitoring program for the 2-year period of record from July 1, 2007 through June 30, 2009. The distributions account for discrete durations ranging between 1 and 48 hours for wind directions from 22.5-degree 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. Except the first discrete value (1), all other discrete values are the upper limits of the durations. For example, 18 stands for 12 < hour ≤ 18;

therefore, any hours counts identified within this range means the longest persistence period is at least 12 hours.

Two individual years (July 01, 2007 through June 30, 2008 and July 01, 2008 through June 30, 2009) of the wind direction persistence tables are presented in Table 2.3.2-2, Sheets 1 through 3 and 4 through 6, respectively. The 60-meter level wind direction persistence tables are presented in Table 2.3.2-3, Sheets 1 through 3 and 4 through 6, respectively.

2.3.2.2.3 Atmospheric Stability

Atmospheric stability is a relative indicator of the potential of turbulent diffusion of pollutants. Atmospheric stability, as addressed here, is based on the delta-temperature (ΔT) method discussed in Section 2.2 of RG 1.23 (Reference 2.3.2-7).

Stability classifications are assigned according to the criteria outlined in Table 1 of RG 1.23.

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

During the 2-year period from July 1, 2007 through June 30, 2009, ΔT was determined from the difference between temperature measurements made at the 60- and 10-meter tower levels. Seasonal and annual frequencies of atmospheric stability class and associated 10-meter level mean wind speeds for this period of record are presented in Table 2.3.2-4.

There is a predominance of neutral (Class D) and slightly stable (Class E) conditions throughout most of the year. These stability classes combined were recorded approximately 48 percent of the time on an annual basis, ranging seasonally from approximately 39 percent during autumn to approximately 55 percent during the winter. Extremely unstable conditions (Class A) were recorded approximately 8 percent of the time on an annual basis, or approximately 12 percent of the time during the spring, and least often during the autumn (only approximately 5 percent of the time). Moderately and extremely stable conditions (Classes F and G) were recorded approximately 30 percent of the time on an annual basis, occurring most often during the autumn (approximately 43 percent of the time) because of increased radiational cooling, and least often during the spring (approximately 21 percent of the time).

Joint frequency distributions (JFDs) of wind speed and wind direction by atmospheric stability class and for all stability classes combined for the 10-meter and 60-meter wind measurement levels are presented in Tables 2.3.2-5 and 2.3.2-6, respectively, based on the 2-year period of record from July 1, 2007 through June 30, 2009. The 10-meter level JFDs are used to evaluate short-term dispersion estimates for accidental atmospheric releases (Subsection 2.3.4) and long-term diffusion estimates for routine releases to the atmosphere (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 vary over the site area by only approximately 3°F, ranging from 68.2°F at the Yoakum station (approximately 46 miles north of the VCS site) to 71.3°F at the Goliad station (approximately 22 miles to the west) (see Table 2.3.2-7).

The diurnal (day-to-night) temperature ranges, as indicated by the differences between the daily mean maximum and minimum temperatures, are similar, ranging from 11.4°F at Port O'Connor (approximately 39 miles east-southeast of the VCS site) to 24.2°F at the Cuero station (approximately 37 miles to the north-northwest) (Table 2.3.2-7). This range reflects each stations' proximity to the Gulf Coast—Port O'Connor is located directly on the coast (less temperature variability due to maritime influence), while Cuero is located farther inland. Similar variations in diurnal temperature range are noted among the other observing stations in the site area.

On a monthly basis, the LCD summary for the Victoria, Texas, NWS station indicates that the daily normal temperature is highest during July and August (84.2°F) and reaches a minimum in January (53.2°F) (Reference 2.3.2-1).

Extreme maximum temperatures recorded in the vicinity of the site for the VCS site have ranged from 103°F to 113°F, with the highest reading observed at the Cuero cooperative station on September 5, 2000. As Table 2.3.1-3 and the accompanying notes show, individual station extreme maximum temperature records were set at multiple locations on the same or adjacent dates (e.g., Palacios Municipal Airport, Port O'Connor, Point Comfort, Yoakum, Rockport, Sinton, Victoria Regional Airport, Refugio 2 NW, and Karnes City 2N on September 5 or 6, 2000) (References 2.3.2-2 and 2.3.2-4).

Extreme minimum temperatures in the vicinity of the VCS site have ranged from 6°F to 12°F, with the lowest reading on record observed at the Yoakum cooperative station (approximately 46 miles to the north) on December 23, 1989. More noteworthy, though, Table 2.3.1-3 and the accompanying notes indicate that record low temperatures were also set at Palacios Municipal Airport, Port O'Connor, Point Comfort, Cuero, Sinton, Aransas Wildlife Refuge, Victoria Regional Airport and Karnes City 2N on the same date (References 2.3.2-2 and 2.3.2-4).

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 VCS site area. The similarity of the respective extremes and their dates of occurrence suggest that these statistics are reasonably representative of the temperature extremes that might be expected to be observed for the VCS site region.

2.3.2.2.5 Atmospheric Water Vapor

Based on a 24-year period of record, the LCD summary for the Victoria, Texas, NWS station (see Table 2.3.1-2) indicates that the mean annual wet bulb temperature is 64.2°F, with a seasonal maximum during the summer months (June through August) and a seasonal minimum during the winter months (December through February). The highest monthly mean wet bulb temperature is 76.1°F in July (only slightly less during August); the lowest monthly mean value (49.7°F) occurs during January (Reference 2.3.2-1).

The LCD summary shows a mean annual dew point temperature of 61.2°F, reaching its seasonal maximum and minimum during the summer and winter, respectively. The highest monthly mean dew point temperature is 73.6°F in July (again, only slightly less during August). The lowest monthly mean dew point temperature (46.4°F) occurs during January (Reference 2.3.2-1).

The 30-year normal daily relative humidity averages 76 percent annually, typically reaching its diurnal maximum in the early morning hours (around 0600 Local Standard Time [LST]) and its diurnal minimum during the early afternoon hours (around 1200 LST). There would be 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 LCD summary indicates that average early morning relative humidity levels are greater than or equal to 93 percent during the months of June, July, August, and September (Reference 2.3.2-1).

2.3.2.2.6 Precipitation

Table 2.3.2-7 shows normal annual rainfall totals for the 15 nearby observing stations listed in Table 2.3.1-1 (i.e., within approximately 50 miles of the VCS site) vary, ranging from 28.35 inches at the Karnes City 2N observing station (approximately 55 miles to the west-northwest of the VCS site) to 45.40 inches at the Palacios Municipal Airport station (approximately 48 miles to the east) (Reference 2.3.2-3). Total annual rainfall tends to decrease more with location from east to west than it does as a function of distance inland from the Gulf of Mexico and adjacent bay waters.

If the four climatological observing stations closest to and surrounding the VCS site are considered (Victoria Regional Airport, Goliad, Refugio 2 NW, and Aransas Wildlife Refuge), all within 25 miles, normal annual rainfall totals are quite similar ranging from 38.58 inches at Goliad to 40.83 inches at Aransas Wildlife Refuge (Reference 2.3.2-3). Therefore, long-term average annual total rainfall at the VCS site could reasonably be expected to be within this range.

The LCD summary of normal rainfall totals for the Victoria, Texas, NWS station indicates two seasonal maximums—the highest (13.05 inches) during late spring into early summer (April through June) and the second (12.31 inches) during the mid-summer into mid-autumn (August through October). Together, these periods account for approximately 63 percent of the annual total rainfall for the Victoria NWS station, although rainfall is greater than 2.0 inches during every month of the year. The overall maximum monthly total rainfall occurs during May (5.12 inches) (Reference 2.3.2-1).

Subsection 2.3.1.3.4 described historical precipitation extremes (rainfall and snowfall), as presented in Table 2.3.1-3 for the 15 nearby climatological observing stations listed in Table 2.3.1-1. 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 VCS site.

2.3.2.2.7 Fog

The closest station to the VCS site at which observations of fog are made and routinely recorded is the Victoria, Texas, NWS station, approximately 17 miles to the north-northeast. The 2007 LCD summary for this station (Table 2.3.1-2) indicates an average of approximately 44 days per year of heavy fog conditions, based on a 43-year period of record. The NWS defines heavy fog as fog that reduces visibility to 1/4 mile or less (Reference 2.3.2-1).

On a seasonal basis, heavy fog conditions occur most often during the winter months (December through February), reaching peak frequency in January, averaging 7.2 days per month. Heavy fog conditions occur least often in the summer (i.e., June to August), averaging less than 1 day per month (Reference 2.3.2-1).

The frequency of heavy fog conditions in the region of the VCS site would be expected to be very similar to the observations made at the Victoria, Texas, NWS station due to their nearness to each other (approximately 17 miles). 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 35.5 to 40 days per year in the area that includes both Victoria, Texas, and the VCS site (Reference 2.3.2-8). The seasonal variation in "*The Climate Atlas*" is very similar to that in the 2007 LCD for the Victoria NWS station (References 2.3.2-8 and 2.3.2-1).

Enhancement of naturally occurring fog conditions due to the cooling basin and mechanical draft cooling towers associated with the VCS site is addressed in Subsection 5.3.3.1 of the Environmental Report.

2.3.2.3 Topographic Description

The VCS site is located in Victoria County, Texas, approximately 13 miles from the city of Victoria. The site is approximately 125 miles southwest of Houston and 60 miles north-northeast of Corpus Christi. The VCS site property encompasses approximately 11,500 acres. The power block area covers approximately 78 acres.

Terrain features within 50 miles of the VCS site region, based on digital map elevations, are illustrated in Figure 2.3.1-1. 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 2.3.2-14 (Sheets 1 through 6). The locus of these radial lines is the “power block reference point,” which is located approximately 250 feet plant south of the centroid of the power block area.

The nominal plant grade elevation for the power block at the VCS site is approximately 95 feet NAVD 88. Located within the south-central Texas Coastal Plain, terrain within 50 miles of the VCS site is generally flat to gently rolling with elevations decreasing to the east-northeast clockwise through the south-southwest. Elevations tend to increase to the west-southwest through the north-northeast with increasing distance from the site with relief of up to approximately 450 feet relative to nominal plant grade. Figure 2.3.1-1 indicates that the highest elevation within 50 miles of the site is 550 feet above MSL (this spot elevation does not fall along one of the 16 standard direction radials presented in Figure 2.3.2-14). The lowest elevation within 50 miles of the site, 0 feet MSL (Gulf of Mexico and adjacent bay waters), occurs to the east through the south (see Figures 2.3.1-1 and 2.3.2-14).

More detailed topographic features within 5 miles of the VCS site are shown in Figure 2.3.2-13. Terrain within this radial distance of the site primarily consists of flat plains with very little elevation change, relative to nominal plant grade.

2.3.2.4 Potential Influence of the Plant and Related Facilities on Meteorology

Construction at the VCS site will include clearing, grubbing, excavation, leveling, and landscaping activities typical of large-scale projects. The most prominent feature, however, in terms of land alteration associated with this facility, will be the excavation and construction of an approximately 4900-acre cooling water basin. Nevertheless, alterations to the existing terrain would not represent a significant change to the flat to gently rolling topographic character of the site vicinity or the surrounding site area (see Figure 2.3.2-13 and Subsection 2.3.2.3).

Subsections 2.3.3.2.1, 2.3.3.2.2, and 2.3.3.2.3 provide additional details regarding the considerations made in siting and equipping the meteorological tower, installed for the pre-application phase monitoring program, in relation to the construction of, and/or major structures associated with, the units.

The dimensions and operating characteristics of the facilities associated with the VCS site, including paved, concrete, or other improved surfaces, are considered to be insufficient to generate discernable, long-term effects to local or microscale meteorological conditions, or to the mean and extreme climatological characteristics of the site area discussed previously in Subsections 2.3.2.2 and 2.3.1.3.4.

Wind flow will be altered in areas immediately adjacent to and downwind of larger site structures. These effects will likely dissipate beyond ten structure heights downwind of the intervening structure(s). While ambient temperatures immediately above any improved surfaces would 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. See Subsections 2.3.3.2.4 and 2.3.3.2.5 for additional details.

The VCS site uses a cooling basin and mechanical draft cooling towers as a means of heat dissipation during normal and post-accident operation. Potential meteorological effects due to the cooling basin and cooling towers could include enhanced ground-level fogging and icing, precipitation enhancement, and increased ground-level humidity. These effects are addressed in detail in Subsections 5.3.3.1 and 5.3.3.2 of the Environmental Report.

2.3.2.5 Current and Projected Site Air Quality

This subsection addresses current ambient air quality conditions in the VCS site area and region (i.e., 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 Environmental Report that address the types and characteristics of nonradiological emission sources associated with plant construction and operation and the expected impacts associated with those activities (Subsection 2.3.2.5.2). Previously, Subsection 2.3.1.6 characterized conditions (from a climatological standpoint) in the site area and region that may be restrictive to atmospheric dispersion.

2.3.2.5.1 Regional Air Quality Conditions

The VCS site is located within the Corpus Christi-Victoria Intrastate Air Quality Control Region and includes Aransas, Bee, Brooks, Calhoun, DeWitt, Duval, Goliad, Gonzales, Jackson, Jim Wells, Kenedy, Kleberg, Lavaca, Live Oak, McMullen, Nueces, Refugio, San Patricio, and Victoria counties (40 CFR 81.136). 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 (NAAQS). Criteria pollutants are those for which NAAQS have been established: sulfur dioxide, particulate matter (i.e., PM_{10} and $PM_{2.5}$ — particles with nominal aerodynamic diameters less than or equal to 10.0 and 2.5 microns, respectively), carbon monoxide, nitrogen dioxide, ozone, and lead (40 CFR 50).

The Corpus Christi-Victoria Intrastate Air Quality Control Region is in attainment for all criteria pollutants except for lead, which is undesignated (40 CFR 81.344).

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 VCS site. The Big Bend National Park, in Texas, is the closest Class I area (40 CFR 81.429); approximately 355 miles west of the site.

2.3.2.5.2 Projected Air Quality Conditions

The VCS site nuclear steam supply systems and other related radiological systems are not sources of criteria pollutants or other air toxic emissions. Supporting equipment (e.g., diesel generators, combustion turbine, auxiliary boilers), and other nonradiological emission-generating sources (e.g., storage tanks and related equipment) or activities will not be expected to be a significant source of criteria pollutant emissions.

Emergency equipment will only be operated on an intermittent test or emergency-use basis. These emission sources are not expected to impact ambient air quality levels in the vicinity of the VCS site. Likewise, because of the relatively long distance of separation from the VCS site, visibility at any Class I Federal Areas is not expected to be significantly impacted by project construction and facility operations.

Nevertheless, these nonradiological emission sources will likely be regulated by the Texas Commission on Environmental Quality as required under the Texas Administrative Code, Title 30, Part I, Chapters 101 through 122, depending on the source type, source emissions, and permitting requirements for construction and operation. Section 1.2 of the Environmental Report (ER) and, in particular, ER Tables 1.2-1 and 1.2-2, identify state and federal permits and authorizations, including those related to air quality, associated with facility construction and operation activities.

Emission-generating sources and activities related to construction at the VCS site, potential impacts, and mitigation measures are addressed in ER Subsection 4.4.1.3. Nonradiological emission-generating sources associated with routine facility operations are described further in ER Subsection 3.6.3.1. Characteristics of these emission sources and the potential effects on air quality associated with their operation are addressed under ER Subsection 5.8.1.

2.3.2.6 References

2.3.2-1 National Climatic Data Center, *2007 Local Climatological Data, Annual Summary with Comparative Data, Victoria, Texas*, CD-ROM, LCD Annual 2007, NCDC, National Environmental Satellite, Data and Information Service (NESDIS), National Oceanic and Atmospheric Administration (NOAA).

2.3.2-2 National Climatic Data Center, *Climatography of the United States, No. 20, 1971–2000, Monthly Station Climate Summaries, Data Summaries for Palacios Municipal Airport, Beeville 5 NE, Port O' Connor, Point Comfort, Cuero, Yoakum, Rockport, Goliad, Sinton, Aransas Wildlife Refuge, Victoria Regional Airport, TX*, CD-ROM NCDC, NESDIS, NOAA, July 2005.

2.3.2-3 National Climatic Data Center, Climatography of the United States, *No. 81, 1971–2000, U.S. Monthly Climate Normals,* CD-ROM, NCDC, NESDIS, NOAA, February 2002.

2.3.2-4 Utah State University, Utah Climate Center, *Texas Climate Data for Palacios Municipal Airport, Beeville 5 NE, Port O' Connor, Point Comfort, Cuero, Maurbro, Yoakum, Edna Highway 59 Bridge, Rockport, Goliad, Sinton, Aransas Wildlife Refuge, Victoria Regional Airport, Refugio 2 NW, Karnes City 2N.* Available at http://climate.usurf.usu.edu/, accessed various dates through June 19, 2008.

2.3.2-5 National Climatic Data Center*, Cooperative Summary of the Day, TD3200, Period of Record through 2001 (Includes daily weather data from the Central United States*), Version 1.0, CD-ROM, data listings for Palacios Municipal Airport, Beeville 5 NE, Port O' Connor, Point Comfort, Cuero, Maurbro, Yoakum, Edna Highway 59 Bridge, Rockport, Goliad, Sinton, Aransas Wildlife Refuge, Victoria Regional Airport, Refugio 2 NW, Karnes City 2N, Texas, NCDC, NOAA, data released November 2002.

2.3.2-6 National Climatic Data Center, *U.S. Summary of Day Climate Data (DS 3200/3210), POR 2002–2005*, CD-ROM, data listings for Palacios Municipal Airport, Beeville 5 NE, Port O' Connor, Point Comfort, Cuero, Maurbro, Yoakum, Edna Highway 59 Bridge, Rockport, Goliad, Sinton, Aransas Wildlife Refuge, Victoria Regional Airport, Refugio 2 NW, Karnes City 2N, Texas, NCDC, NOAA, July 2006.

2.3.2-7 U.S. Nuclear Regulatory Commission, *Meteorological Monitoring Programs for Nuclear Power Plants,* Regulatory Guide 1.23, Revision 1, March 2007.

2.3.2-8 National Climatic Data Center, *The Climate Atlas of the United States*, Version 2.0 (CD-ROM), NCDC, Climate Services Division, NOAA, September 2002.

Table 2.3.2-1
Seasonal and Annual Mean Wind Speeds for the VCS Site Pre-Application Phase Monitoring Program (July 1, 2007–June 30, 2009) and the Victoria, Texas, NWS Station

Primary Tower Elevation	Location	Winter	Spring	Summer	Autumn	Annual
Upper Level (60 m) (m/sec)	VCS Site	6.7	7.0	5.4	5.3	6.1
Lower Level (10 m) (m/sec)	VCS Site	4.5	4.9	3.6	3.2	4.0
Single Level (6.1 m) (m/sec)	Victoria Regional Airport[a]	4.4	4.8	3.8	3.9	4.2

(a) Reference 2.3.2-1.

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

Table 2.3.2-2 (Sheet 1 of 6)
Wind Direction Persistence/Wind Speed Distributions for the VCS Site — 10-Meter Level

Site ID: VICT
Number of Sectors Included: 1
10m Wind Speed (MPH)

Period of Record: 07/01/2007 01:00 to 06/30/2008 24:00
Width in Degrees 22.5
10m Wind Direction (deg)

Speed Greater Than or Equal to: 5.0 mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	634	505	303	215	364	448	1300	1421	553	137	57	37	47	62	170	264
2	449	289	124	79	171	196	856	971	320	56	19	10	14	23	92	141
4	274	136	26	21	51	63	448	507	137	13	3	4	6	3	29	61
8	136	46	0	6	12	10	146	151	13	1	0	0	2	0	4	18
12	67	14	0	1	1	1	44	54	0	0	0	0	0	0	0	5
18	22	0	0	0	0	0	14	7	0	0	0	0	0	0	0	0
24	8	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0
30	1	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: 10.0 mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	337	183	62	40	87	151	719	863	321	50	16	8	19	29	85	133
2	252	126	27	8	53	64	505	621	196	16	4	1	3	14	50	84
4	164	63	5	0	24	19	257	341	87	2	0	0	0	2	16	38
8	67	18	0	0	7	4	65	104	8	0	0	0	0	0	2	11
12	28	2	0	0	0	0	14	31	0	0	0	0	0	0	0	2
18	8	0	0	0	0	0	0	5	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 2.3.2-2 (Sheet 2 of 6)
Wind Direction Persistence/Wind Speed Distributions for the VCS Site — 10-Meter Level

Speed Greater Than or Equal to: 15.0 mph

Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	109	31	11	2	10	31	265	394	142	7	1	2	5	10	48	66
2	75	19	5	0	4	16	169	280	98	3	0	0	1	3	27	41
4	44	7	1	0	0	8	71	159	42	0	0	0	0	0	9	20
8	21	2	0	0	0	4	18	48	2	0	0	0	0	0	2	4
12	11	0	0	0	0	0	4	14	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	2	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: 20.0 mph

Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	16	2	1	0	0	5	36	113	52	1	0	0	2	3	25	29
2	11	0	0	0	0	3	19	78	30	0	0	0	0	1	12	21
4	7	0	0	0	0	1	7	37	10	0	0	0	0	0	3	9
8	3	0	0	0	0	0	0	3	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 2.3.2-2 (Sheet 3 of 6)
Wind Direction Persistence/Wind Speed Distributions for the VCS Site — 10-Meter Level

Speed Greater Than or Equal to: 25.0 mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	3	0	0	0	0	0	2	15	1	0	0	0	0	3	7	0
2	1	0	0	0	0	0	1	10	0	0	0	0	0	1	4	0
4	0	0	0	0	0	0	0	3	0	0	0	0	0	0	2	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: 30.0 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	2	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 2.3.2-2 (Sheet 4 of 6)
Wind Direction Persistence/Wind Speed Distributions for the VCS Site — 10-Meter Level

Speed Greater Than or Equal to: 5.0, mph

Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	683	474	325	234	379	394	1131	1329	710	196	122	62	114	102	152	278
2	494	265	142	98	197	169	765	948	483	93	52	21	49	36	76	152
4	305	116	35	18	91	38	413	548	262	23	13	2	13	7	29	64
8	139	27	0	0	26	1	134	214	86	5	0	0	0	2	3	14
12	68	5	0	0	13	0	60	107	36	0	0	0	0	0	0	4
18	17	0	0	0	2	0	39	60	9	0	0	0	0	0	0	0
24	2	0	0	0	0	0	33	26	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	27	12	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	21	6	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0

Speed Greater Than or Equal to:10.0, mph

Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	400	137	91	50	120	135	695	844	477	70	22	11	14	23	70	137
2	309	77	48	25	69	61	491	605	330	30	11	6	3	10	42	72
4	208	37	12	7	45	10	267	326	177	4	1	1	0	5	20	28
8	102	10	0	0	25	0	86	116	46	0	0	0	0	1	3	3
12	45	4	0	0	13	0	49	54	18	0	0	0	0	0	0	0
18	10	0	0	0	2	0	39	31	5	0	0	0	0	0	0	0
24	0	0	0	0	0	0	33	16	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	27	6	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	21	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0

Table 2.3.2-2 (Sheet 5 of 6)
Wind Direction Persistence/Wind Speed Distributions for the VCS Site — 10-Meter Level

Speed Greater Than or Equal to:15.0, mph

Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	188	27	8	5	33	32	293	420	253	18	5	3	3	15	36	59
2	137	13	0	2	25	11	195	278	173	8	3	1	0	9	22	32
4	80	7	0	0	16	0	105	132	88	0	0	0	0	5	8	13
8	19	3	0	0	6	0	36	28	9	0	0	0	0	1	1	0
12	5	0	0	0	2	0	17	3	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	5	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:20.0, mph

Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	37	6	1	2	5	1	40	135	86	7	0	0	0	5	12	13
2	20	5	0	1	3	0	25	93	54	2	0	0	0	3	9	3
4	7	3	0	0	0	0	12	50	25	0	0	0	0	1	5	0
8	0	0	0	0	0	0	6	7	0	0	0	0	0	0	1	0
12	0	0	0	0	0	0	2	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 2.3.2-2 (Sheet 6 of 6)
Wind Direction Persistence/Wind Speed Distributions for the VCS Site — 10-Meter Level

Speed Greater Than or Equal to:25.0, mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	7	0	1	1	0	0	2	5	7	0	0	0	0	0	5	1
2	2	0	0	0	0	0	0	4	3	0	0	0	0	0	4	0
4	0	0	0	0	0	0	0	2	1	0	0	0	0	0	2	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:30.0, 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	1	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 2.3.2-3 (Sheet 1 of 6)
Wind Direction Persistence/Wind Speed Distributions for the VCS Site — 60-Meter Level

Site ID: VICT   Period of Record: 07/01/2007 01:00 to 06/30/2008 24:00
Number of Sectors Included: 1   Width in Degrees 22.5
60m Wind Speed (MPH)   60m Wind Direction (deg)

Speed Greater Than or Equal to: 5.0 mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	660	565	470	363	453	642	1312	1912	960	246	124	66	66	65	162	259
2	490	353	250	176	225	354	909	1442	636	125	50	25	23	25	91	163
4	309	173	83	55	87	124	479	894	325	34	16	3	9	3	37	81
8	162	56	13	10	18	24	150	383	83	2	5	0	3	0	5	24
12	89	22	1	1	6	4	56	176	18	0	0	0	0	0	0	6
18	36	3	0	0	0	0	15	54	0	0	0	0	0	0	0	0
24	14	0	0	0	0	0	6	24	0	0	0	0	0	0	0	0
30	2	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	7	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: 10.0 mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	537	420	261	214	267	436	1136	1725	800	161	67	38	42	43	107	175
2	413	280	142	109	145	233	804	1322	528	82	27	17	17	19	66	115
4	263	151	52	37	62	75	430	829	252	21	9	3	8	3	26	57
8	133	54	13	4	18	12	142	353	55	0	4	0	3	0	4	20
12	72	21	1	0	6	0	53	162	12	0	0	0	0	0	0	6
18	32	3	0	0	0	0	15	51	0	0	0	0	0	0	0	0
24	14	0	0	0	0	0	6	23	0	0	0	0	0	0	0	0
30	2	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	6	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 2.3.2-3 (Sheet 2 of 6)
Wind Direction Persistence/Wind Speed Distributions for the VCS Site — 60-Meter Level

Speed Greater Than or Equal to: 15.0 mph

Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	329	227	75	43	68	125	588	1043	388	61	17	16	16	28	72	98
2	239	151	35	16	37	58	399	751	250	29	5	6	5	11	43	62
4	137	67	5	0	17	11	193	438	121	4	3	0	1	1	17	32
8	60	18	0	0	5	0	53	178	30	0	0	0	0	0	3	13
12	28	0	0	0	0	0	12	90	8	0	0	0	0	0	0	4
18	8	0	0	0	0	0	1	38	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	5	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: 20.0 mph

Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	119	34	14	4	9	13	174	365	173	14	0	1	2	7	37	42
2	84	17	7	0	4	6	113	262	116	5	0	0	0	2	23	27
4	51	8	1	0	0	2	50	148	57	0	0	0	0	0	8	12
8	25	0	0	0	0	0	14	53	6	0	0	0	0	0	3	2
12	12	0	0	0	0	0	1	14	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	2	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 2.3.2-3 (Sheet 3 of 6)
Wind Direction Persistence/Wind Speed Distributions for the VCS Site — 60-Meter Level

Speed Greater Than or Equal to: 25.0 mph

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
	Direction															
1	28	5	1	0	0	4	30	125	74	0	0	0	0	4	21	8
2	18	2	0	0	0	1	18	84	45	0	0	0	0	2	13	2
4	9	0	0	0	0	0	9	40	18	0	0	0	0	0	5	0
8	0	0	0	0	0	0	1	5	0	0	0	0	0	0	1	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: 30.0 mph

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
	Direction															
1	3	0	1	0	0	0	3	25	8	0	0	0	0	2	8	0
2	1	0	0	0	0	0	2	15	1	0	0	0	0	1	6	0
4	0	0	0	0	0	0	0	7	0	0	0	0	0	0	4	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 2.3.2-3 (Sheet 4 of 6)
Wind Direction Persistence/Wind Speed Distributions for the VCS Site — 60-Meter Level

Speed Greater Than or Equal to: 5.0, mph

Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	725	532	474	354	424	536	1166	1715	1220	354	175	114	106	107	162	217
2	564	318	273	169	228	297	777	1237	876	193	81	51	40	46	74	125
4	385	132	105	41	76	117	387	701	493	55	23	15	9	18	21	55
8	217	21	14	1	17	21	107	224	181	5	2	2	0	3	1	9
12	139	9	0	0	4	4	24	67	92	1	0	0	0	0	0	0
18	73	0	0	0	0	0	3	4	42	0	0	0	0	0	0	0
24	26	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0
30	11	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0
36	5	0	0	0	0	0	0	0	1	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:10.0, mph

Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	609	366	312	204	262	398	995	1573	1045	230	89	61	55	70	98	136
2	491	219	185	94	152	236	675	1144	755	132	43	30	20	32	50	80
4	349	91	72	25	61	96	333	645	427	42	14	12	4	11	18	36
8	206	21	8	1	17	16	87	199	163	5	2	2	0	3	1	5
12	129	9	0	0	4	4	16	58	85	1	0	0	0	0	0	0
18	63	0	0	0	0	0	0	2	38	0	0	0	0	0	0	0
24	19	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0
30	8	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
36	2	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 2.3.2-3 (Sheet 5 of 6)
Wind Direction Persistence/Wind Speed Distributions for the VCS Site — 60-Meter Level

Speed Greater Than or Equal to:15.0, mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	382	169	109	51	93	144	599	962	636	117	35	16	19	42	58	58
2	311	104	60	26	57	76	390	643	450	69	21	8	6	20	27	39
4	224	43	18	10	26	30	190	299	263	20	11	2	0	7	4	18
8	125	12	3	0	8	3	39	60	104	1	2	0	0	0	0	0
12	68	6	0	0	2	0	8	11	56	0	0	0	0	0	0	0
18	25	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0
24	11	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
30	5	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:20.0, mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	177	45	9	5	30	15	181	326	306	36	6	3	6	20	21	16
2	133	24	4	2	18	3	118	216	222	17	2	1	2	10	11	9
4	82	15	2	0	5	0	58	96	120	2	0	0	0	4	4	1
8	30	5	0	0	1	0	14	17	29	0	0	0	0	0	0	0
12	10	0	0	0	0	0	5	5	13	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	1	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 2.3.2-3 (Sheet 6 of 6)
Wind Direction Persistence/Wind Speed Distributions for the VCS Site — 60-Meter Level

Speed Greater Than or Equal to:25.0, mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	53	13	1	1	5	1	25	113	122	12	0	0	1	4	12	1
2	34	9	0	0	3	0	14	70	82	5	0	0	0	1	8	0
4	16	4	0	0	0	0	5	25	41	1	0	0	0	0	4	0
8	5	0	0	0	0	0	1	0	5	0	0	0	0	0	0	0
12	1	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:30.0, mph
Direction

Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
1	9	0	1	0	3	0	2	13	31	1	0	0	0	0	5	0
2	4	0	0	0	2	0	0	5	18	0	0	0	0	0	4	0
4	0	0	0	0	0	0	0	2	8	0	0	0	0	0	2	0
8	0	0	0	0	0	0	0	0	1	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 2.3.2-4
Seasonal and Annual Vertical Stability Class and 10-Meter Level Wind Speed Distributions for the VCS Site (July 1, 2007–June 30, 2009)

Vertical Stability Categories[(a)]							
Period	**A**	**B**	**C**	**D**	**E**	**F**	**G**
Winter							
Frequency (%)	5.62	6.03	6.17	34.96	20.18	11.82	15.21
Wind Speed (m/sec)	7.1	6.1	5.7	5.3	4.0	2.7	2.3
Spring							
Frequency (%)	12.29	7.10	7.83	33.05	18.52	9.41	11.79
Wind Speed (m/sec)	7.3	6.2	5.9	5.7	4.0	2.5	2.1
Summer							
Frequency (%)	9.75	6.64	7.55	22.08	24.83	22.28	6.87
Wind Speed (m/sec)	6.7	5.6	4.8	4.2	2.9	1.9	1.7
Autumn							
Frequency (%)	4.54	5.77	8.19	19.81	19.12	16.44	26.13
Wind Speed (m/sec)	5.7	4.8	4.1	4.1	3.3	2.3	2.0
Annual							
Frequency (%)	8.07	6.39	7.44	27.46	20.67	15.00	14.96
Wind Speed (m/sec)	6.7	5.7	5.1	4.8	3.6	2.3	2.0

(a) Vertical stability based on temperature difference (ΔT) between the 60-m and 10-m measurement levels.

Table 2.3.2-5 (Sheet 1 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007–June 30, 2009)

Site:: Exelon Victoria County
Period:: Months Jul - Jun for years 2007 - 2009
All Stabilities
Elevations:: Winds 10m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	35	94	174	315	247	202	205	314	72	28	1686
NNE	0	23	95	188	396	268	160	140	78	16	0	1364
NE	1	34	98	168	377	160	78	60	41	4	1	1022
ENE	1	42	69	139	260	117	59	42	16	1	1	747
E	0	33	96	148	348	187	113	72	70	6	2	1075
ESE	0	37	96	150	344	213	141	106	91	12	0	1190
SE	0	34	91	186	539	395	391	371	616	185	17	2825
SSE	0	39	74	170	573	404	353	458	636	319	95	3121
S	0	35	60	101	238	194	199	191	261	171	54	1504
SSW	0	17	42	42	107	100	60	47	24	8	4	451
SW	0	22	31	39	101	47	27	16	8	1	0	292
WSW	0	17	37	38	54	30	12	7	7	0	0	202
W	0	17	37	43	82	41	25	13	5	4	0	267
WNW	1	28	41	53	83	39	18	13	21	9	3	309
NW	2	23	52	78	129	52	25	35	56	24	24	500
NNW	0	18	106	162	197	100	71	71	86	55	16	882
Tot	5	454	1119	1879	4143	2594	1934	1847	2330	887	245	17437

Hours of Calm 33
Hours of Variable Direction 28
Hours of Valid Data 17498
Hours of Missing Data . . . 46
Hours in Period 17544

Table 2.3.2-5 (Sheet 2 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007–June 30, 2009)

Site:: Exelon Victoria County
Period:: Months Jul - Jun for years 2007 - 2009
Stability Class A Extremely Unstable based on Lapse Rate
Elevations:: Winds 10m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	0	0	2	8	19	25	69	13	13	149
NNE	0	0	0	0	5	15	13	23	22	4	0	82
NE	0	0	0	2	1	6	4	12	6	1	0	32
ENE	0	0	0	0	1	11	6	7	3	0	0	28
E	0	0	0	0	5	8	7	9	5	1	0	35
ESE	0	0	0	0	2	10	8	17	22	2	0	61
SE	0	0	0	0	2	14	26	43	133	65	7	290
SSE	0	0	0	0	3	7	11	70	177	100	45	413
S	0	0	0	0	2	2	9	18	51	45	13	140
SSW	0	0	0	0	2	2	4	4	6	4	0	22
SW	0	0	0	0	0	1	1	5	3	0	0	10
WSW	0	0	0	0	0	2	3	2	1	0	0	8
W	0	0	0	0	0	0	3	1	0	0	0	4
WNW	0	0	0	0	0	0	2	2	4	6	2	16
NW	0	0	0	0	0	0	2	10	23	3	14	52
NNW	0	0	0	0	1	2	7	11	21	17	6	65
Tot	0	0	0	2	26	88	125	259	546	261	100	1407

Hours of Calm 0
Hours of Variable Direction 0
Hours of Valid Data 1407
Hours of Missing Data . . . 46
Hours in Period 17544

Table 2.3.2-5 (Sheet 3 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007–June 30, 2009)

Site:: Exelon Victoria County
Period:: Months Jul - Jun for years 2007 - 2009
Stability Class B Moderately Unstable based on Lapse Rate
Elevations:: Winds 10m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	0	1	6	19	17	16	24	4	1	88
NNE	0	0	0	0	5	25	14	10	10	3	0	67
NE	0	0	0	2	11	11	11	9	6	1	0	51
ENE	0	0	0	1	5	10	13	9	3	0	1	42
E	0	0	0	0	16	16	14	8	11	1	0	66
ESE	0	0	0	0	10	18	16	16	15	4	0	79
SE	0	0	0	1	14	7	24	38	88	27	3	202
SSE	0	0	0	0	4	12	17	56	76	38	14	217
S	0	0	0	1	3	5	32	21	35	27	6	130
SSW	0	0	0	1	6	15	11	9	5	3	2	52
SW	0	0	0	0	4	5	5	4	1	0	0	19
WSW	0	0	0	0	3	4	1	1	1	0	0	10
W	0	0	0	0	1	2	4	2	1	0	0	10
WNW	0	0	0	1	1	4	1	1	6	0	1	15
NW	0	0	0	0	2	4	4	2	8	4	3	27
NNW	0	0	0	0	5	7	4	5	8	7	3	39
Tot	0	0	0	8	96	164	188	207	298	119	34	1114

Hours of Calm 0
Hours of Variable Direction 4
Hours of Valid Data 1118
Hours of Missing Data . . . 46
Hours in Period 17544

Table 2.3.2-5 (Sheet 4 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007–June 30, 2009)

Site:: Exelon Victoria County
Period:: Months Jul - Jun for years 2007 - 2009
Stability Class C Slightly Unstable based on Lapse Rate
Elevations:: Winds 10m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	0	1	21	31	22	15	15	11	3	119
NNE	0	1	4	7	17	24	10	16	8	3	0	90
NE	0	0	1	6	20	23	10	6	4	0	0	70
ENE	0	0	0	5	18	14	10	5	1	1	0	54
E	0	0	1	4	23	24	14	10	9	2	0	87
ESE	0	0	0	4	15	17	22	15	12	0	0	85
SE	0	0	1	3	10	22	32	35	85	14	0	202
SSE	0	0	1	0	17	20	19	59	68	35	12	231
S	0	0	0	1	5	20	24	20	30	32	16	148
SSW	0	0	2	2	10	12	8	7	1	0	2	44
SW	0	0	0	2	13	12	8	3	2	1	0	41
WSW	0	0	0	4	2	2	2	2	0	0	0	12
W	0	0	1	4	4	5	7	2	1	0	0	24
WNW	0	0	0	1	5	4	3	1	1	1	0	16
NW	0	0	0	4	6	6	4	6	2	4	2	34
NNW	0	0	1	3	7	6	8	6	4	4	1	40
Tot	0	1	12	51	193	242	203	208	243	108	36	1297

Hours of Calm 0
Hours of Variable Direction 6
Hours of Valid Data 1303
Hours of Missing Data . . . 46
Hours in Period 17544

Table 2.3.2-5 (Sheet 5 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007–June 30, 2009)

Site:: Exelon Victoria County
Period:: Months Jul - Jun for years 2007 - 2009
Stability Class D Neutral based on Lapse Rate
Elevations:: Winds 10m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	1	15	25	60	77	97	111	129	28	10	553
NNE	0	4	9	27	96	82	76	71	30	4	0	399
NE	0	2	13	27	80	48	28	26	23	1	1	249
ENE	0	3	5	18	53	33	18	16	4	0	0	150
E	0	2	9	13	44	57	53	38	42	1	2	261
ESE	0	1	8	4	43	60	58	51	38	6	0	269
SE	0	2	7	14	50	77	146	180	285	75	7	843
SSE	0	2	2	16	51	75	136	199	273	142	24	920
S	0	5	5	3	36	60	76	100	125	67	19	496
SSW	0	0	3	13	21	39	24	21	11	1	0	133
SW	0	1	3	7	29	12	8	4	2	0	0	66
WSW	0	0	5	9	14	7	4	1	3	0	0	43
W	0	1	3	11	11	12	8	3	1	4	0	54
WNW	0	0	5	8	14	8	7	5	6	1	0	54
NW	0	2	4	13	37	17	9	9	13	8	2	114
NNW	0	1	12	12	25	27	31	25	31	15	6	185
Tot	0	27	108	220	664	691	779	860	1016	353	71	4789

Hours of Calm 2
Hours of Variable Direction 6
Hours of Valid Data 4797
Hours of Missing Data . . . 46
Hours in Period 17544

Table 2.3.2-5 (Sheet 6 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007–June 30, 2009)

Site:: Exelon Victoria County
Period:: Months Jul - Jun for years 2007 - 2009
Stability Class E Slightly Stable based on Lapse Rate
Elevations:: Winds 10m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	6	16	31	54	60	40	38	77	16	1	339
NNE	0	2	22	38	74	60	41	19	7	2	0	265
NE	0	5	20	40	83	41	19	7	2	1	0	218
ENE	0	10	20	34	65	23	9	5	5	0	0	171
E	0	8	16	31	100	56	24	7	3	1	0	246
ESE	0	5	13	26	75	75	37	6	3	0	0	240
SE	0	2	22	35	121	195	160	74	24	4	0	637
SSE	0	9	7	27	171	219	162	74	42	4	0	715
S	0	3	10	16	76	79	57	32	20	0	0	293
SSW	0	2	5	3	18	19	9	6	1	0	0	63
SW	0	3	8	11	16	6	3	0	0	0	0	47
WSW	0	1	9	3	9	5	1	1	2	0	0	31
W	0	4	8	5	6	8	2	4	2	0	0	39
WNW	1	4	10	12	8	6	2	4	4	1	0	52
NW	1	4	11	10	11	12	3	5	10	5	3	75
NNW	0	3	25	13	36	22	18	24	21	12	0	174
Tot	2	71	222	335	923	886	587	306	223	46	4	3605

Hours of Calm 2
Hours of Variable Direction 5
Hours of Valid Data 3612
Hours of Missing Data . . . 46
Hours in Period 17544

Table 2.3.2-5 (Sheet 7 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007–June 30, 2009)

Site:: Exelon Victoria County
Period:: Months Jul - Jun for years 2007 - 2009
Stability Class F Moderately Stable based on Lapse Rate
Elevations:: Winds 10m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	12	21	50	66	35	7	0	0	0	0	191
NNE	0	4	26	51	98	48	4	1	1	0	0	233
NE	0	9	27	41	85	11	5	0	0	0	0	178
ENE	0	12	27	46	63	12	3	0	0	0	0	163
E	0	9	41	54	84	18	1	0	0	0	0	207
ESE	0	17	38	68	108	21	0	1	0	0	0	253
SE	0	12	36	95	220	60	2	1	1	0	0	427
SSE	0	14	40	81	226	43	8	0	0	0	0	412
S	0	10	26	44	63	19	1	0	0	0	0	163
SSW	0	5	16	12	25	3	4	0	0	0	0	65
SW	0	9	5	6	13	4	2	0	0	0	0	39
WSW	0	7	6	8	8	7	1	0	0	0	0	37
W	0	6	9	5	14	6	0	1	0	0	0	41
WNW	0	3	10	6	9	6	1	0	0	0	0	35
NW	0	7	14	17	17	9	3	2	0	0	0	69
NNW	0	3	18	27	35	16	3	0	1	0	0	103
Tot	0	139	360	611	1134	318	45	6	3	0	0	2616

Hours of Calm 6
Hours of Variable Direction 2
Hours of Valid Data 2624
Hours of Missing Data . . . 46
Hours in Period 17544

Table 2.3.2-5 (Sheet 8 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007–June 30, 2009)

Site:: Exelon Victoria County
Period:: Months Jul - Jun for years 2007 - 2009
Stability Class G Extremely Stable based on Lapse Rate
Elevations:: Winds 10m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	16	42	66	106	17	0	0	0	0	0	247
NNE	0	12	34	65	101	14	2	0	0	0	0	228
NE	1	18	37	50	97	20	1	0	0	0	0	224
ENE	1	17	17	35	55	14	0	0	0	0	0	139
E	0	14	29	46	76	8	0	0	0	0	0	173
ESE	0	14	37	48	91	12	0	0	1	0	0	203
SE	0	18	25	38	122	20	1	0	0	0	0	224
SSE	0	14	24	46	101	28	0	0	0	0	0	213
S	0	17	19	36	53	9	0	0	0	0	0	134
SSW	0	10	16	11	25	10	0	0	0	0	0	72
SW	0	9	15	13	26	7	0	0	0	0	0	70
WSW	0	9	17	14	18	3	0	0	0	0	0	61
W	0	6	16	18	46	8	1	0	0	0	0	95
WNW	0	21	16	25	46	11	2	0	0	0	0	121
NW	1	10	23	34	56	4	0	1	0	0	0	129
NNW	0	11	50	107	88	20	0	0	0	0	0	276
Tot	3	216	417	652	1107	205	7	1	1	0	0	2609

Hours of Calm 23
Hours of Variable Direction 5
Hours of Valid Data 2637
Hours of Missing Data . . . 46
Hours in Period 17544

Table 2.3.2-6 (Sheet 1 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007–June 30, 2009)

Site:: Exelon Victoria County
Period:: Months Jul - Jun for years 2007 - 2009
All Stabilities
Elevations:: Winds 60m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	4	15	32	84	121	154	200	404	260	176	1450
NNE	0	5	13	30	117	140	172	183	353	115	33	1161
NE	0	4	16	27	129	181	182	172	232	49	6	998
ENE	0	1	14	34	95	151	174	158	131	21	1	780
E	0	6	10	20	121	168	182	181	178	50	13	929
ESE	0	6	22	29	96	166	227	270	361	57	9	1243
SE	0	3	10	23	89	170	253	456	941	421	155	2521
SSE	0	3	6	21	90	153	315	563	1465	655	401	3672
S	0	6	12	20	92	158	272	395	635	318	319	2227
SSW	0	4	11	14	67	103	109	113	129	64	25	639
SW	0	3	9	15	59	68	64	45	51	22	0	336
WSW	0	2	14	24	33	40	24	34	43	7	2	223
W	0	3	8	13	37	34	30	33	31	8	5	202
WNW	0	1	5	11	20	32	24	21	40	25	16	195
NW	0	8	13	21	54	60	32	30	73	41	39	371
NNW	0	5	19	25	62	74	88	64	104	57	31	529
Tot	0	64	197	359	1245	1819	2302	2918	5171	2170	1231	17476

Hours of Calm 6
Hours of Variable Direction 15
Hours of Valid Data 17497
Hours of Missing Data . . . 47
Hours in Period 17544

Table 2.3.2-6 (Sheet 2 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007–June 30, 2009)

Site:: Exelon Victoria County
Period:: Months Jul - Jun for years 2007 - 2009
Stability Class A Extremely Unstable based on Lapse Rate
Elevations:: Winds 60m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	0	0	0	4	9	16	51	44	26	150
NNE	0	0	0	0	1	9	9	17	27	15	6	84
NE	0	0	0	1	1	6	4	5	20	1	0	38
ENE	0	0	0	0	1	4	11	4	6	1	0	27
E	0	0	0	0	5	4	7	10	10	2	1	39
ESE	0	0	0	0	1	2	8	7	18	4	0	40
SE	0	0	0	0	0	2	15	22	86	100	27	252
SSE	0	0	0	0	0	5	14	22	133	136	106	416
S	0	0	0	0	1	1	3	12	41	60	73	191
SSW	0	0	0	0	1	2	3	2	5	6	7	26
SW	0	0	0	0	0	0	1	1	6	1	0	9
WSW	0	0	0	0	0	0	1	3	5	0	0	9
W	0	0	0	0	0	2	0	3	1	0	0	6
WNW	0	0	0	0	0	0	0	2	4	1	5	12
NW	0	0	0	0	0	0	0	3	20	7	16	46
NNW	0	0	0	0	1	0	5	11	21	20	4	62
Tot	0	0	0	1	12	41	90	140	454	398	271	1407

Hours of Calm 0
Hours of Variable Direction 0
Hours of Valid Data 1407
Hours of Missing Data . . . 47
Hours in Period 17544

Table 2.3.2-6 (Sheet 3 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007–June 30, 2009)

Site:: Exelon Victoria County
Period:: Months Jul - Jun for years 2007 - 2009
Stability Class B Moderately Unstable based on Lapse Rate
Elevations:: Winds 60m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	0	1	3	15	14	12	20	15	7	87
NNE	0	0	0	0	2	14	17	6	12	7	3	61
NE	0	0	0	1	7	10	9	8	13	1	2	51
ENE	0	0	0	0	6	9	11	13	7	3	0	49
E	0	0	0	0	7	13	15	10	13	5	2	65
ESE	0	0	0	0	5	13	15	6	14	8	0	61
SE	0	0	0	0	3	11	13	33	62	48	26	196
SSE	0	0	0	0	6	3	16	12	75	50	44	206
S	0	0	0	0	4	2	13	28	48	29	34	158
SSW	0	0	0	0	6	6	15	10	14	6	10	67
SW	0	0	0	0	2	1	7	4	2	1	0	17
WSW	0	0	0	0	1	5	2	0	2	1	0	11
W	0	0	0	0	0	2	1	5	2	0	0	10
WNW	0	0	0	0	0	1	3	0	2	2	1	9
NW	0	0	0	0	3	5	3	3	8	5	2	29
NNW	0	0	0	0	2	4	7	2	10	7	6	38
Tot	0	0	0	2	57	114	161	152	304	188	137	1115

Hours of Calm 0
Hours of Variable Direction 3
Hours of Valid Data 1118
Hours of Missing Data . . . 47
Hours in Period 17544

Table 2.3.2-6 (Sheet 4 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007–June 30, 2009)

Site:: Exelon Victoria County
Period:: Months Jul - Jun for years 2007 - 2009
Stability Class C Slightly Unstable based on Lapse Rate
Elevations:: Winds 60m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	1	1	16	17	24	17	19	13	11	119
NNE	0	1	2	2	19	11	14	8	20	4	4	85
NE	0	0	1	3	13	21	18	8	5	3	0	72
ENE	0	0	0	3	17	9	10	8	5	1	1	54
E	0	0	0	1	13	26	14	11	14	3	3	85
ESE	0	0	1	4	9	17	13	14	15	5	0	78
SE	0	0	1	2	10	13	18	30	75	36	9	194
SSE	0	0	1	0	9	11	16	19	83	41	37	217
S	0	0	1	0	4	14	16	20	44	26	56	181
SSW	0	0	1	0	4	14	9	10	9	1	4	52
SW	0	0	0	2	6	10	9	5	2	1	0	35
WSW	0	0	2	5	4	3	0	4	2	1	1	22
W	0	0	0	0	6	4	5	4	2	0	0	21
WNW	0	0	0	2	3	3	4	0	1	2	0	15
NW	0	0	0	3	8	6	2	2	4	3	1	29
NNW	0	0	1	2	5	6	7	3	5	4	5	38
Tot	0	1	12	30	146	185	179	163	305	144	132	1297

Hours of Calm 0
Hours of Variable Direction 6
Hours of Valid Data 1303
Hours of Missing Data . . . 47
Hours in Period 17544

Table 2.3.2-6 (Sheet 5 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007–June 30, 2009)

Site:: Exelon Victoria County
Period:: Months Jul - Jun for years 2007 - 2009
Stability Class D Neutral based on Lapse Rate
Elevations:: Winds 60m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	0	4	17	37	44	54	67	136	101	76	536
NNE	0	2	4	14	52	54	55	54	114	34	9	392
NE	0	3	8	12	60	57	42	23	53	22	3	283
ENE	0	1	5	16	30	33	27	17	21	4	0	154
E	0	2	7	9	38	33	26	41	45	27	6	234
ESE	0	0	4	4	19	35	33	53	86	22	7	263
SE	0	0	3	6	29	45	59	90	238	192	80	742
SSE	0	1	2	8	14	38	59	82	287	257	203	951
S	0	2	3	5	26	30	41	68	149	122	150	596
SSW	0	2	4	3	19	29	24	26	37	17	4	165
SW	0	0	4	4	22	18	11	6	10	0	0	75
WSW	0	2	2	9	13	9	5	5	1	2	0	48
W	0	0	3	5	12	10	8	5	2	3	1	49
WNW	0	0	1	3	9	10	9	4	7	3	3	49
NW	0	1	6	12	18	24	5	5	15	7	9	102
NNW	0	0	10	8	18	26	21	16	29	13	13	154
Tot	0	16	70	135	416	495	479	562	1230	826	564	4793

Hours of Calm 0
Hours of Variable Direction 4
Hours of Valid Data 4797
Hours of Missing Data . . . 47
Hours in Period 17544

Table 2.3.2-6 (Sheet 6 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007–June 30, 2009)

Site:: Exelon Victoria County
Period:: Months Jul - Jun for years 2007 - 2009
Stability Class E Slightly Stable based on Lapse Rate
Elevations:: Winds 60m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	1	5	5	15	18	26	34	64	71	56	295
NNE	0	0	3	6	22	29	31	40	64	32	10	237
NE	0	0	3	5	21	41	41	49	55	6	1	222
ENE	0	0	3	7	20	46	41	36	20	5	0	178
E	0	2	1	0	16	39	49	42	42	6	1	198
ESE	0	1	8	10	13	27	50	82	78	7	2	278
SE	0	0	0	7	16	35	48	115	239	30	12	502
SSE	0	0	1	5	20	33	65	165	414	101	11	815
S	0	2	3	7	16	30	58	103	162	55	6	442
SSW	0	1	3	5	8	13	10	21	19	15	0	95
SW	0	2	1	2	8	18	14	8	9	1	0	63
WSW	0	0	2	5	4	7	3	5	2	2	1	31
W	0	1	1	3	6	6	4	4	4	2	2	33
WNW	0	0	3	2	1	9	3	5	3	5	2	33
NW	0	1	4	2	7	8	8	7	4	9	10	60
NNW	0	2	3	10	16	15	21	15	30	13	3	128
Tot	0	13	44	81	209	374	472	731	1209	360	117	3610

Hours of Calm 0
Hours of Variable Direction 2
Hours of Valid Data 3612
Hours of Missing Data . . . 47
Hours in Period 17544

Table 2.3.2-6 (Sheet 7 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007–June 30, 2009)

Site:: Exelon Victoria County
Period:: Months Jul - Jun for years 2007 - 2009
Stability Class F Moderately Stable based on Lapse Rate
Elevations:: Winds 60m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	2	1	4	7	12	15	29	56	7	0	133
NNE	0	1	2	5	11	9	19	22	56	14	1	140
NE	0	0	2	1	13	19	41	51	44	6	0	177
ENE	0	0	0	2	10	31	35	39	21	3	0	141
E	0	2	0	6	20	28	46	25	26	1	0	154
ESE	0	1	1	4	23	35	57	66	61	1	0	249
SE	0	1	1	5	11	35	47	85	101	4	1	291
SSE	0	1	0	5	23	41	99	190	262	15	0	636
S	0	2	2	5	21	39	80	118	93	8	0	368
SSW	0	0	3	4	10	16	28	25	17	4	0	107
SW	0	0	3	4	8	12	9	9	4	6	0	55
WSW	0	0	2	1	7	4	5	7	4	0	0	30
W	0	1	2	3	4	4	5	6	11	1	0	37
WNW	0	1	0	0	6	3	1	2	10	3	0	26
NW	0	2	1	0	5	10	5	5	7	4	0	39
NNW	0	0	2	0	6	9	11	7	3	0	0	38
Tot	0	14	22	49	185	307	503	686	776	77	2	2621

Hours of Calm 2
Hours of Variable Direction 0
Hours of Valid Data 2623
Hours of Missing Data . . . 47
Hours in Period 17544

Table 2.3.2-6 (Sheet 8 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for the VCS Site (July 1, 2007–June 30, 2009)

Site:: Exelon Victoria County
Period:: Months Jul - Jun for years 2007 - 2009
Stability Class G Extremely Stable based on Lapse Rate
Elevations:: Winds 60m Stability 60m

Wind Direction Sector	Wind Speed Range (m/s) <0.50	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	>10.00	Total
N	0	1	4	4	6	11	12	25	58	9	0	130
NNE	0	1	2	3	10	14	27	36	60	9	0	162
NE	0	1	2	4	14	27	27	28	42	10	0	155
ENE	0	0	6	6	11	19	39	41	51	4	0	177
E	0	0	2	4	22	25	25	42	28	6	0	154
ESE	0	4	8	7	26	37	51	42	89	10	0	274
SE	0	2	5	3	20	29	53	81	140	11	0	344
SSE	0	1	2	3	18	22	46	73	211	55	0	431
S	0	0	3	3	20	42	61	46	98	18	0	291
SSW	0	1	0	2	19	23	20	19	28	15	0	127
SW	0	1	1	3	13	9	13	12	18	12	0	82
WSW	0	0	6	4	4	12	8	10	27	1	0	72
W	0	1	2	2	9	6	7	6	9	2	2	46
WNW	0	0	1	4	1	6	4	8	13	9	5	51
NW	0	4	2	4	13	7	9	5	15	6	1	66
NNW	0	3	3	5	14	14	16	10	6	0	0	71
Tot	0	20	49	61	220	303	418	484	893	177	8	2633

Hours of Calm 4
Hours of Variable Direction 0
Hours of Valid Data 2637
Hours of Missing Data . . . 47
Hours in Period 17544

Table 2.3.2-7
Climatological Normals at Selected NWS and Cooperative Observing Stations in the VCS Site Area

Station	Normal Annual Temperatures (°F)[a]				Normal Annual Precipitation	
	Daily Maximum	Daily Minimum	Daily[b] Range	Daily Mean	Rainfall[a] (inches)	Snowfall[c] (inches)
Palacios Municipal Airport	77.2	61.1	16.1	69.2	45.40	0.1
Beeville 5 NE	80.8	59.6	21.2	70.2	33.48	0.1
Port O' Connor	76.4	65.0	11.4	70.7	34.78	0.1
Point Comfort	79.7	62.4	17.3	71.1	43.87	Trace
Cuero	81.7	57.5	24.2	69.6	36.08	0.1
Yoakum	79.7	56.7	23.0	68.2	40.96	Trace
Edna Highway 59 Bridge	N/A[d]	N/A[d]	N/A[d]	N/A[d]	42.17	N/A[d]
Rockport	77.9	62.9	15.0	70.4	35.96	Trace
Goliad	83.1	59.4	23.7	71.3	38.58	0.5
Sinton	79.4	60.7	18.7	70.1	35.54	0.1
Aransas Wildlife Refuge	77.5	62.9	14.6	70.2	40.83	Trace
Victoria Regional Airport	79.6	60.4	19.2	70.0	40.10	0.3
Refugio 2 NW	81.9	60.0	21.9	71.0	40.00	N/A[d]
Karnes City 2N	80.4	57.8	22.6	69.1	28.35	N/A[d]

(a) NCDC Climatography No. 81 1971–2000 (Reference 2.3.2-3).
(b) Value is calculated as the difference between the normal daily maximum and normal daily minimum temperatures.
(c) NCDC Climatography No. 20 1971–2000 (Reference 2.3.2-2).
(d) N/A = Measurements not made at this station.

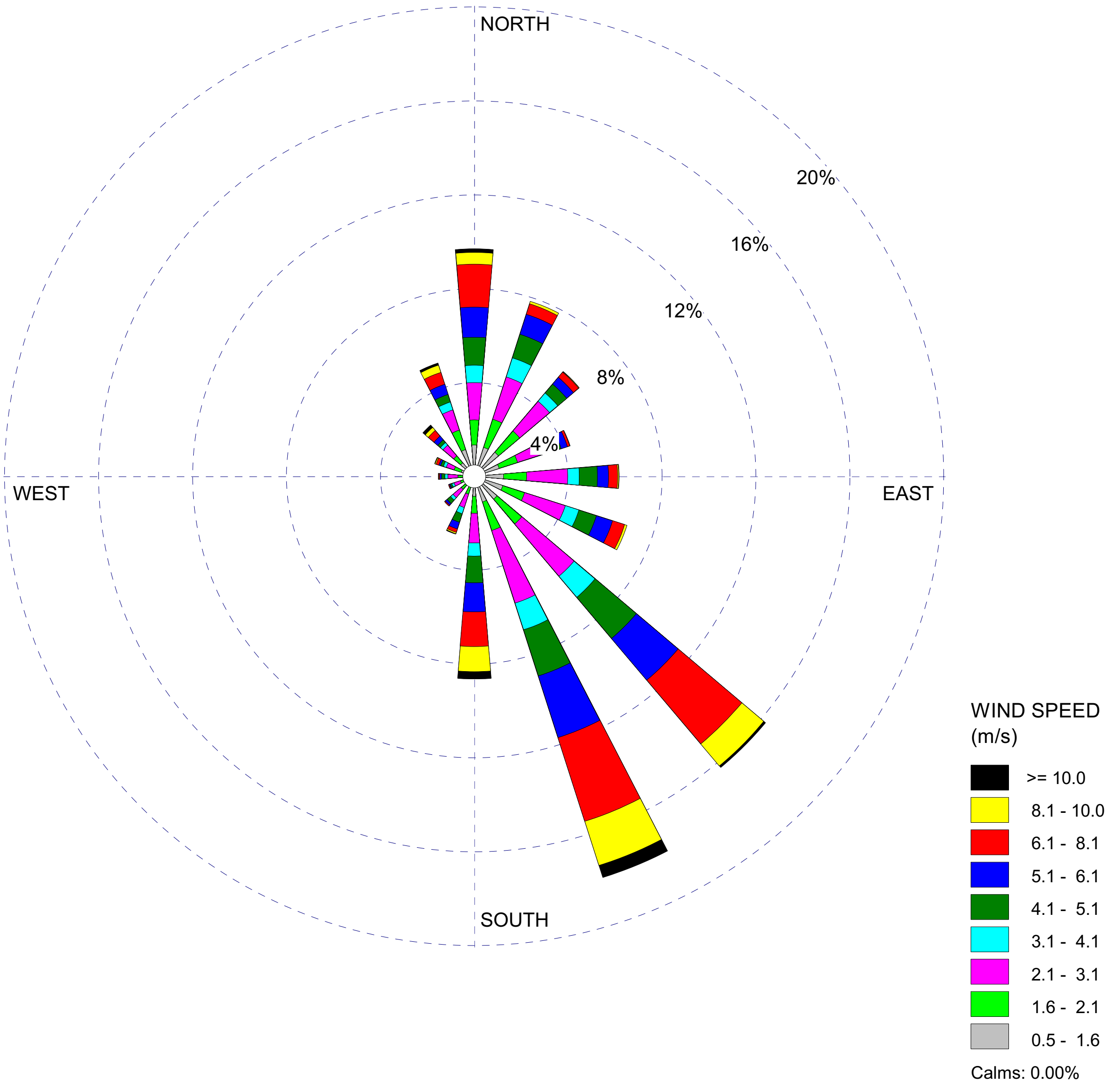


Figure 2.3.2-1 10-Meter Level Wind Rose — Annual
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

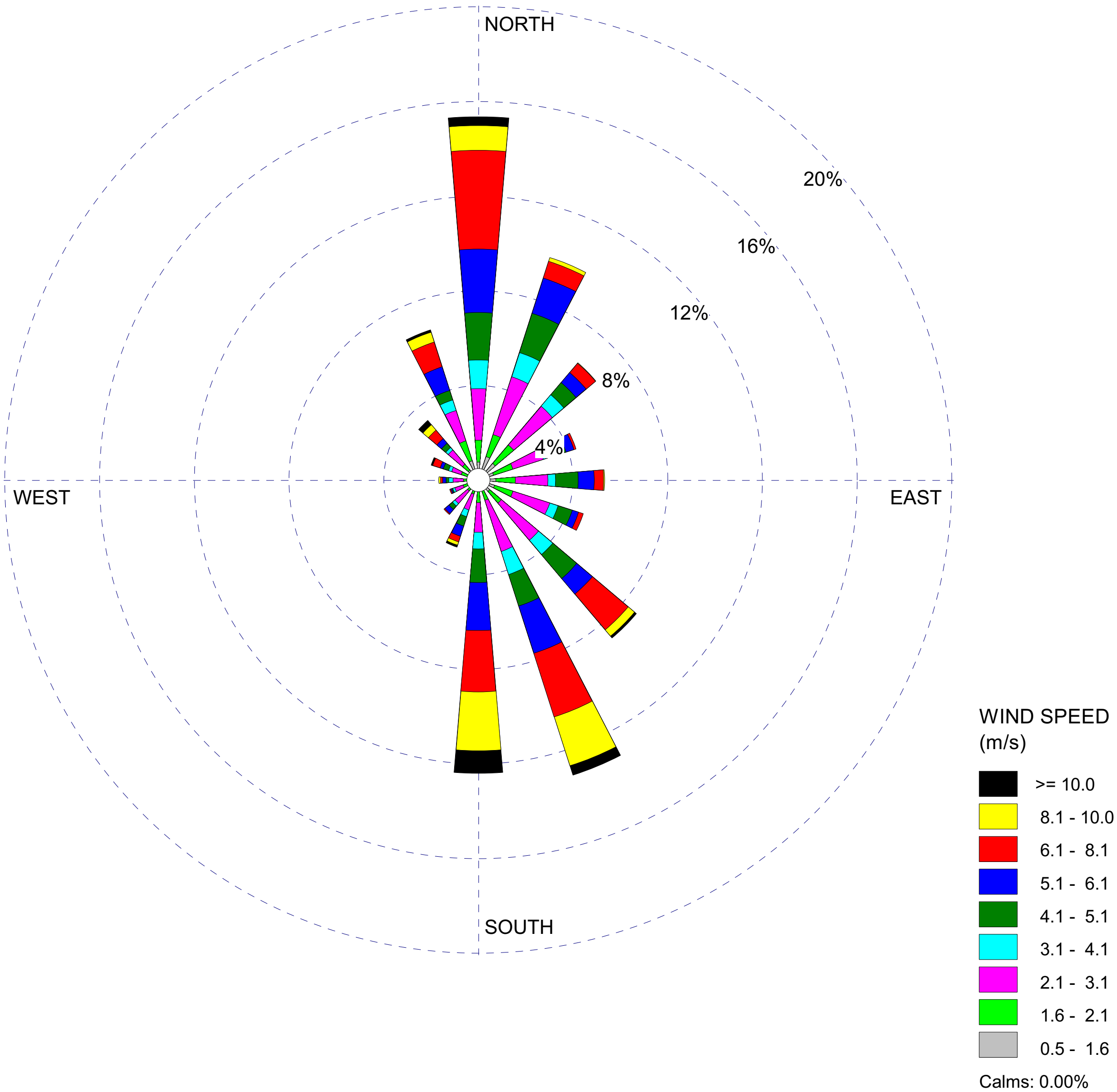


Figure 2.3.2-2 10-Meter Level Wind Rose — Winter
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

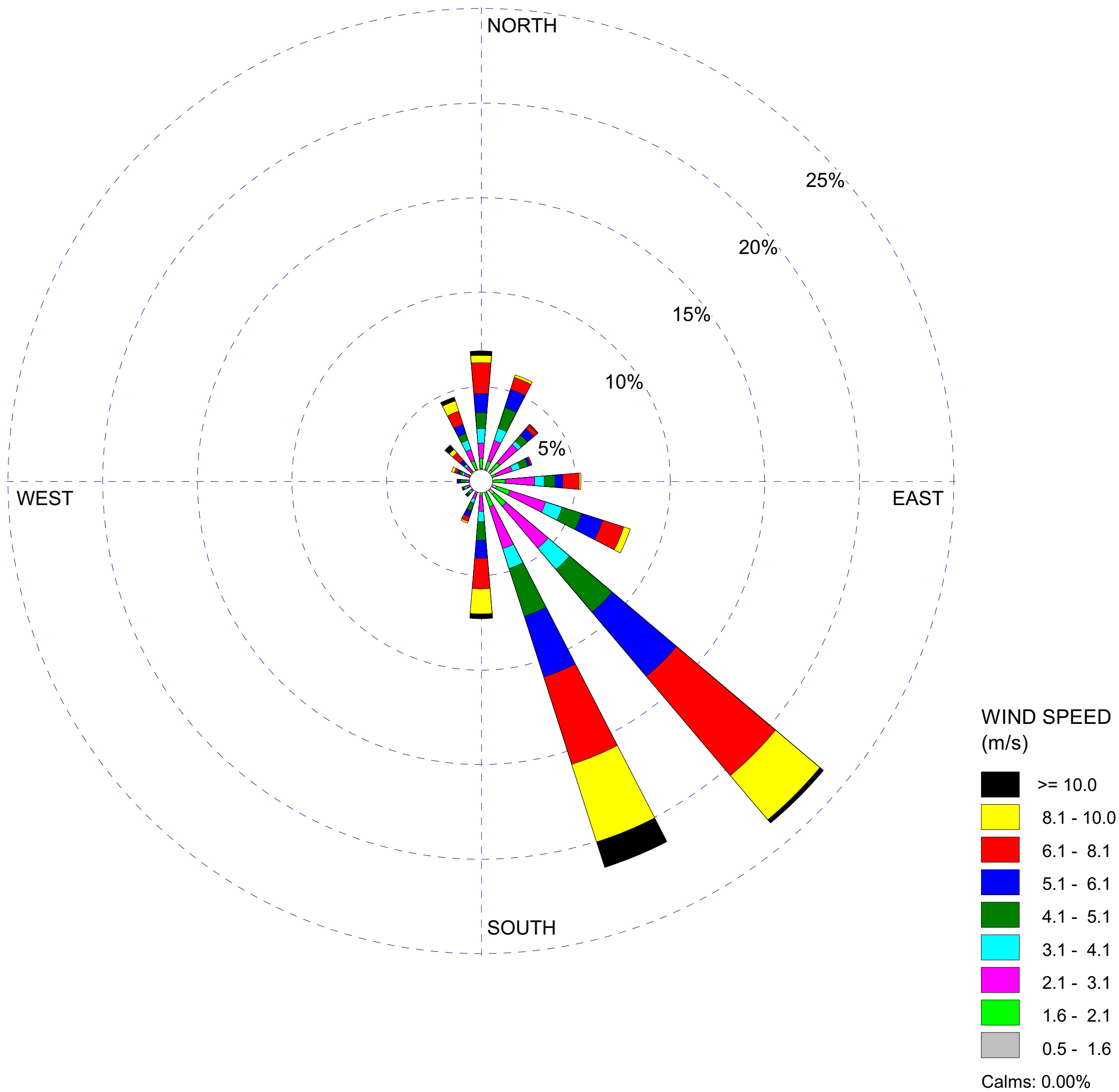


Figure 2.3.2-3 10-Meter Level Wind Rose — Spring
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

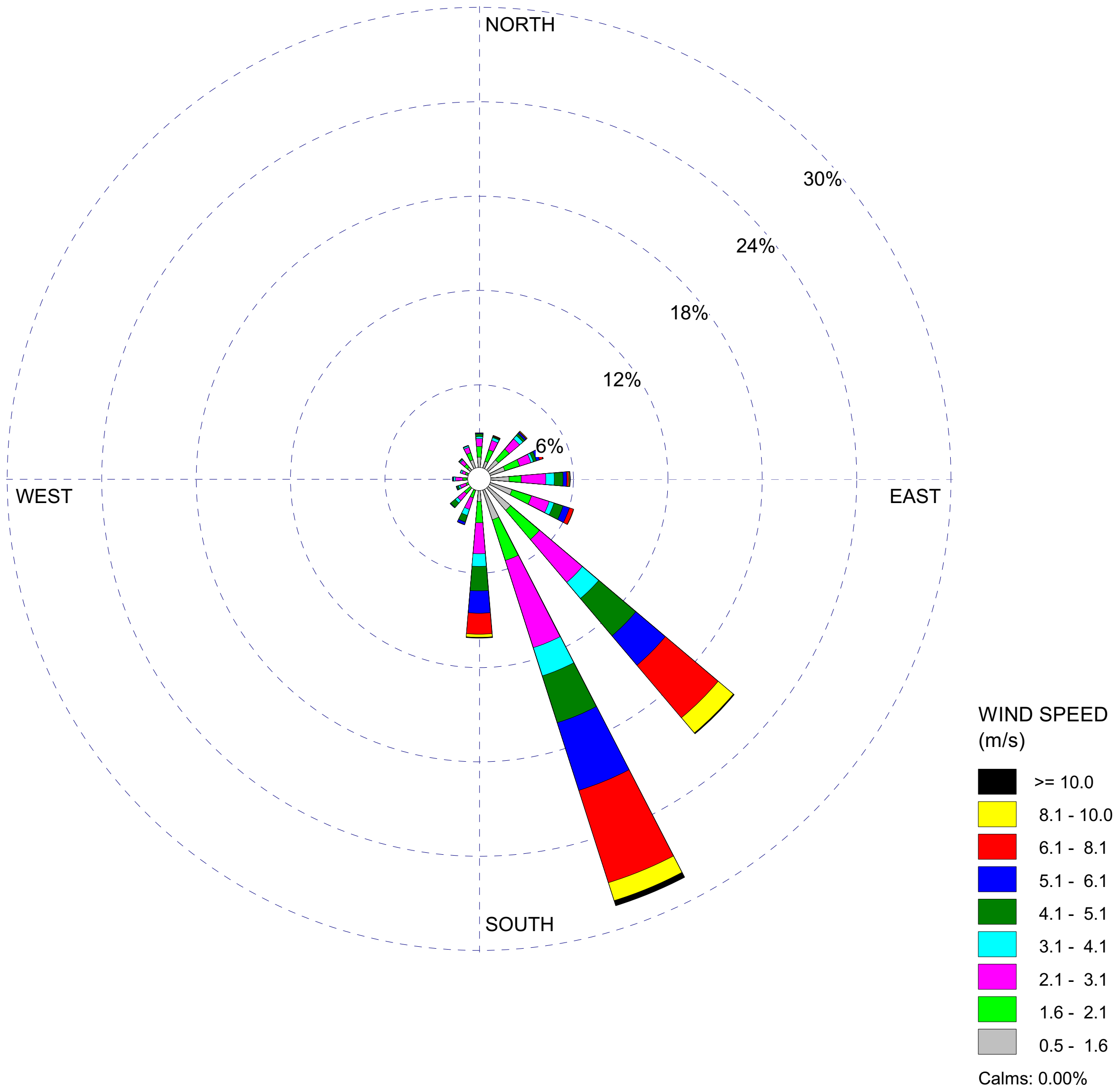


Figure 2.3.2-4 10-Meter Level Wind Rose — Summer
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

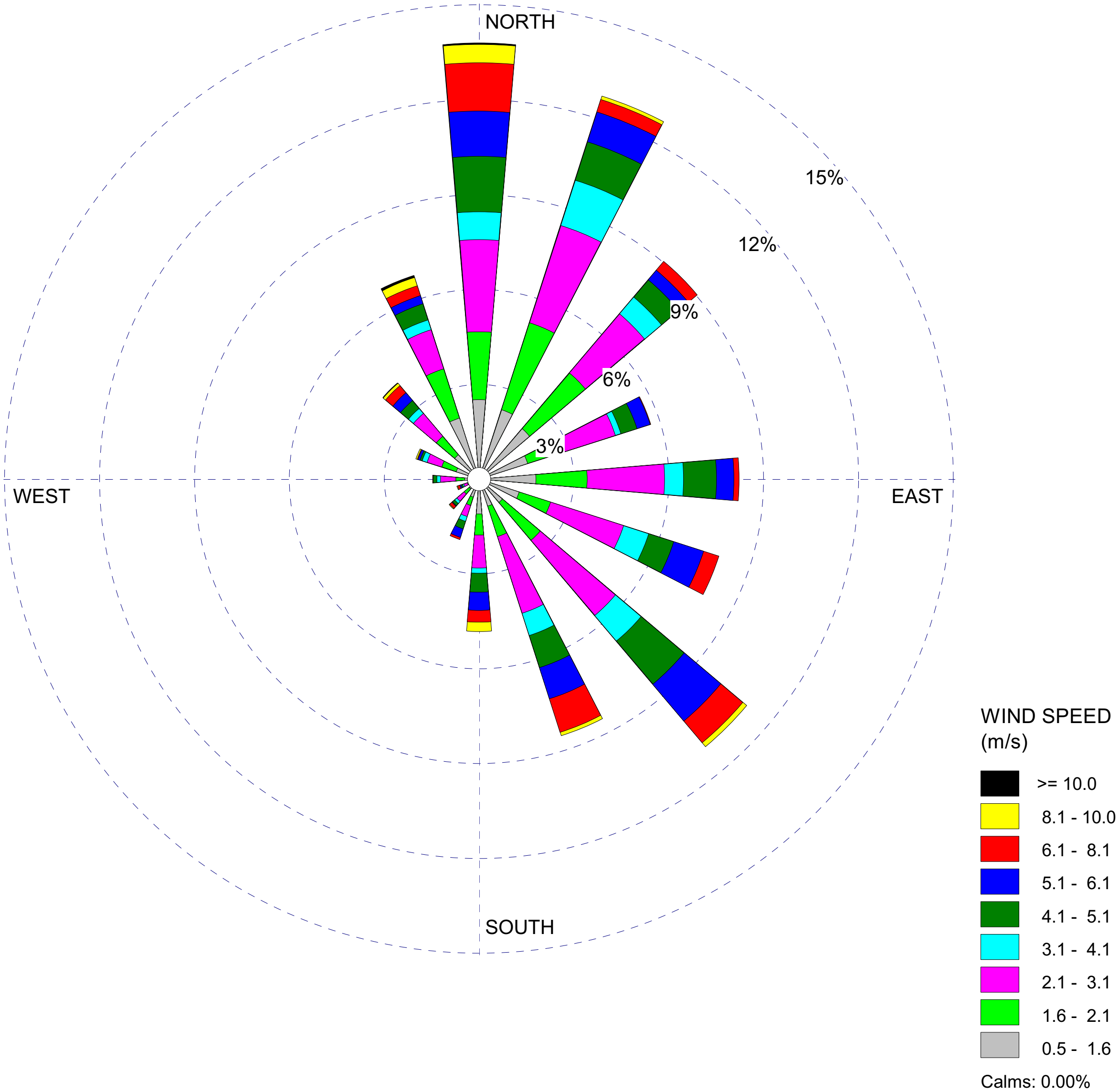


Figure 2.3.2-5 10-Meter Level Wind Rose — Autumn
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

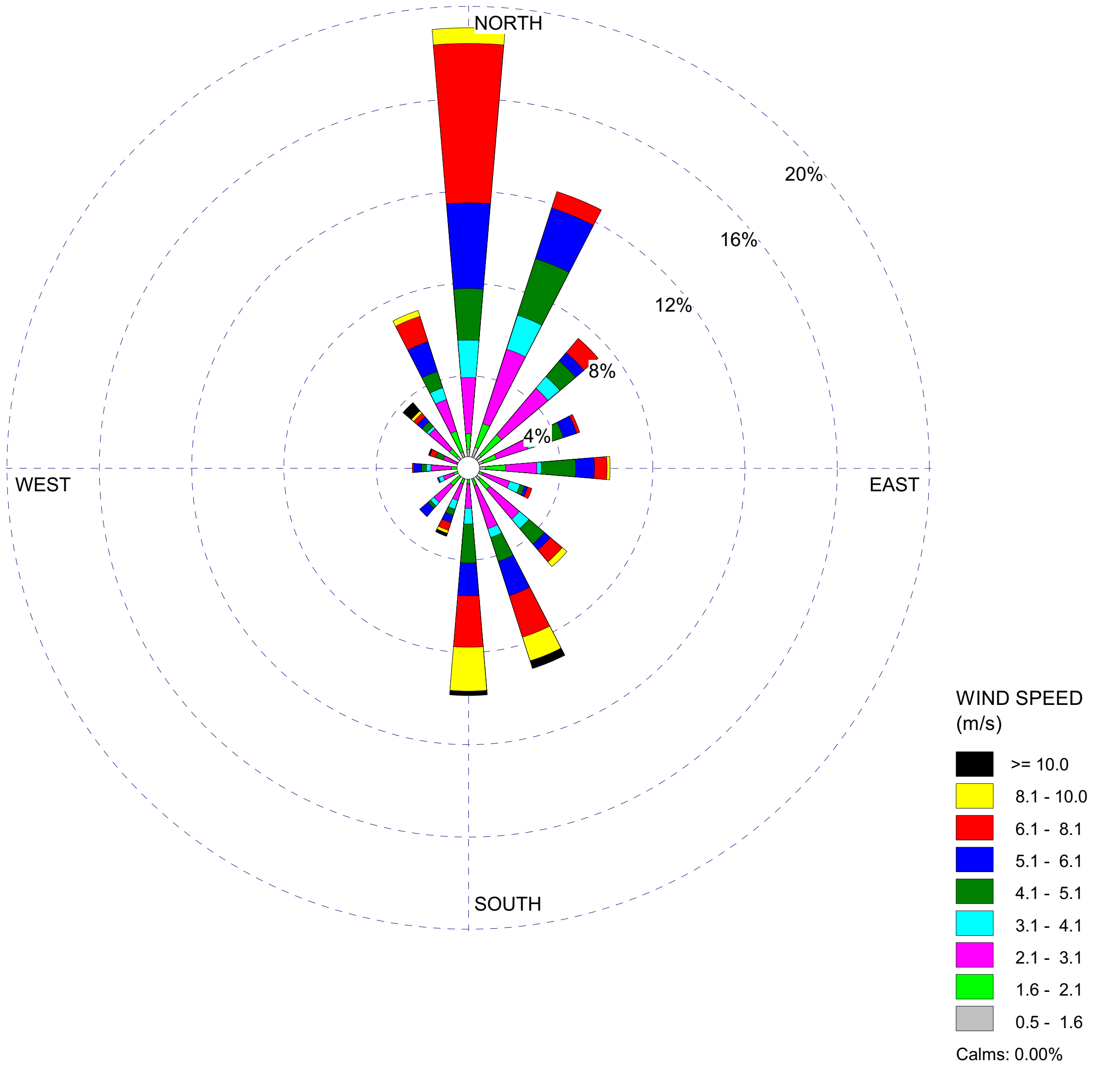


**Figure 2.3.2-6 10-Meter Level Wind Rose — January (Sheet 1 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)**

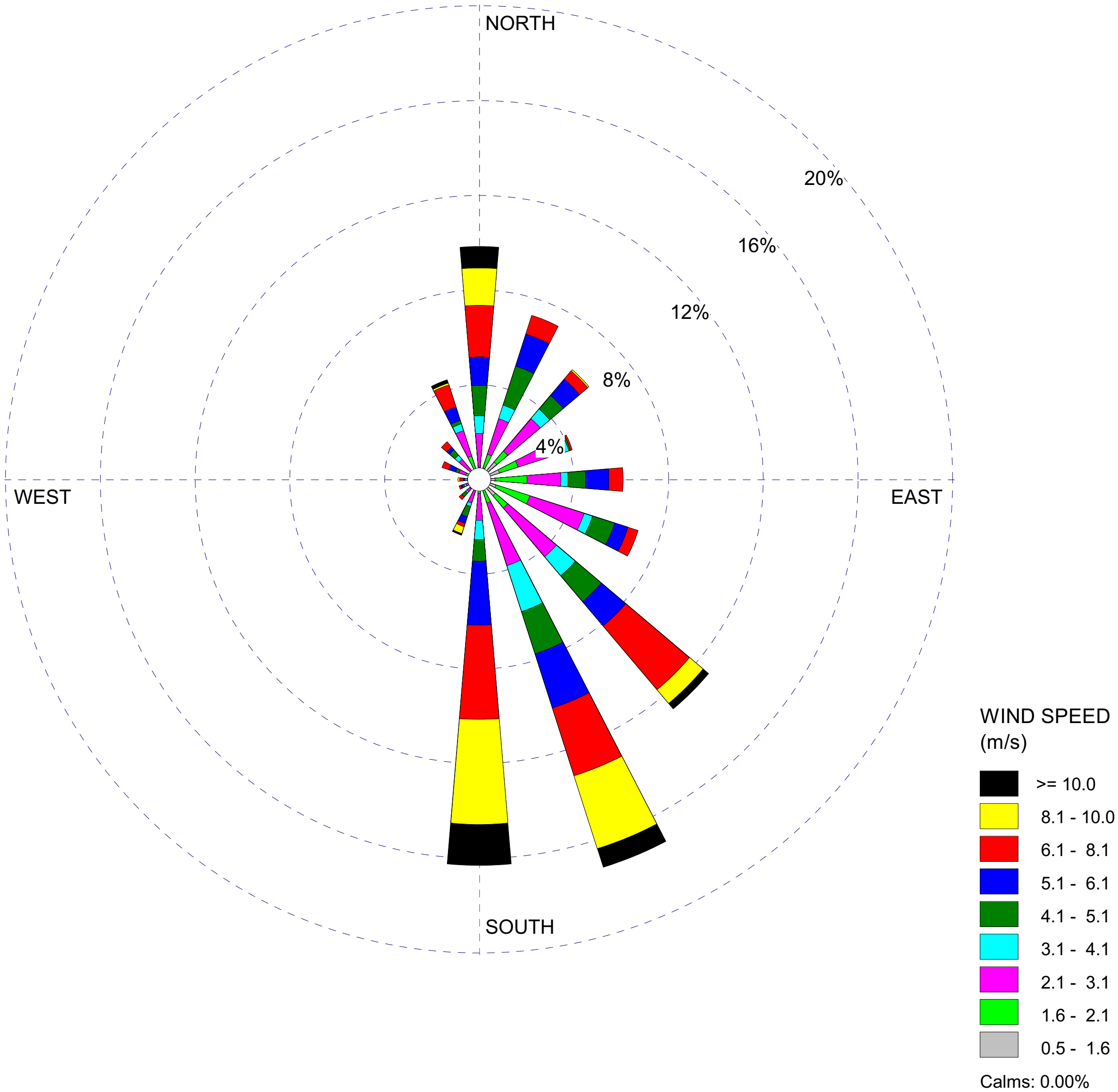


Figure 2.3.2-6 10-Meter Level Wind Rose — February (Sheet 2 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

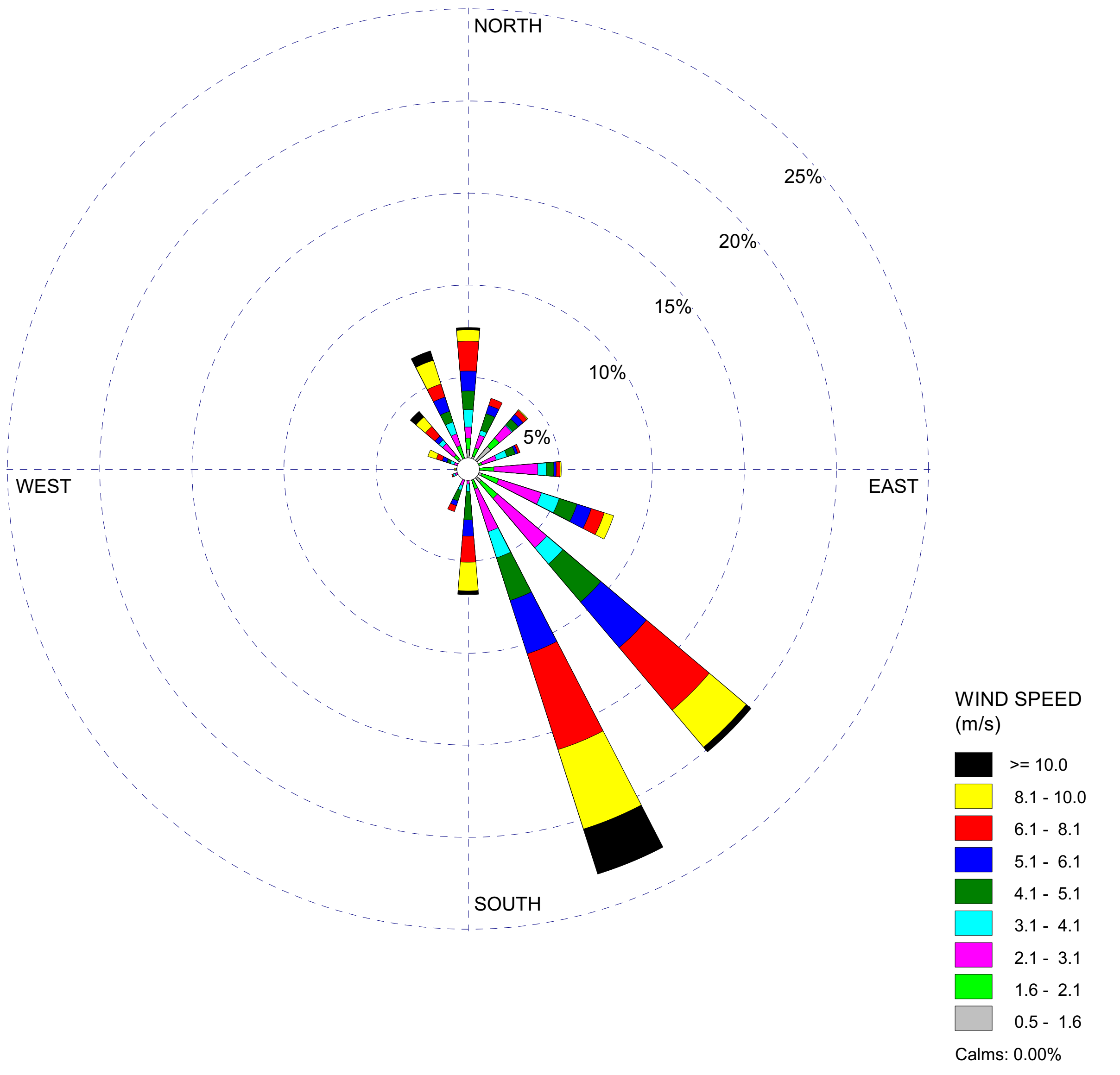


**Figure 2.3.2-6 10-Meter Level Wind Rose — March (Sheet 3 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)**

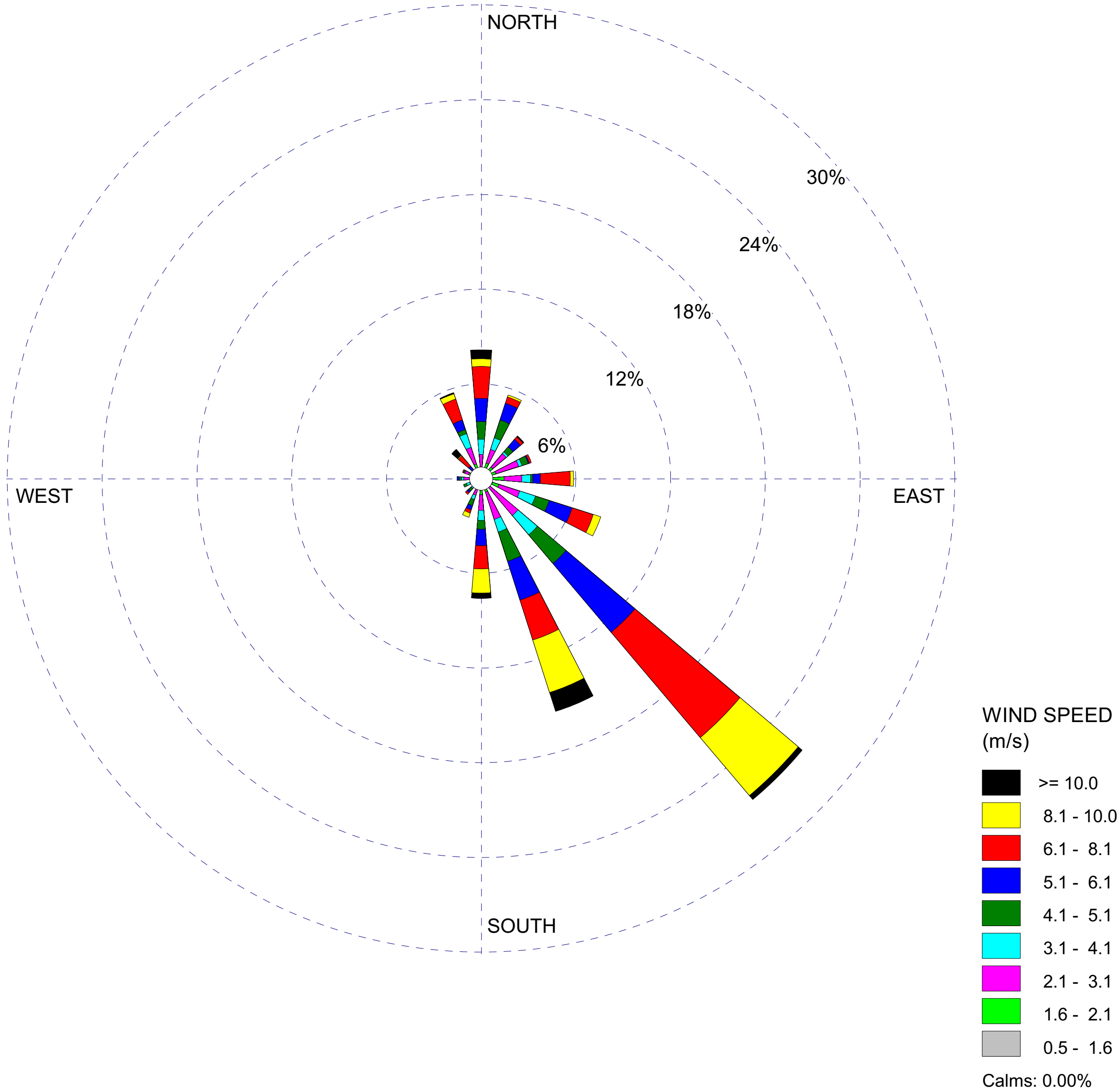


Figure 2.3.2-6 10-Meter Level Wind Rose — April (Sheet 4 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

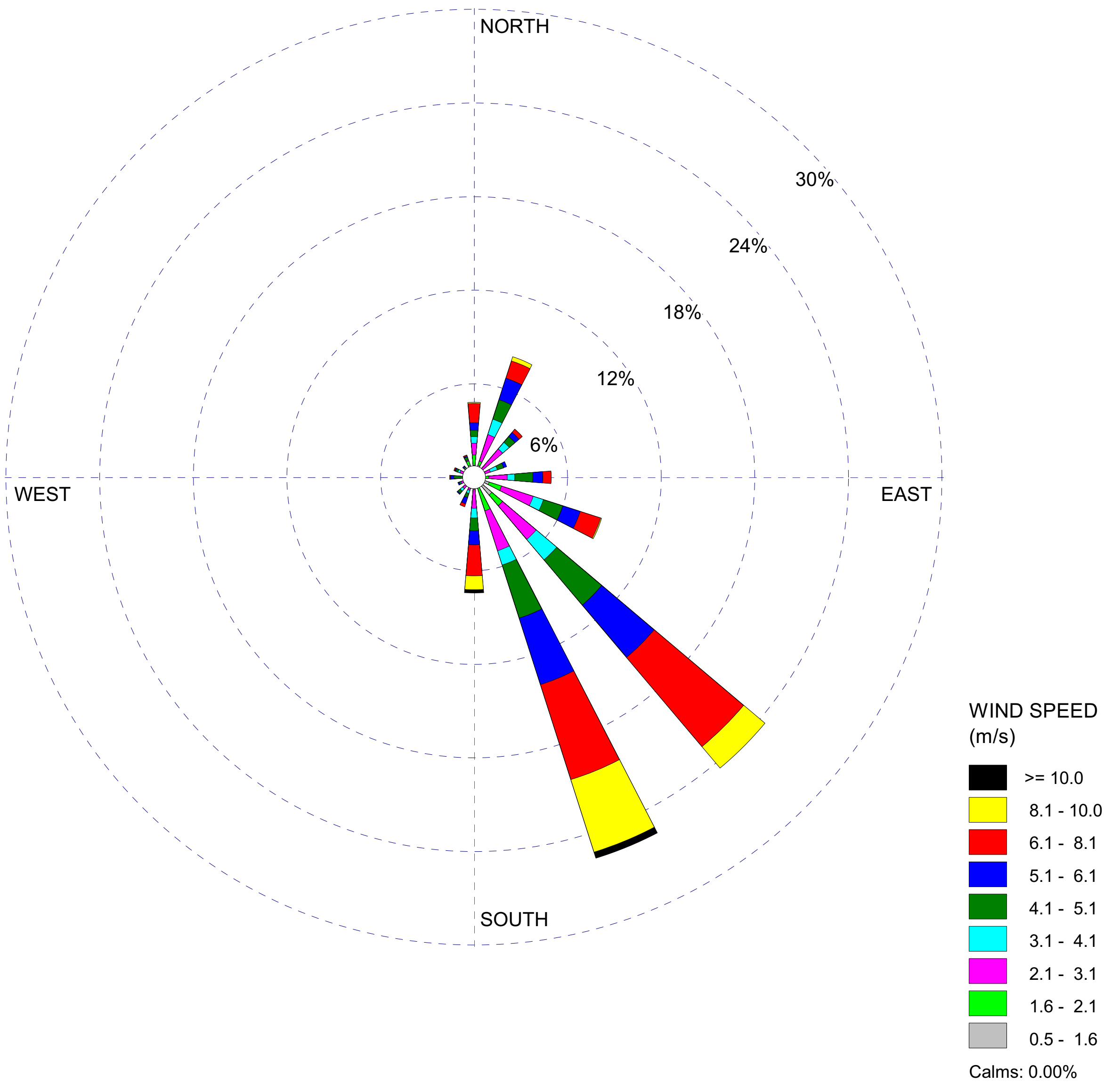


Figure 2.3.2-6 10-Meter Level Wind Rose — May (Sheet 5 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

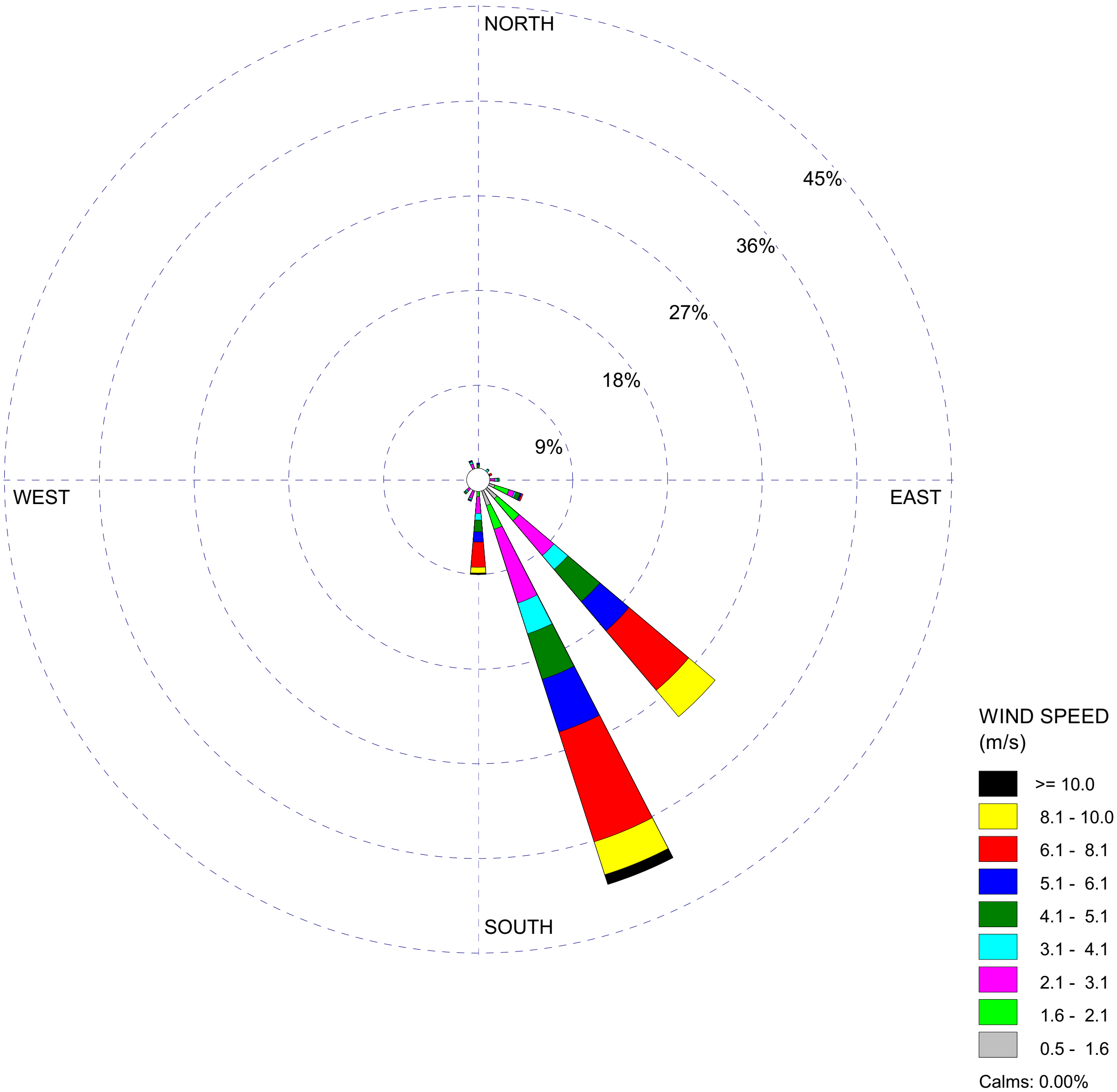


Figure 2.3.2-6 10-Meter Level Wind Rose — June (Sheet 6 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

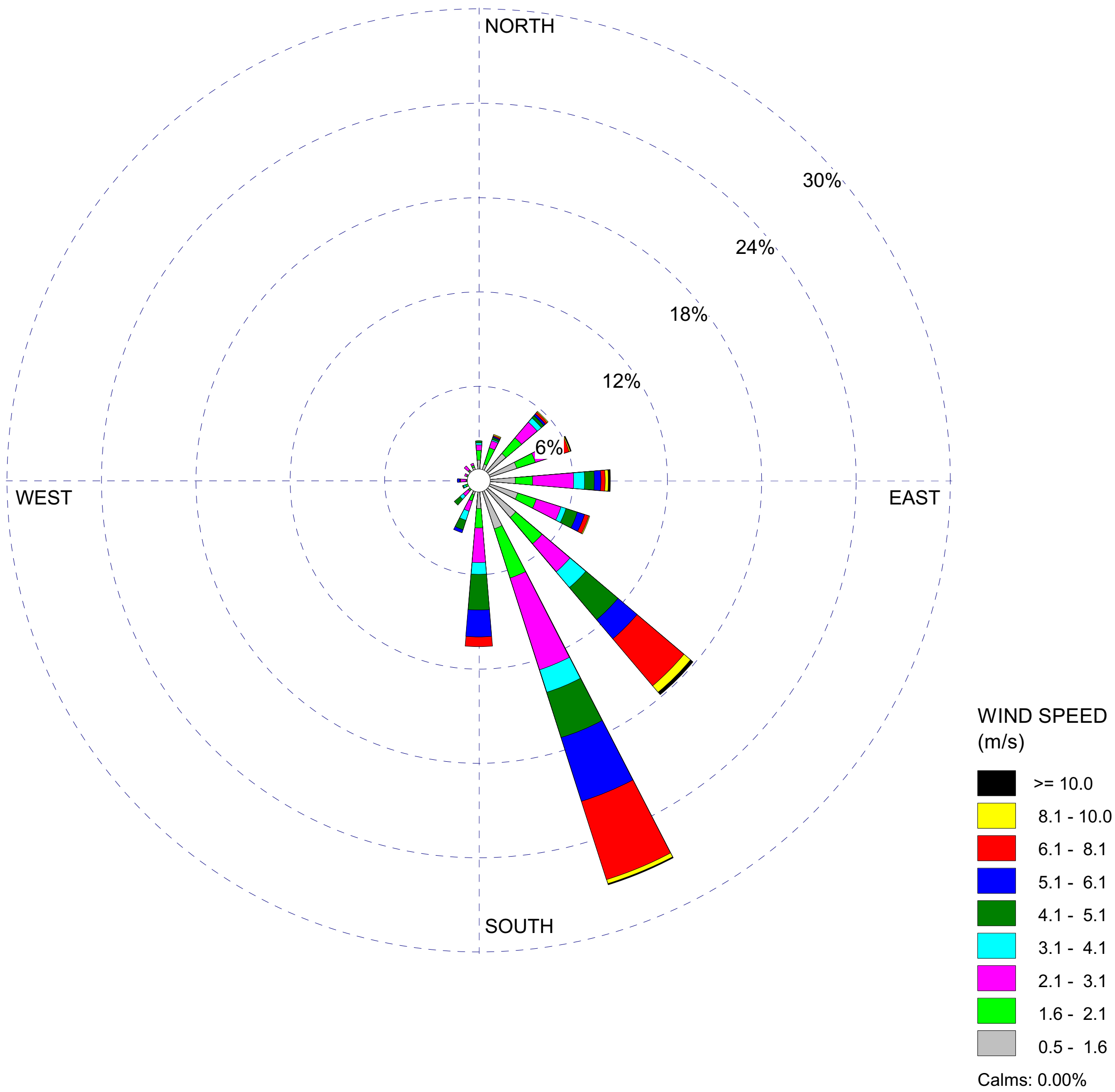


Figure 2.3.2-6 10-Meter Level Wind Rose — July (Sheet 7 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

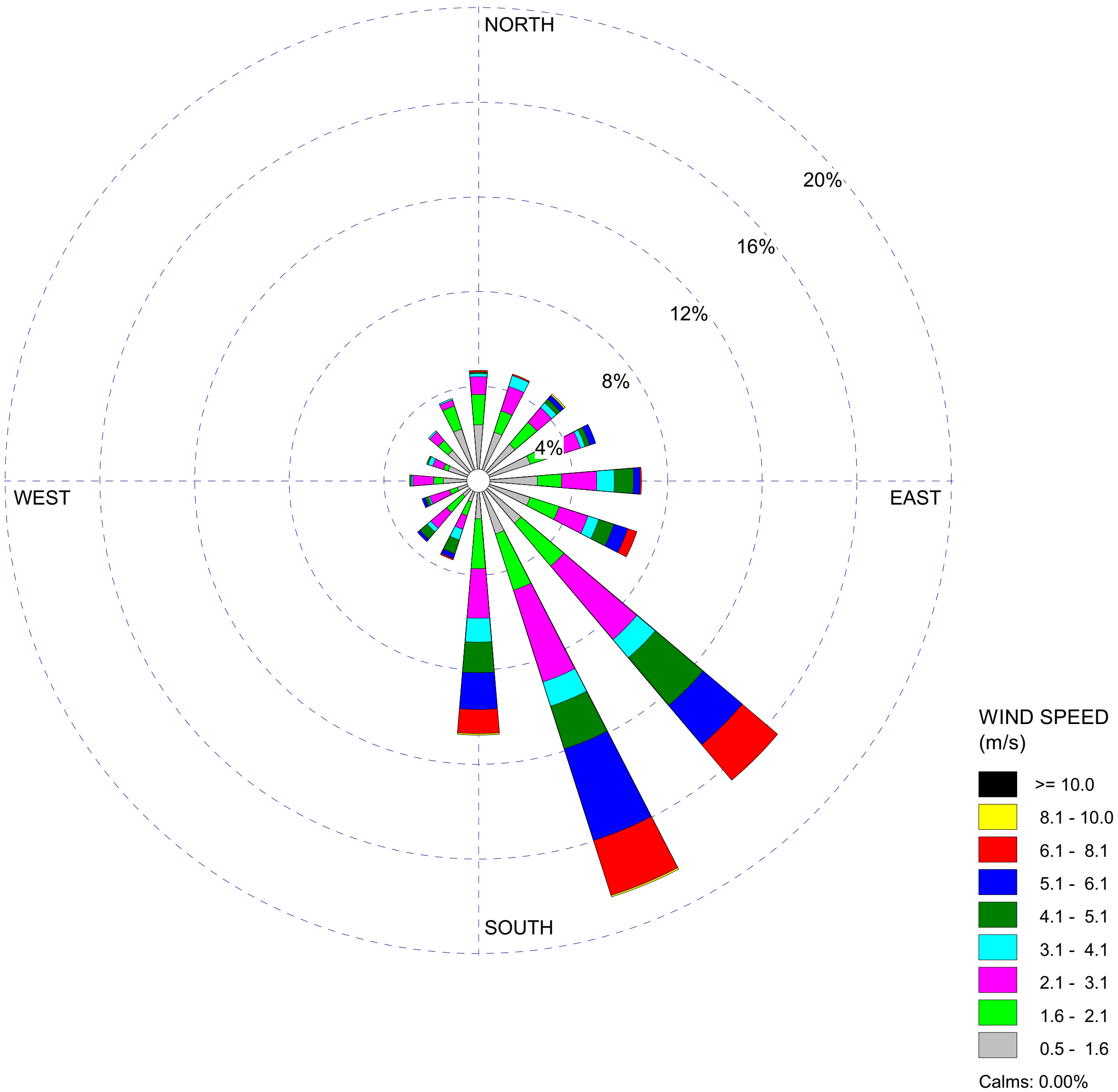


Figure 2.3.2-6 10-Meter Level Wind Rose — August (Sheet 8 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

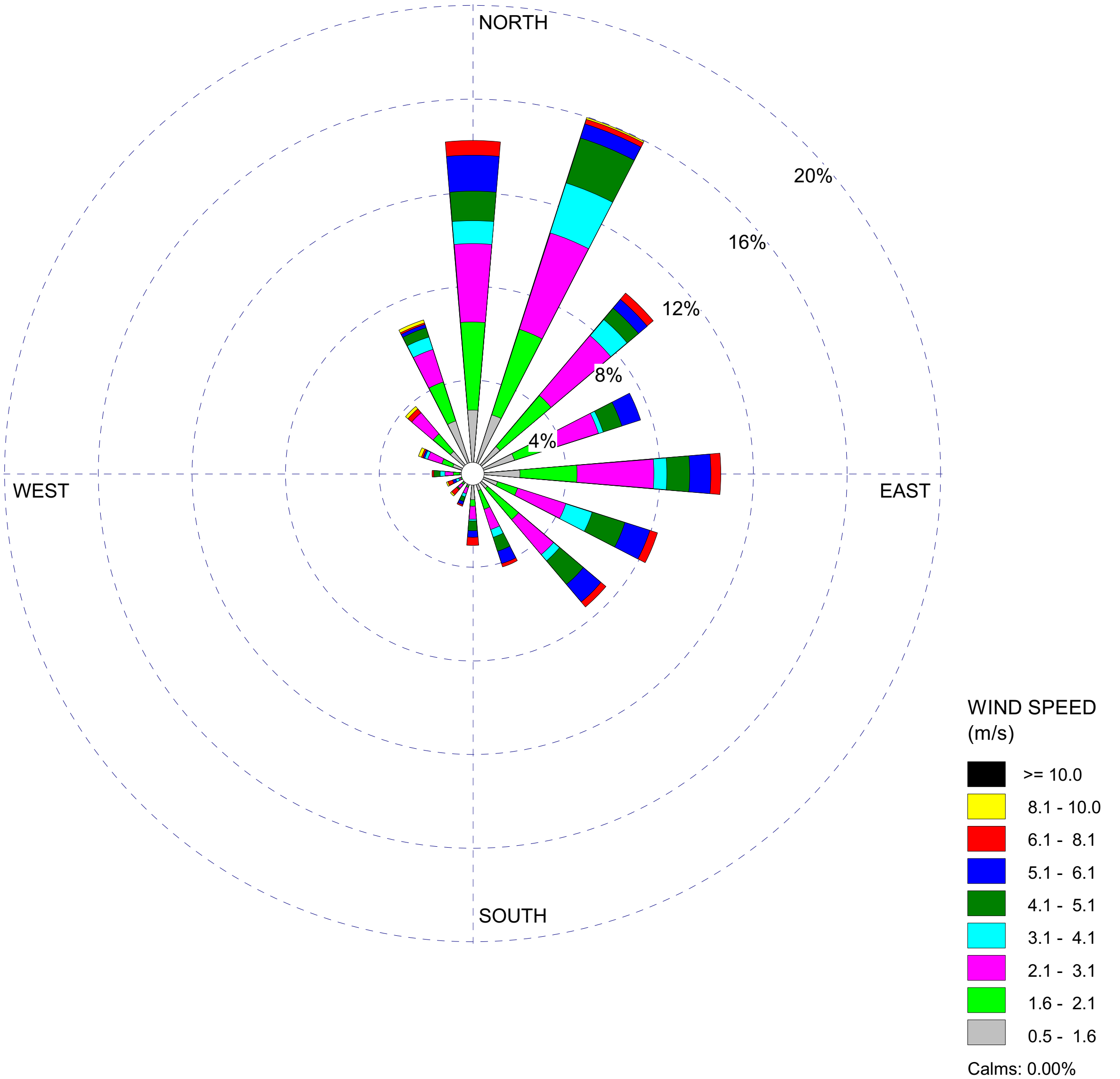


Figure 2.3.2-6 10-Meter Level Wind Rose — September (Sheet 9 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

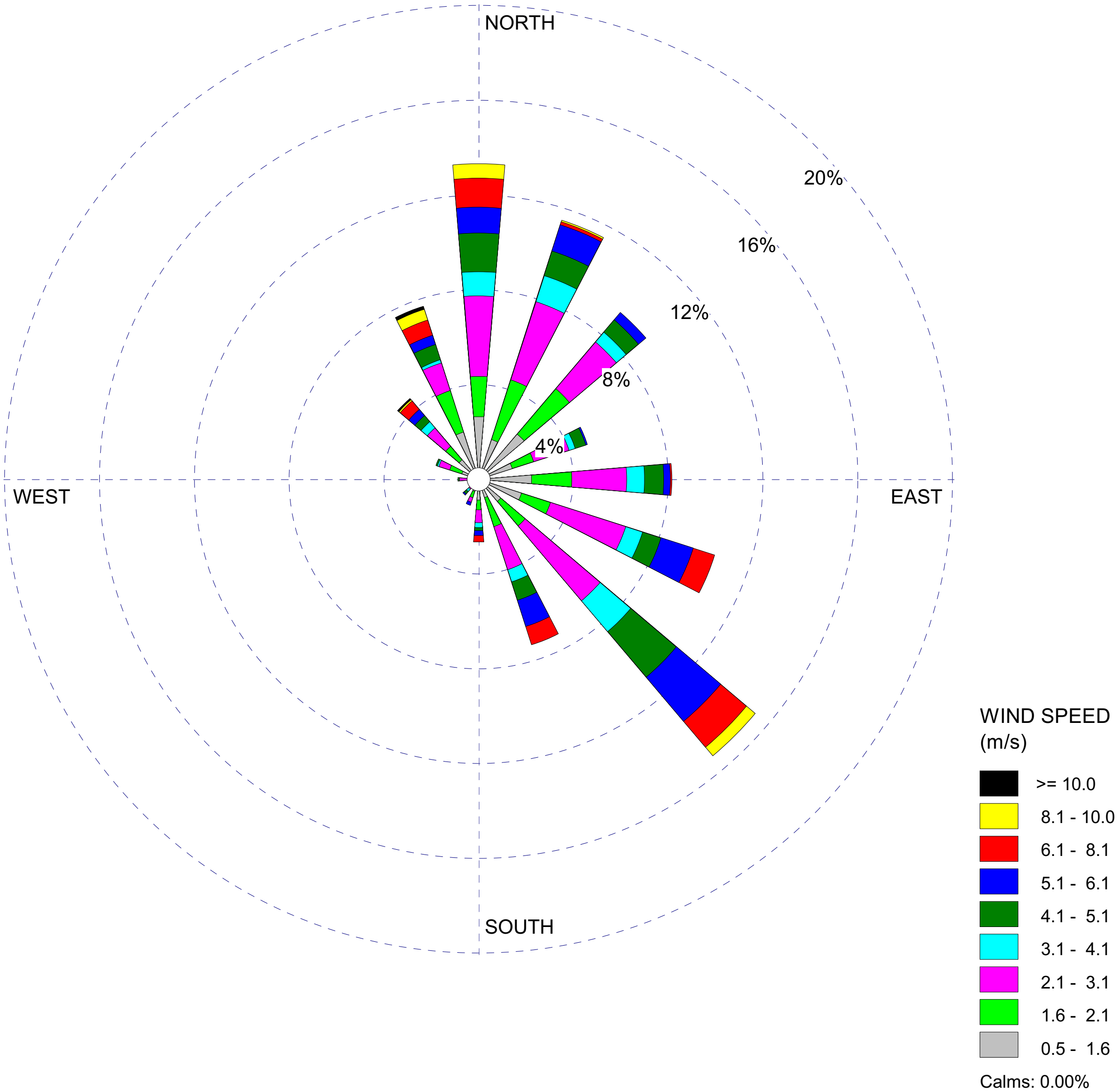


**Figure 2.3.2-6 10-Meter Level Wind Rose — October (Sheet 10 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)**

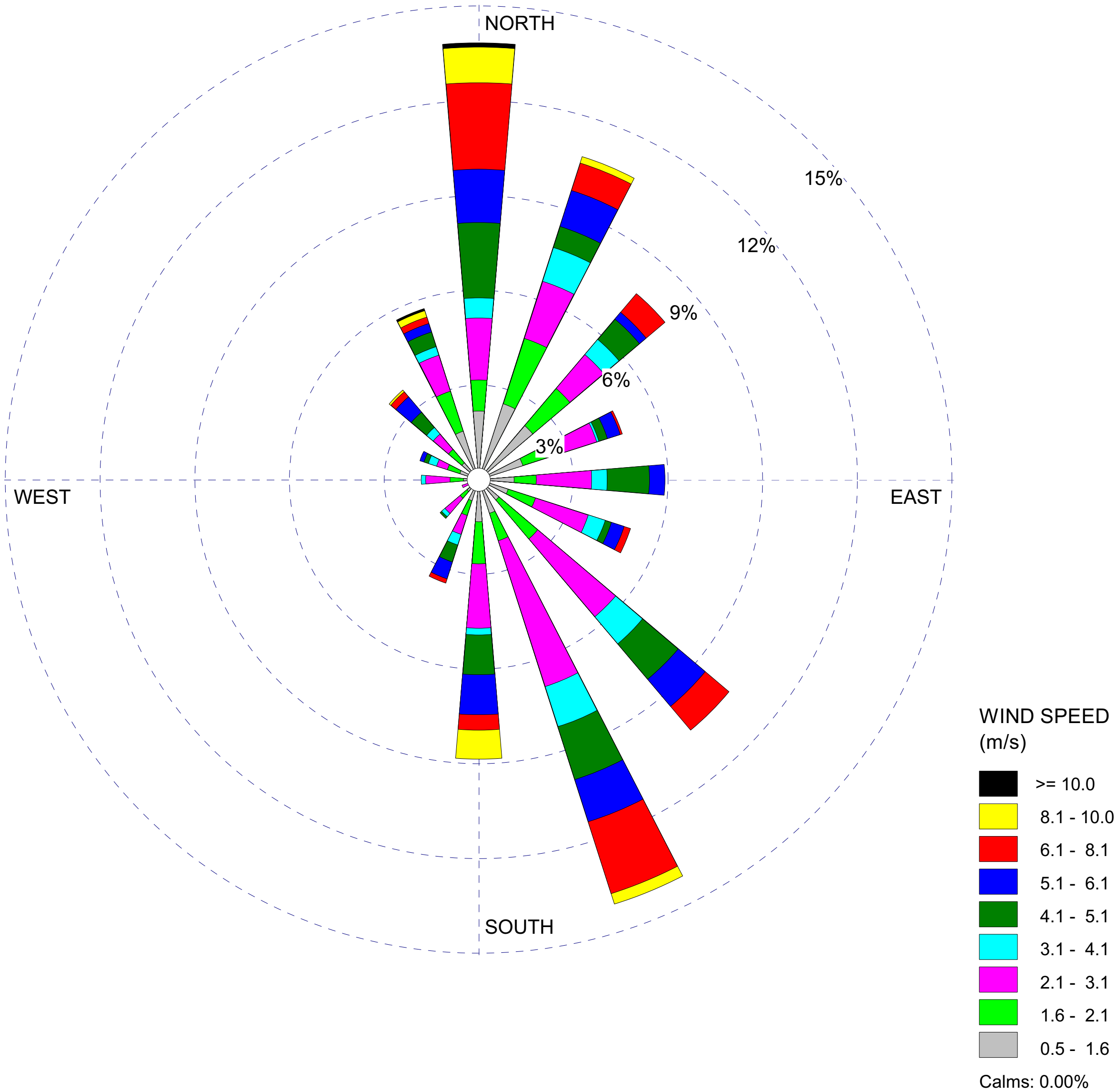


Figure 2.3.2-6 10-Meter Level Wind Rose — November (Sheet 11 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

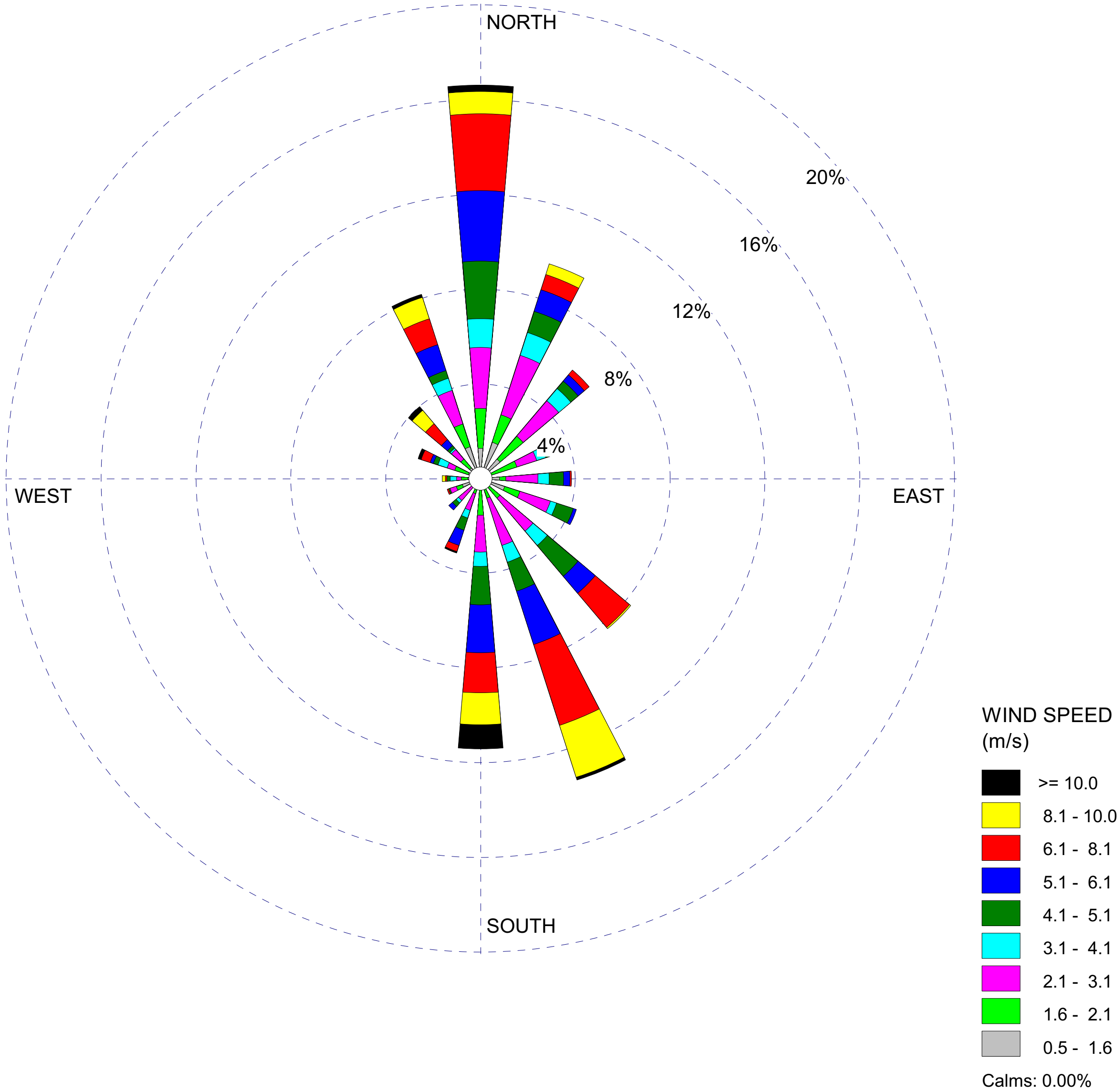


Figure 2.3.2-6 10-Meter Level Wind Rose — December (Sheet 12 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

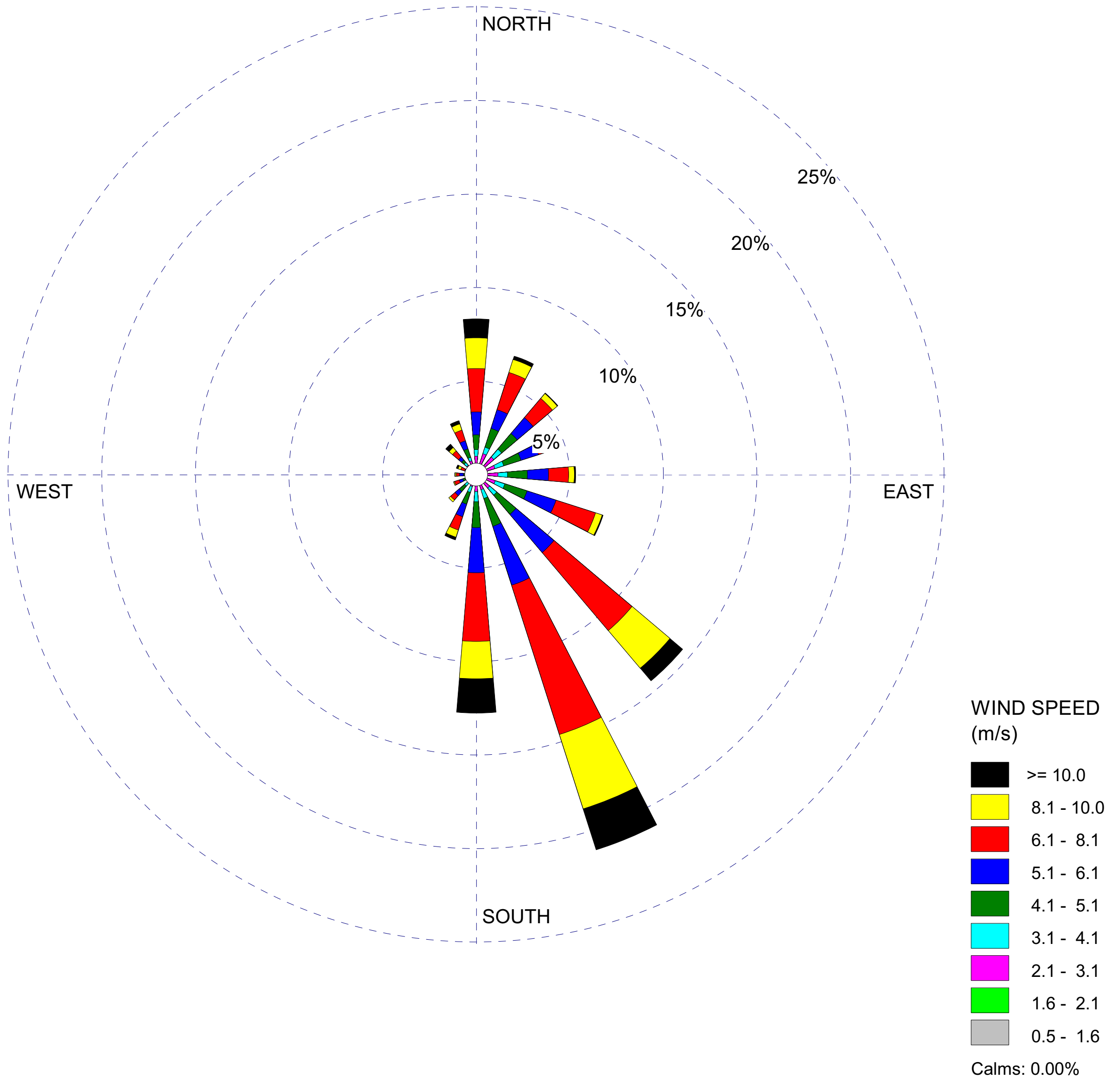


Figure 2.3.2-7 60-Meter Level Wind Rose — Annual
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

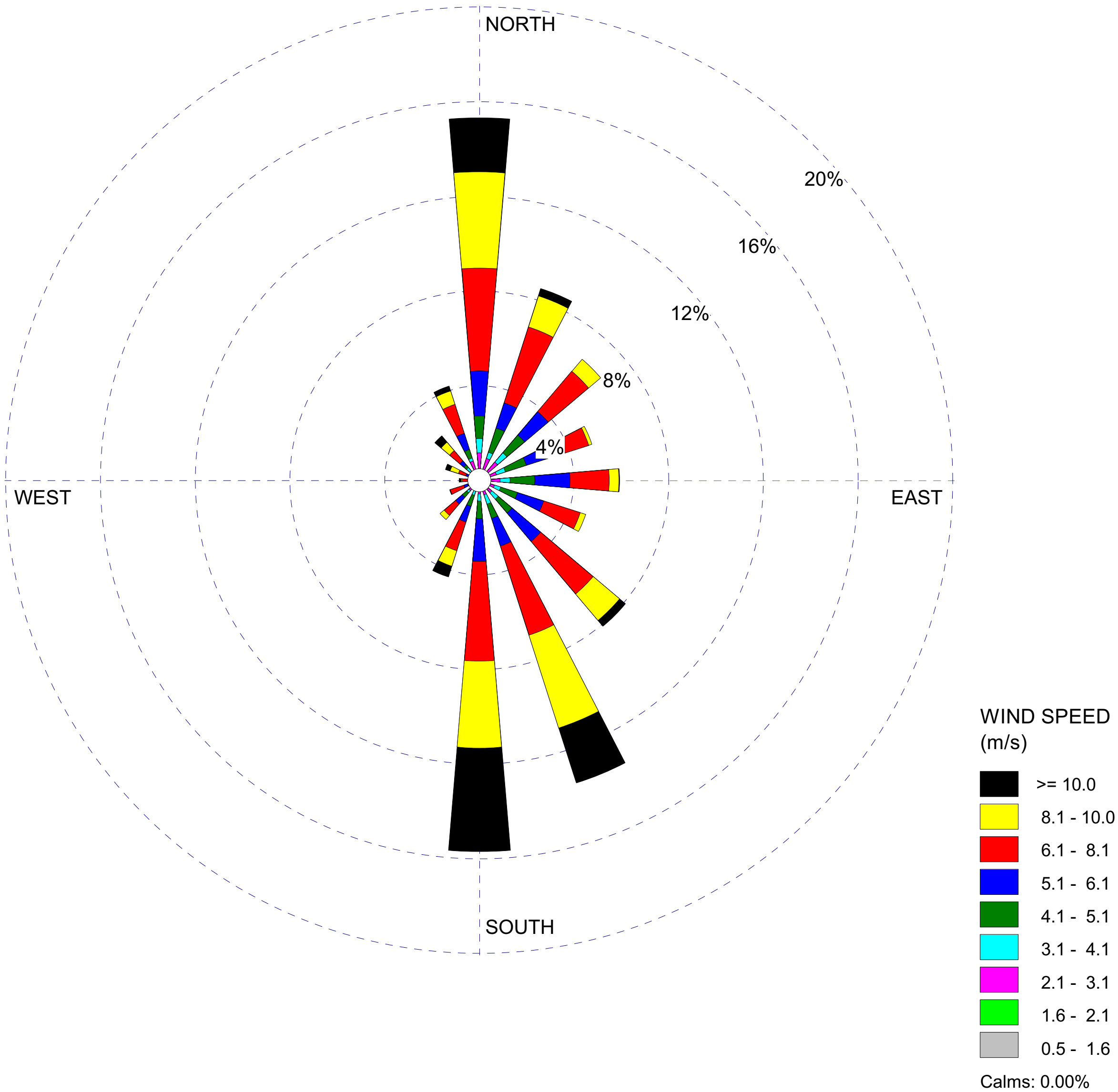


Figure 2.3.2-8 60-Meter Level Wind Rose — Winter
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

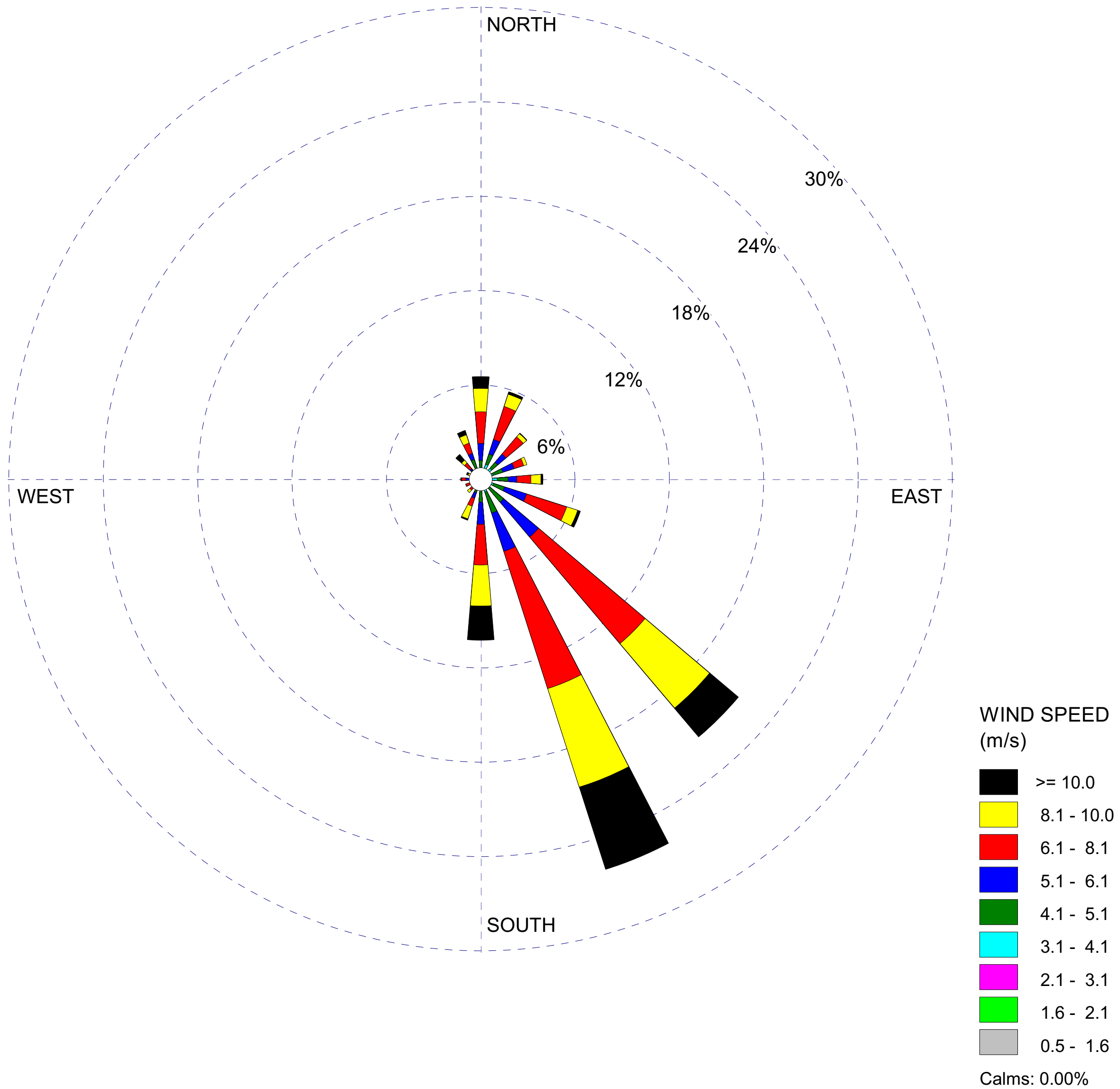


Figure 2.3.2-9 60-Meter Level Wind Rose — Spring
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

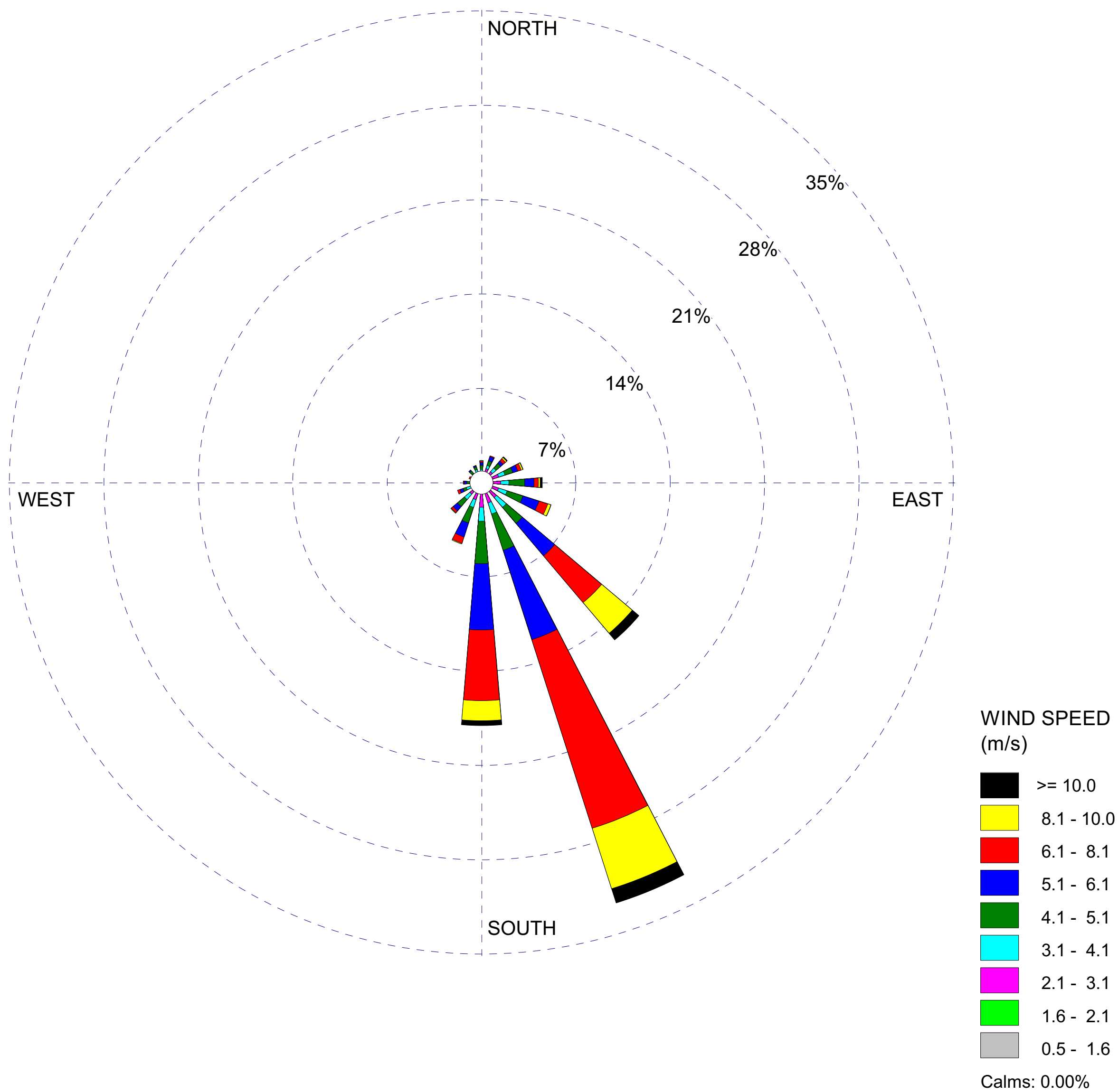


Figure 2.3.2-10 60-Meter Level Wind Rose — Summer
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

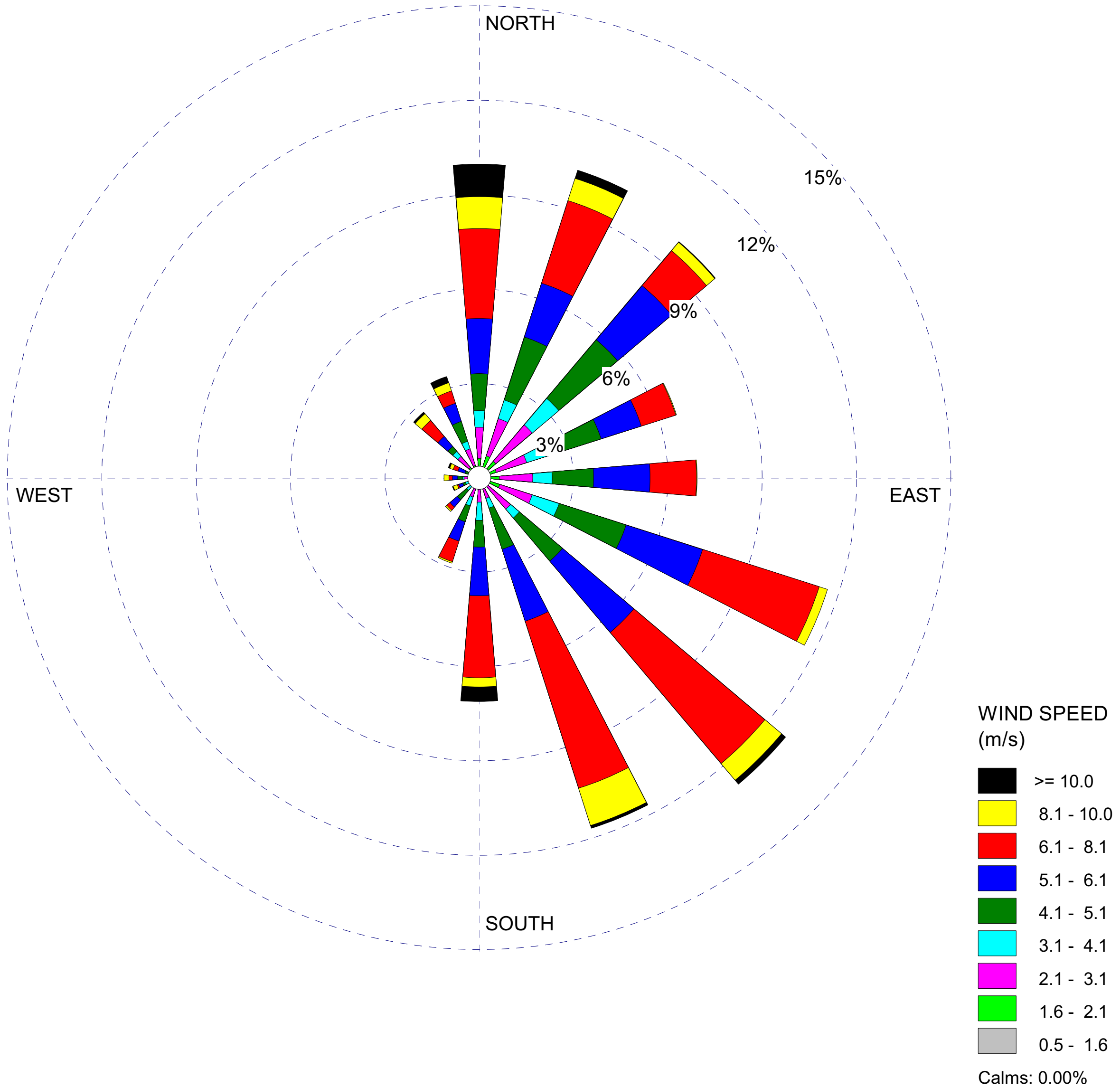


Figure 2.3.2-11 60-Meter Level Wind Rose — Autumn
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

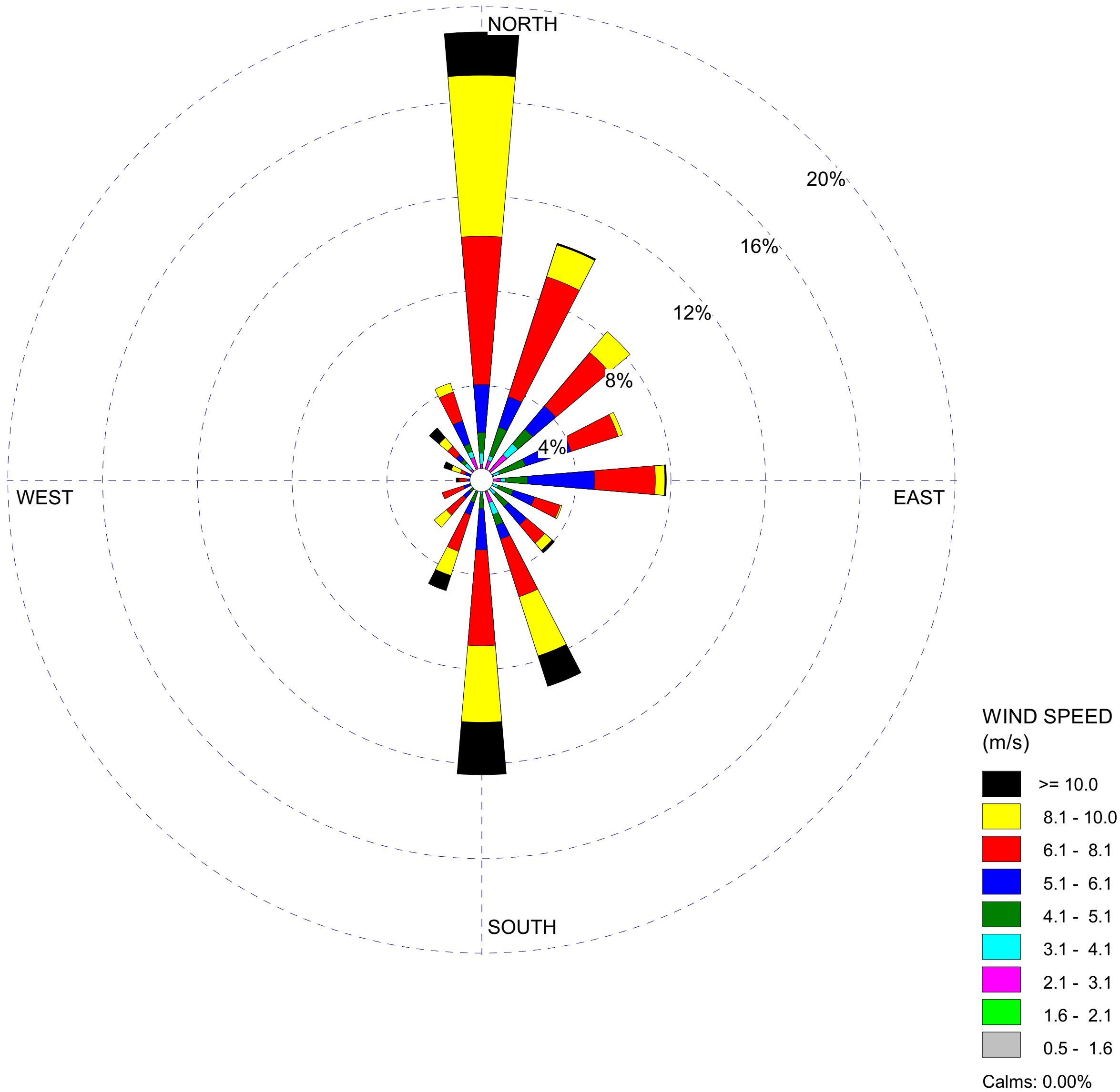


Figure 2.3.2-12 60-Meter Level Wind Rose — January (Sheet 1 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

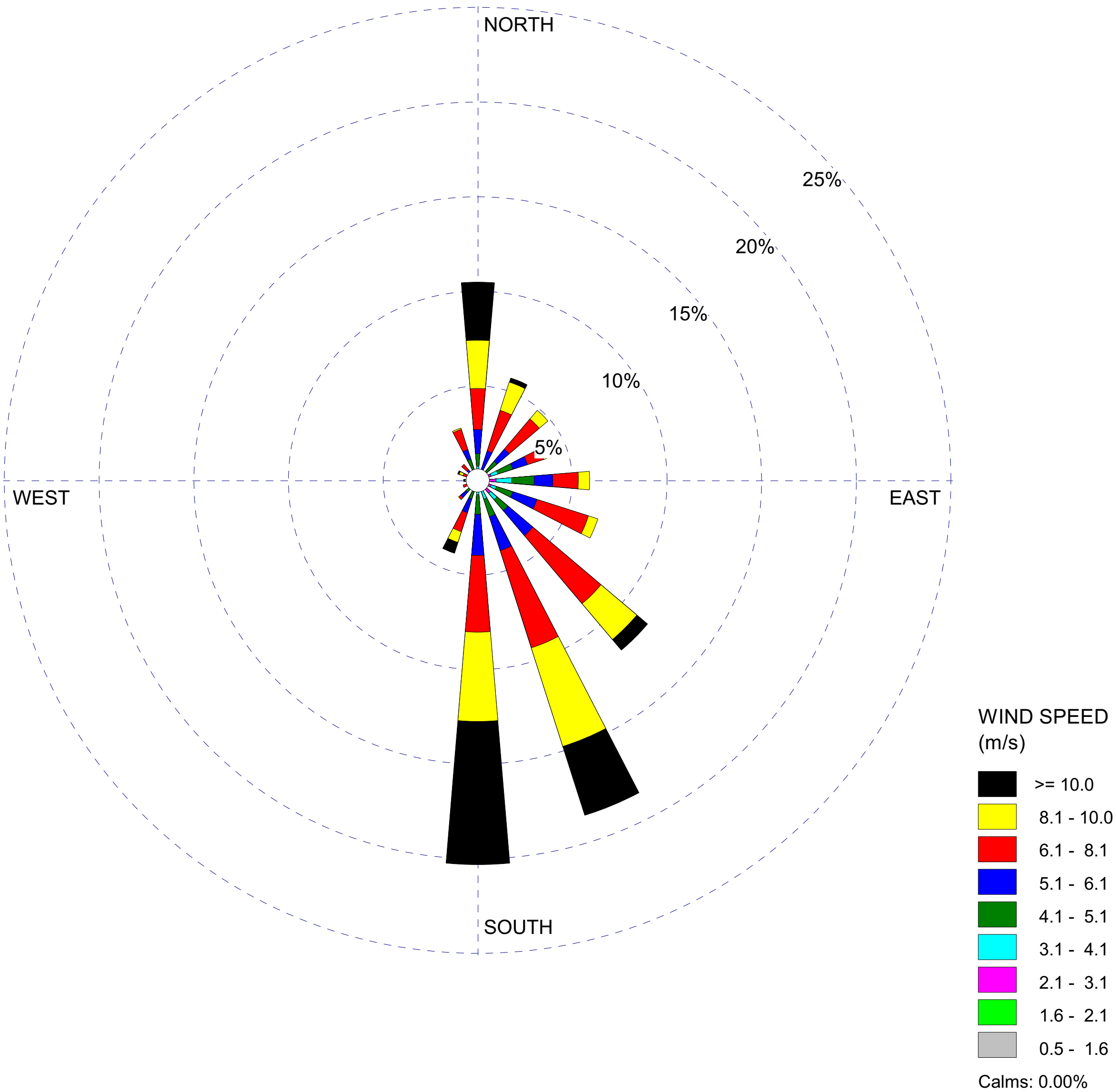


Figure 2.3.2-12 60-Meter Level Wind Rose — February (Sheet 2 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

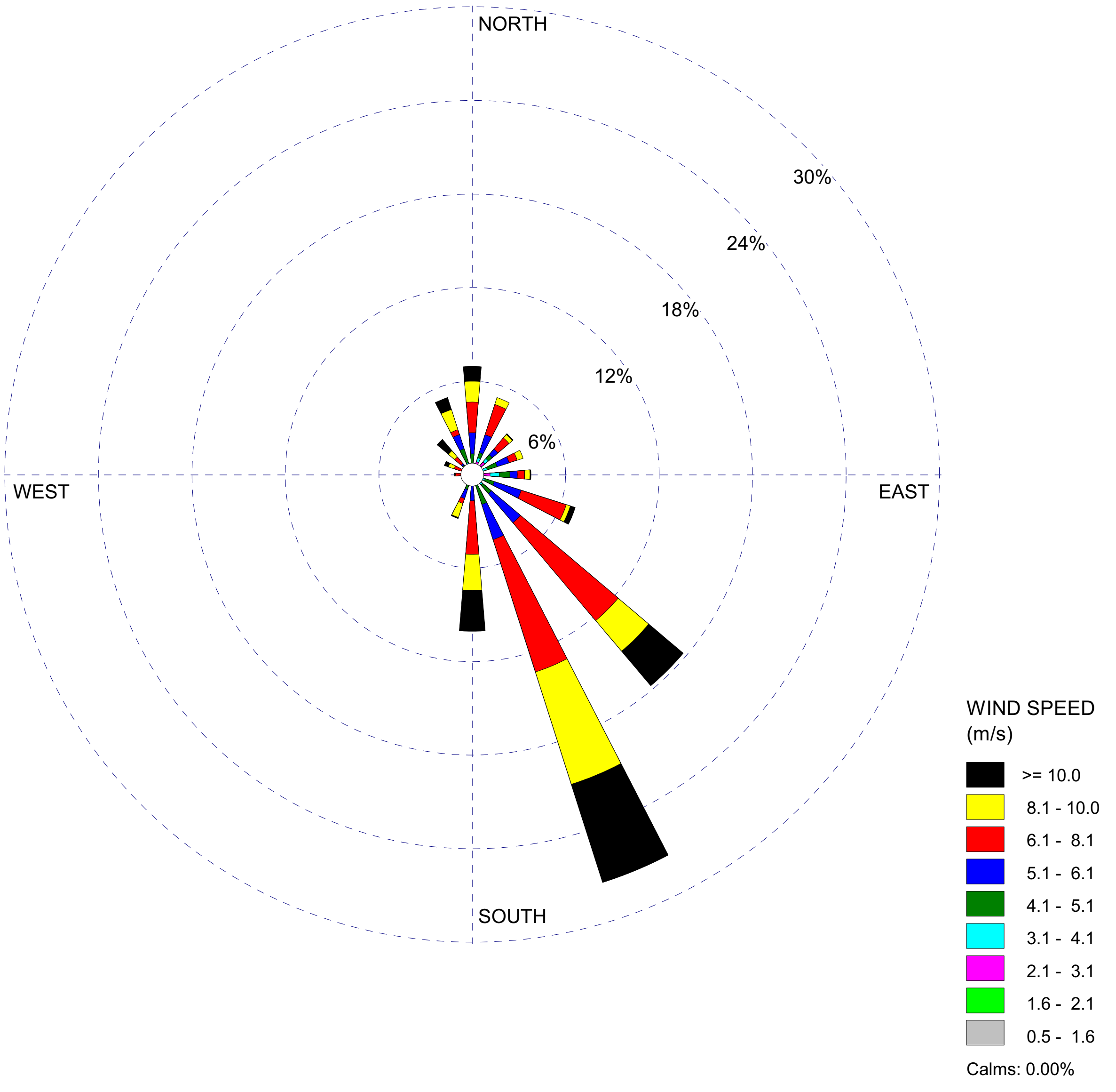


Figure 2.3.2-12 60-Meter Level Wind Rose — March (Sheet 3 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

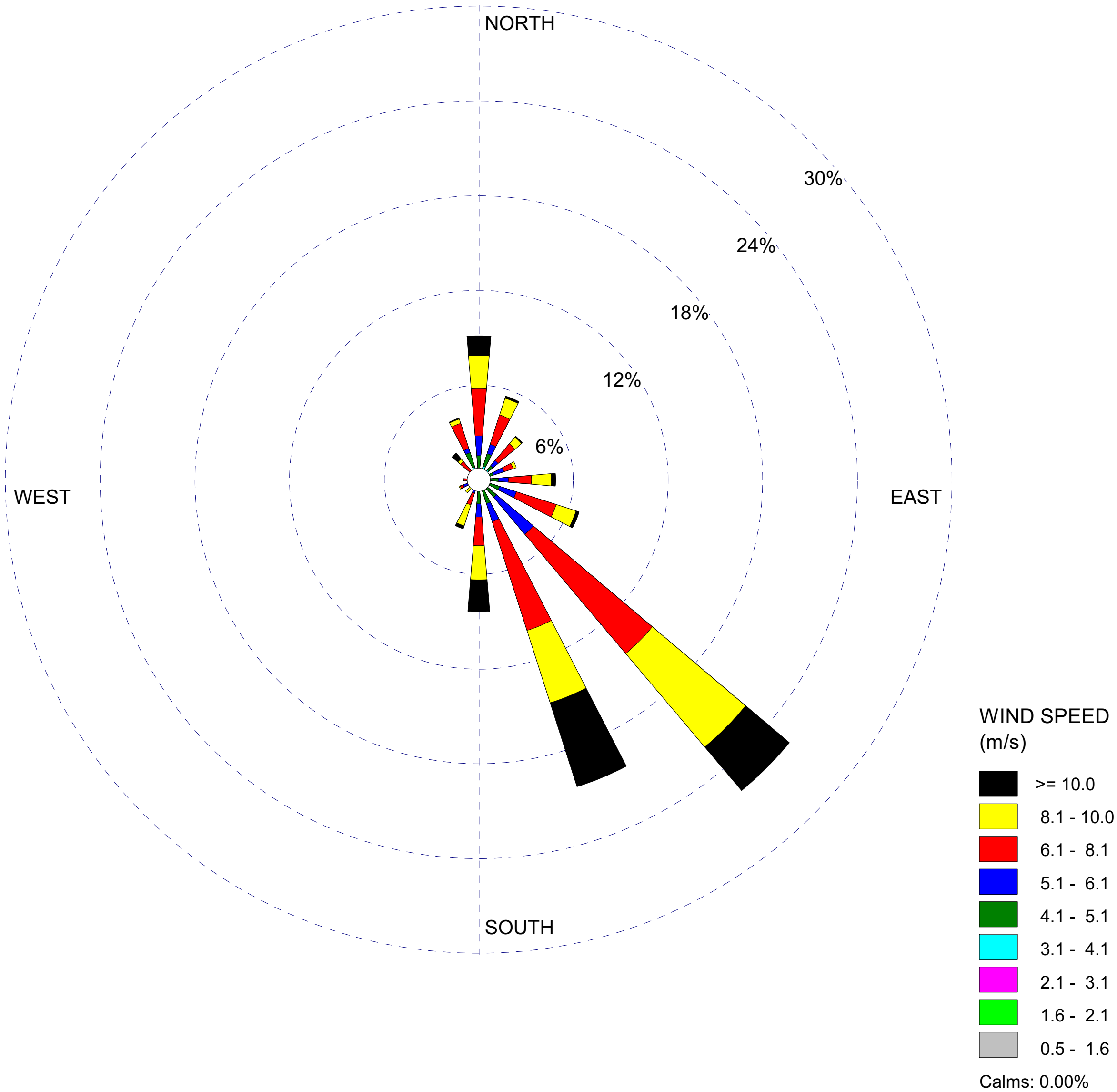


**Figure 2.3.2-12 60-Meter Level Wind Rose — April (Sheet 4 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)**

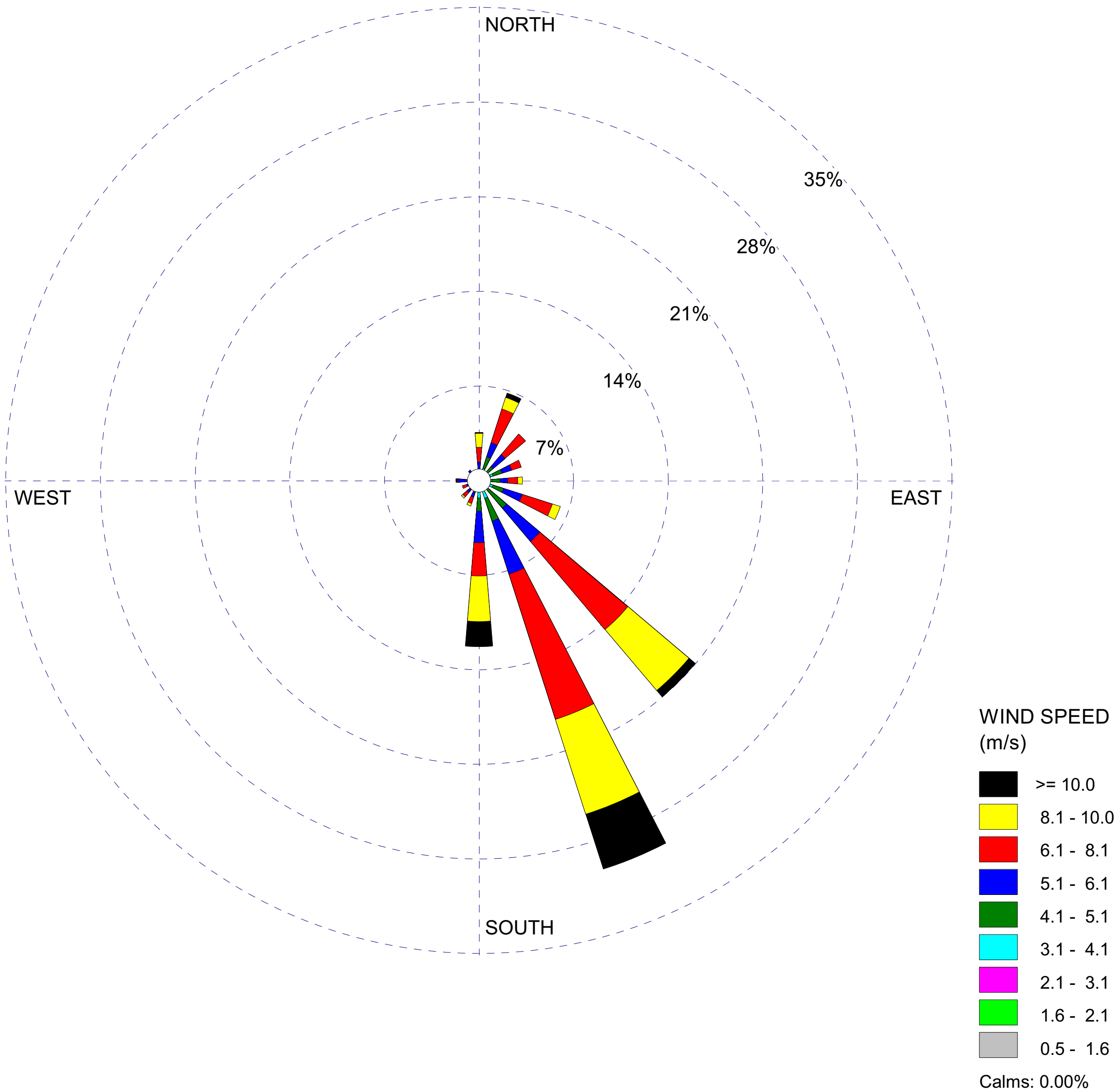


Figure 2.3.2-12 60-Meter Level Wind Rose — May (Sheet 5 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

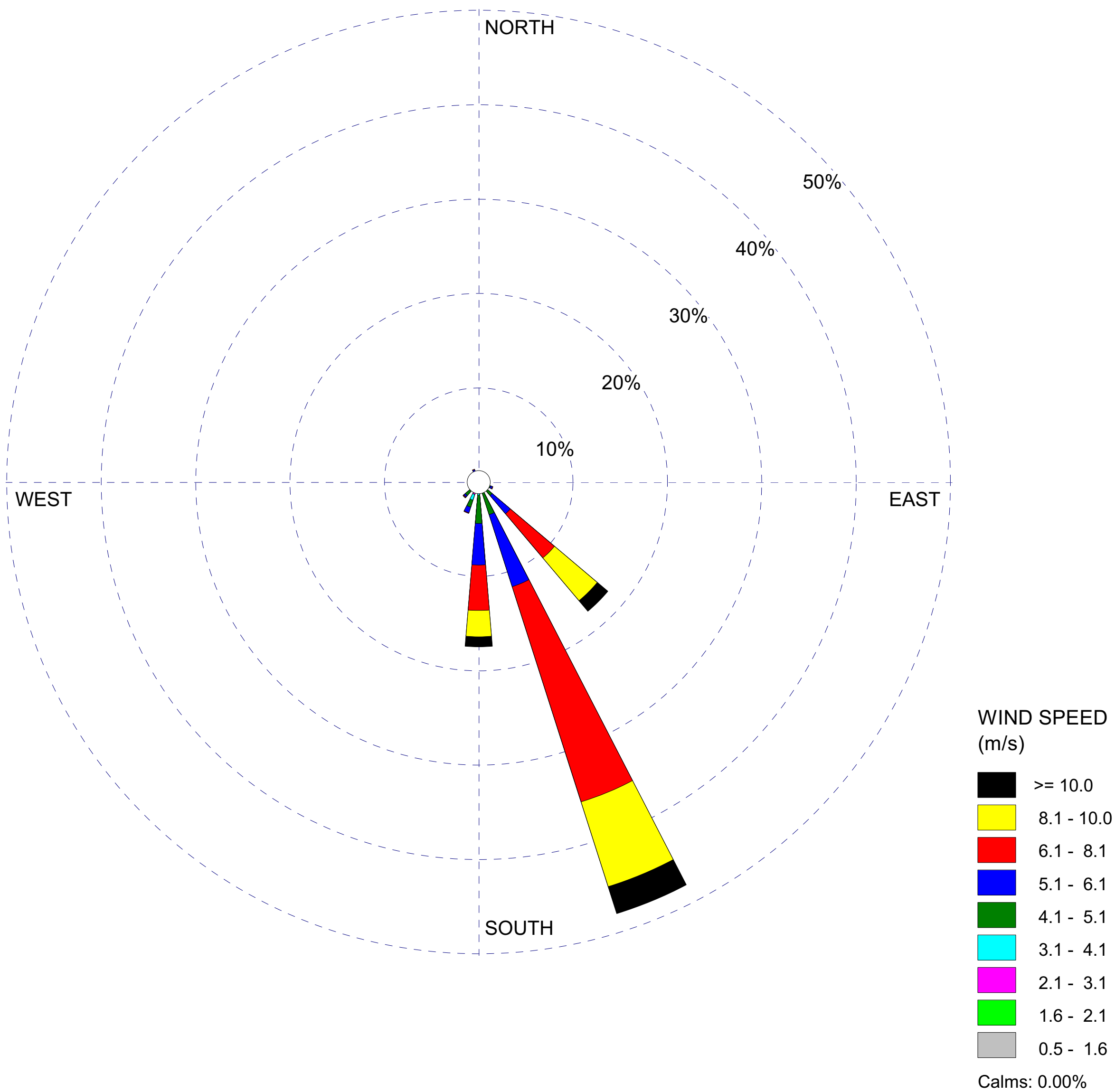


Figure 2.3.2-12 60-Meter Level Wind Rose — June (Sheet 6 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

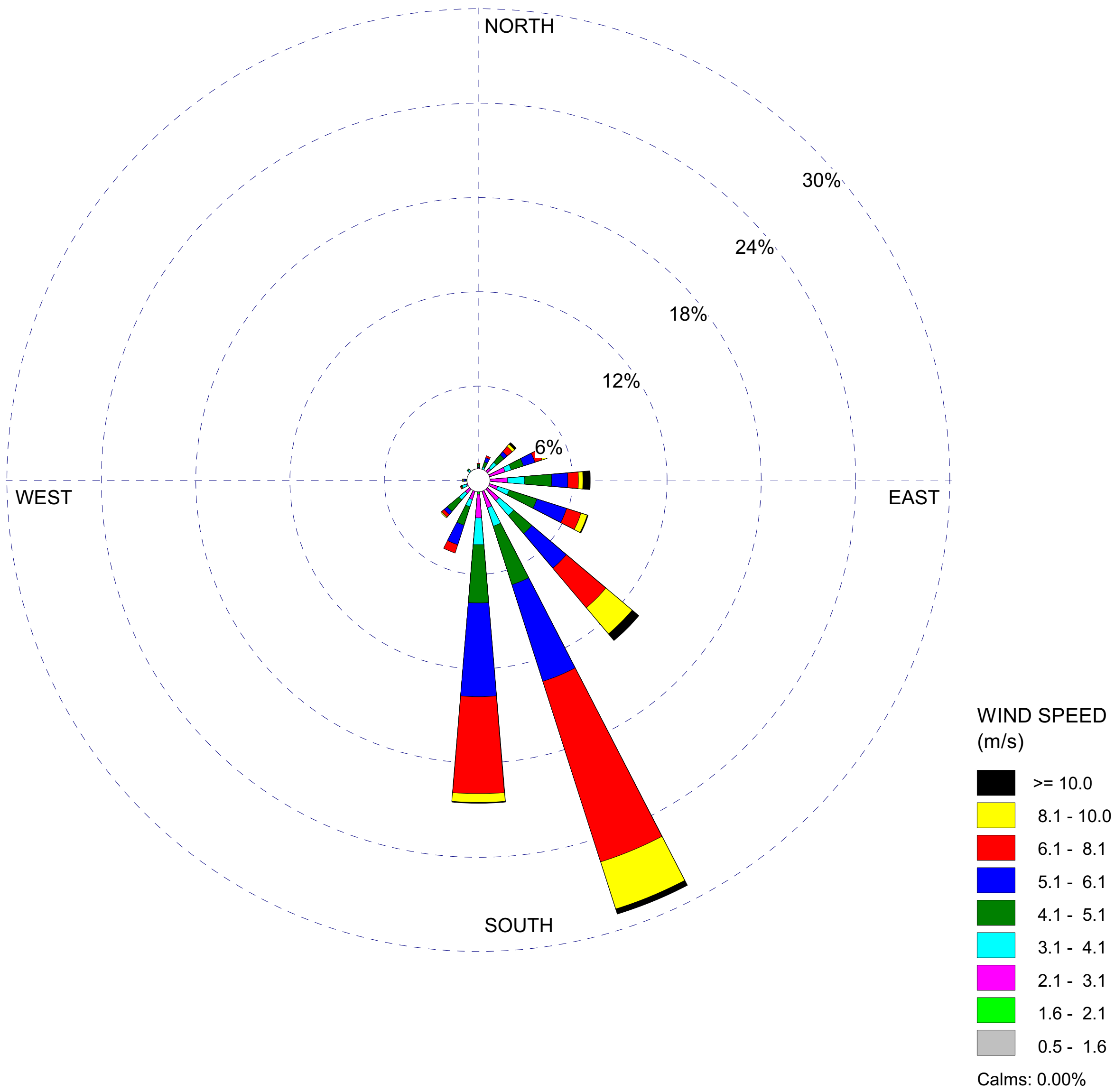


Figure 2.3.2-12 60-Meter Level Wind Rose — July (Sheet 7 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

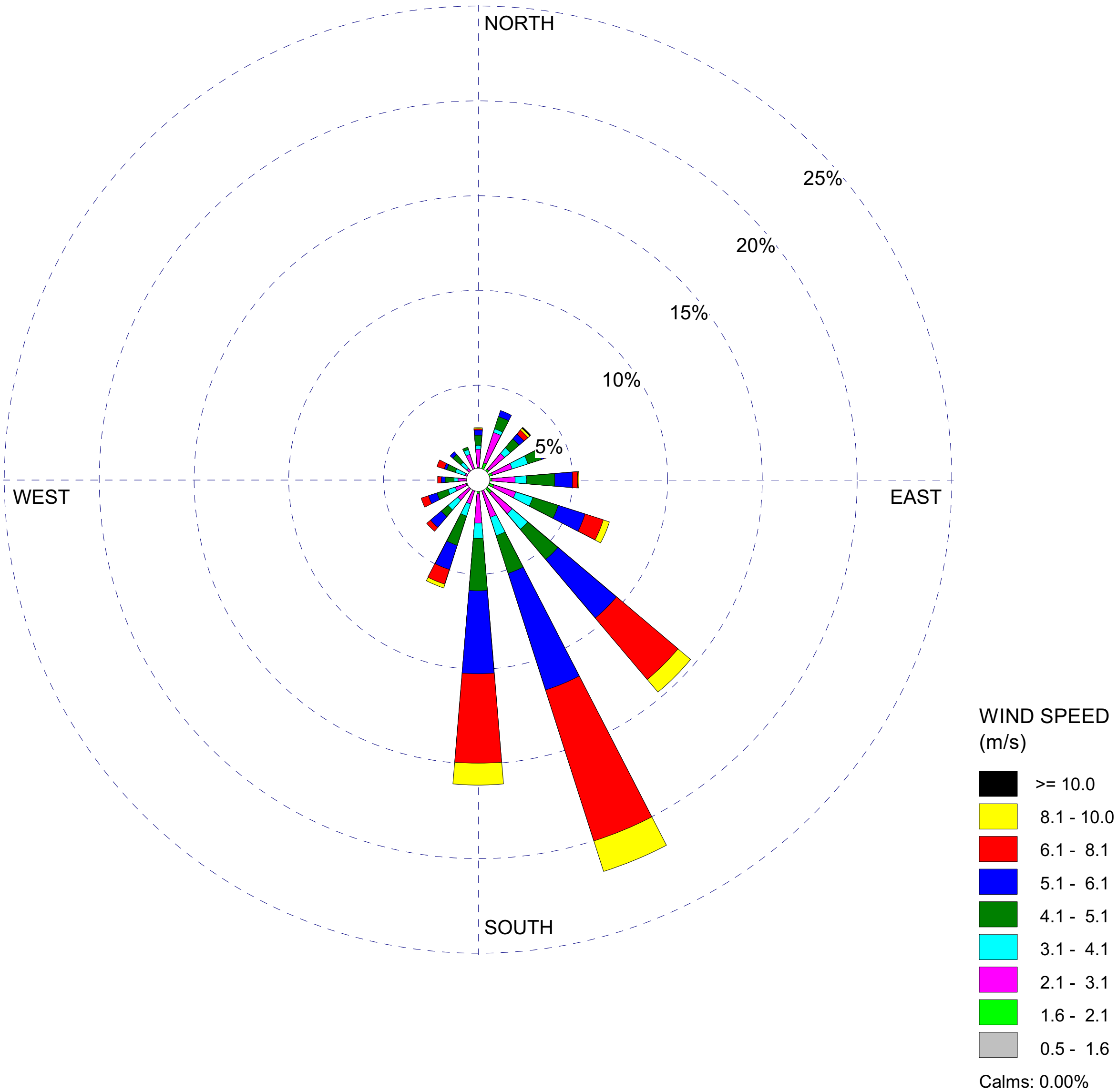


Figure 2.3.2-12 60-Meter Level Wind Rose — August (Sheet 8 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

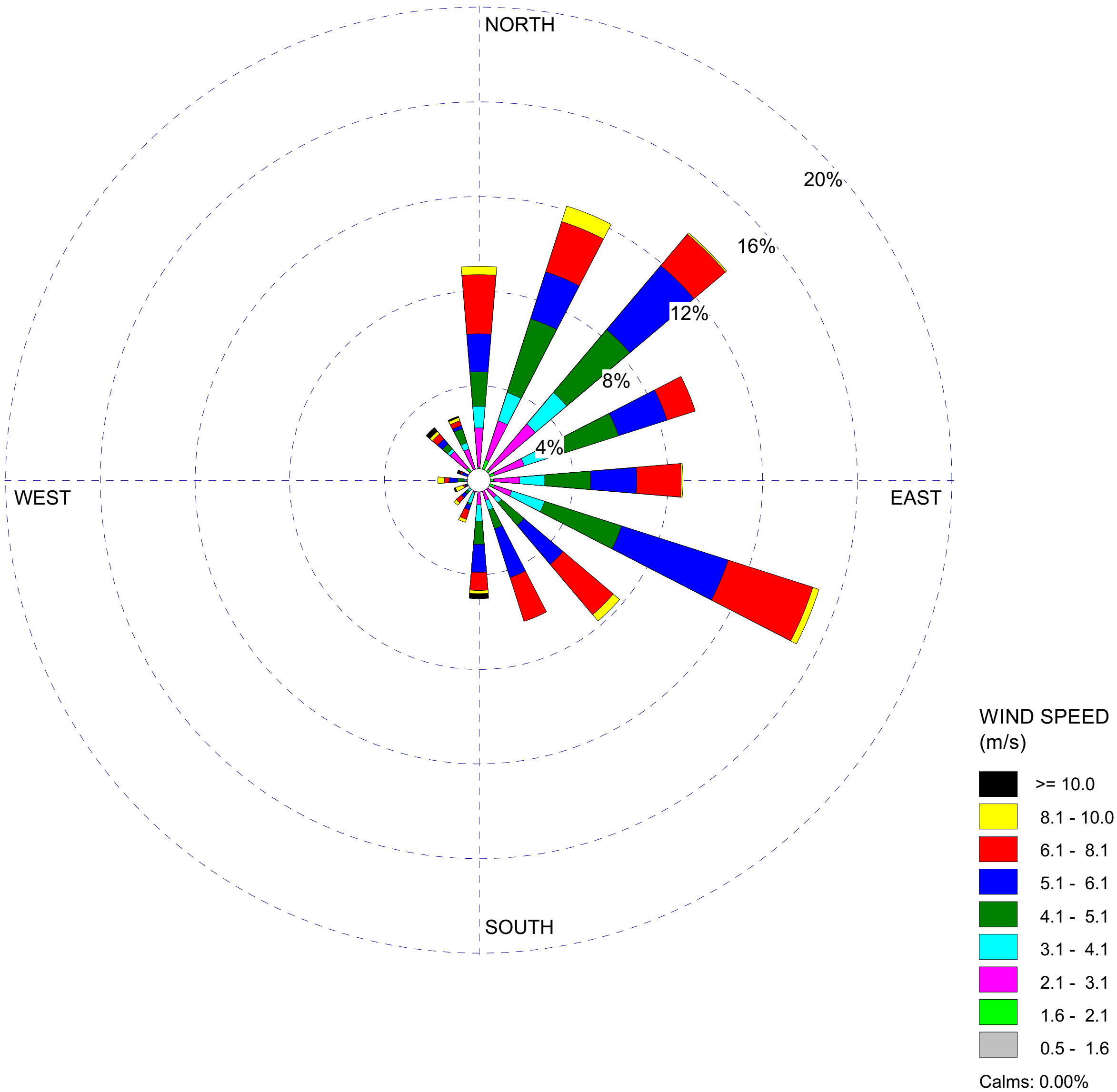


Figure 2.3.2-12 60-Meter Level Wind Rose — September (Sheet 9 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

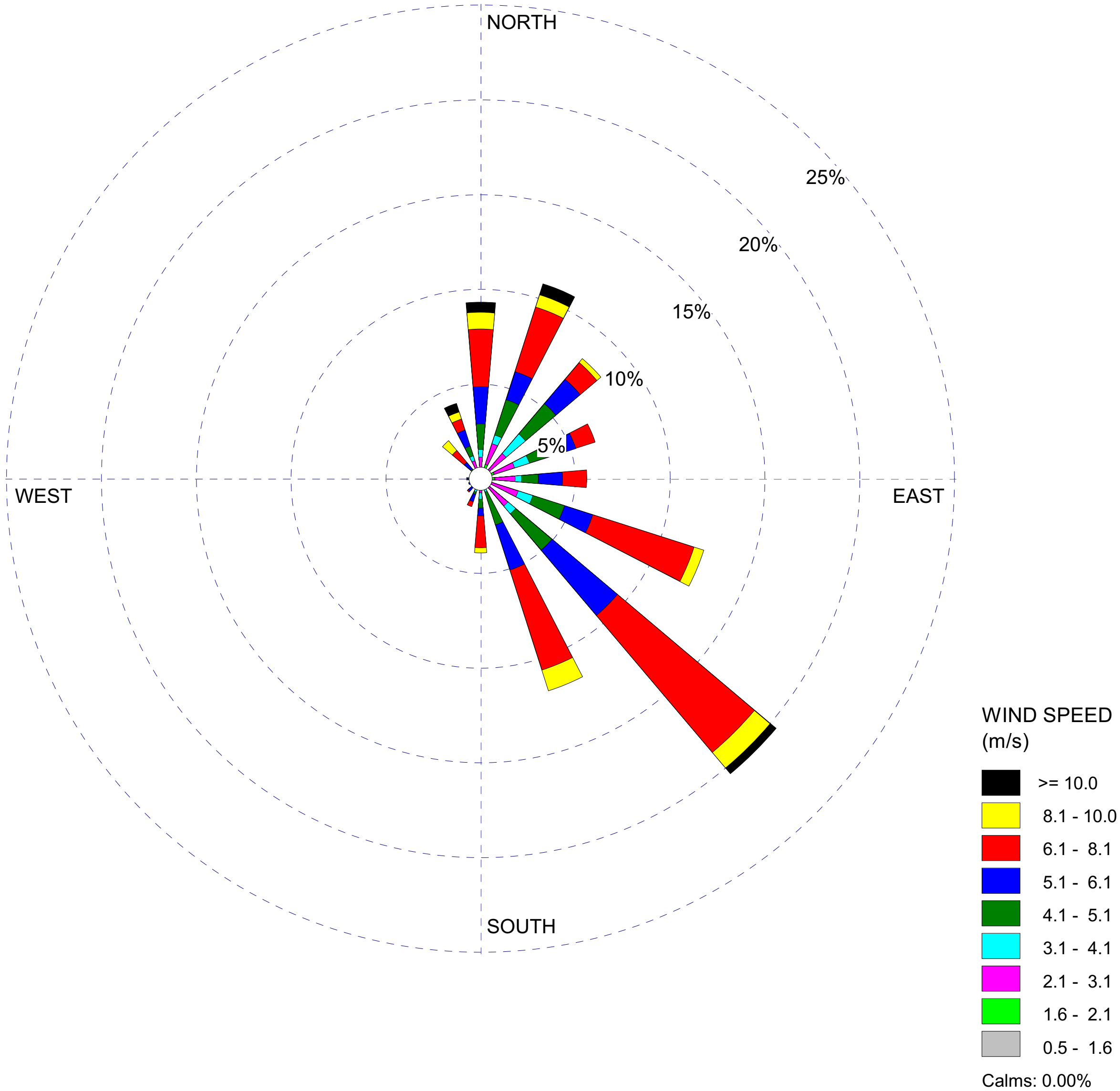


Figure 2.3.2-12 60-Meter Level Wind Rose — October (Sheet 10 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

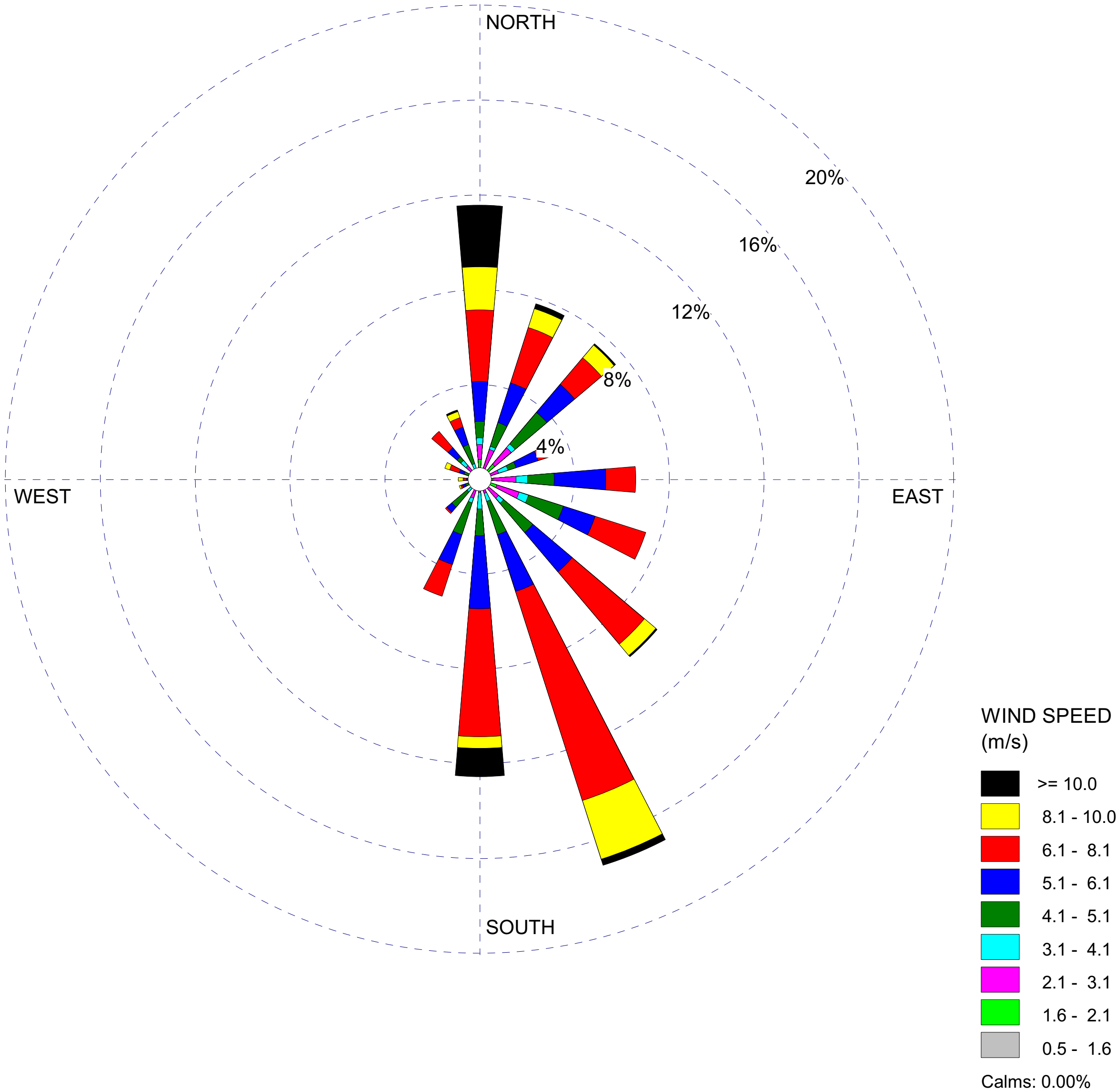


Figure 2.3.2-12 60-Meter Level Wind Rose — November (Sheet 11 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

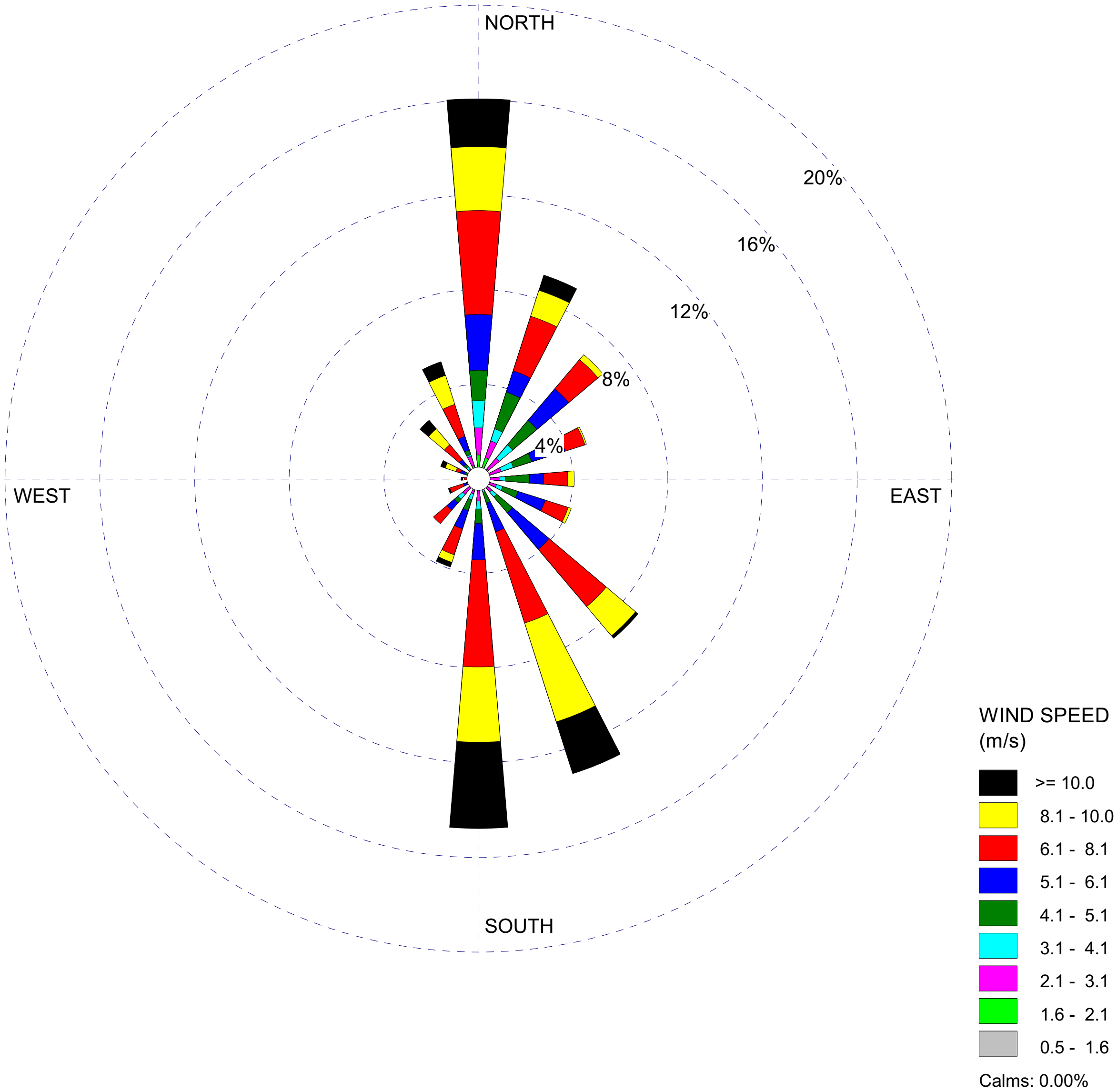


Figure 2.3.2-12 60-Meter Level Wind Rose — December (Sheet 12 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2009)

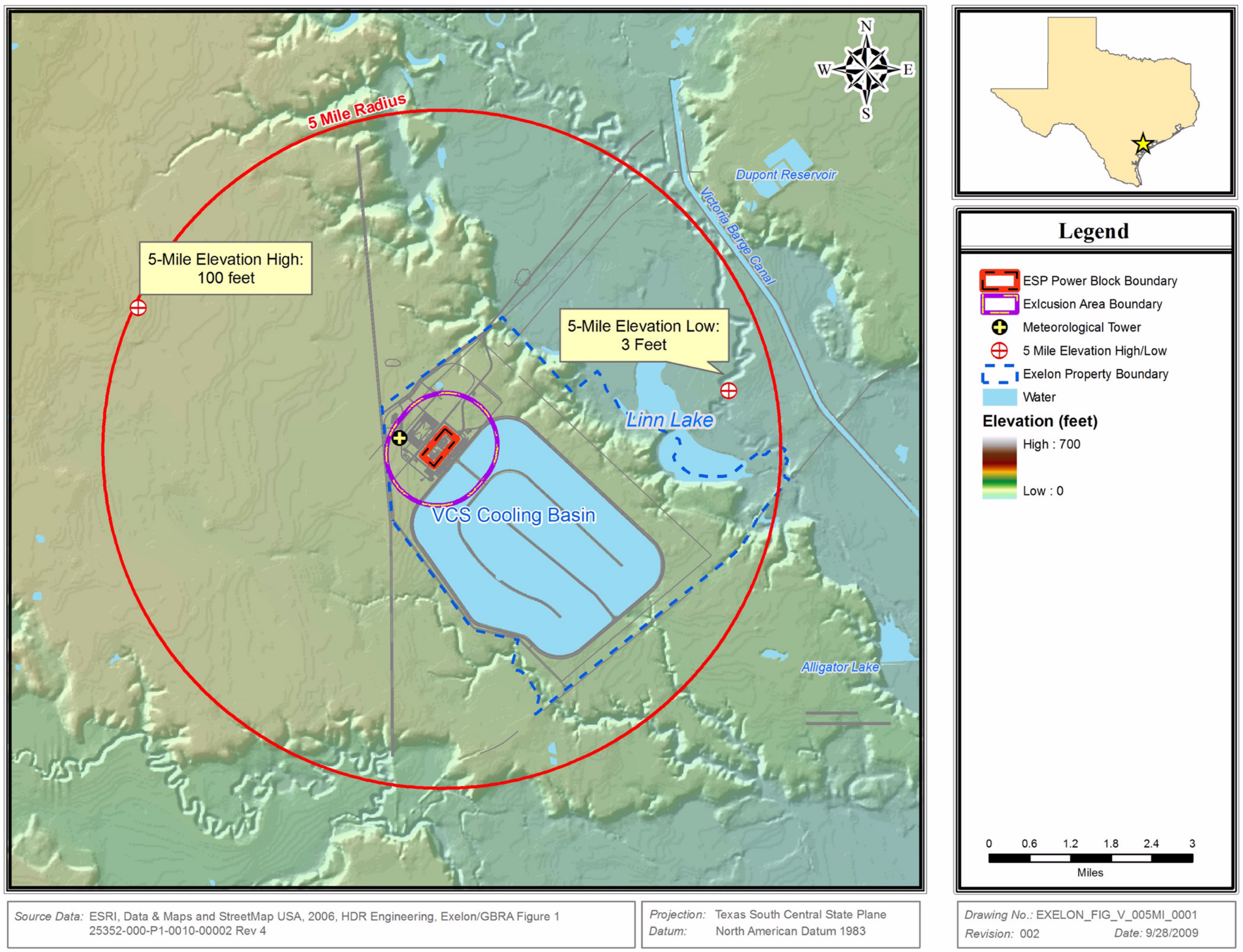
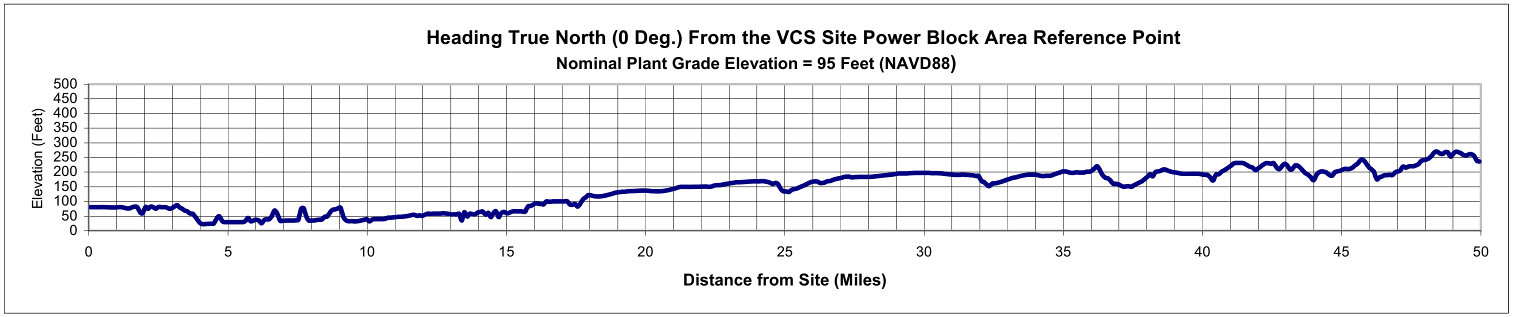
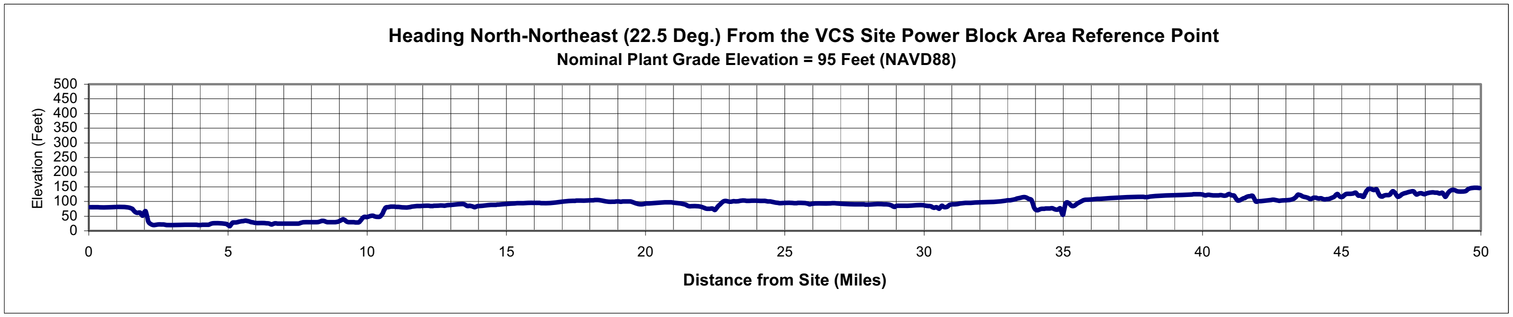


Figure 2.3.2-13 Site and Vicinity Map (5-Mile Radius)





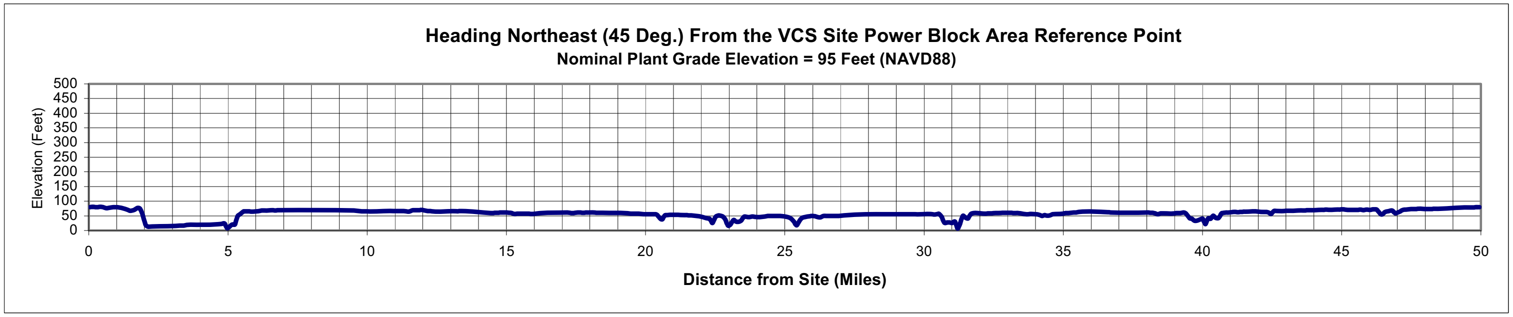


Figure 2.3.2-14 Terrain Elevation Profiles within 50 miles of the VCS Site (Sheet 1 of 6)

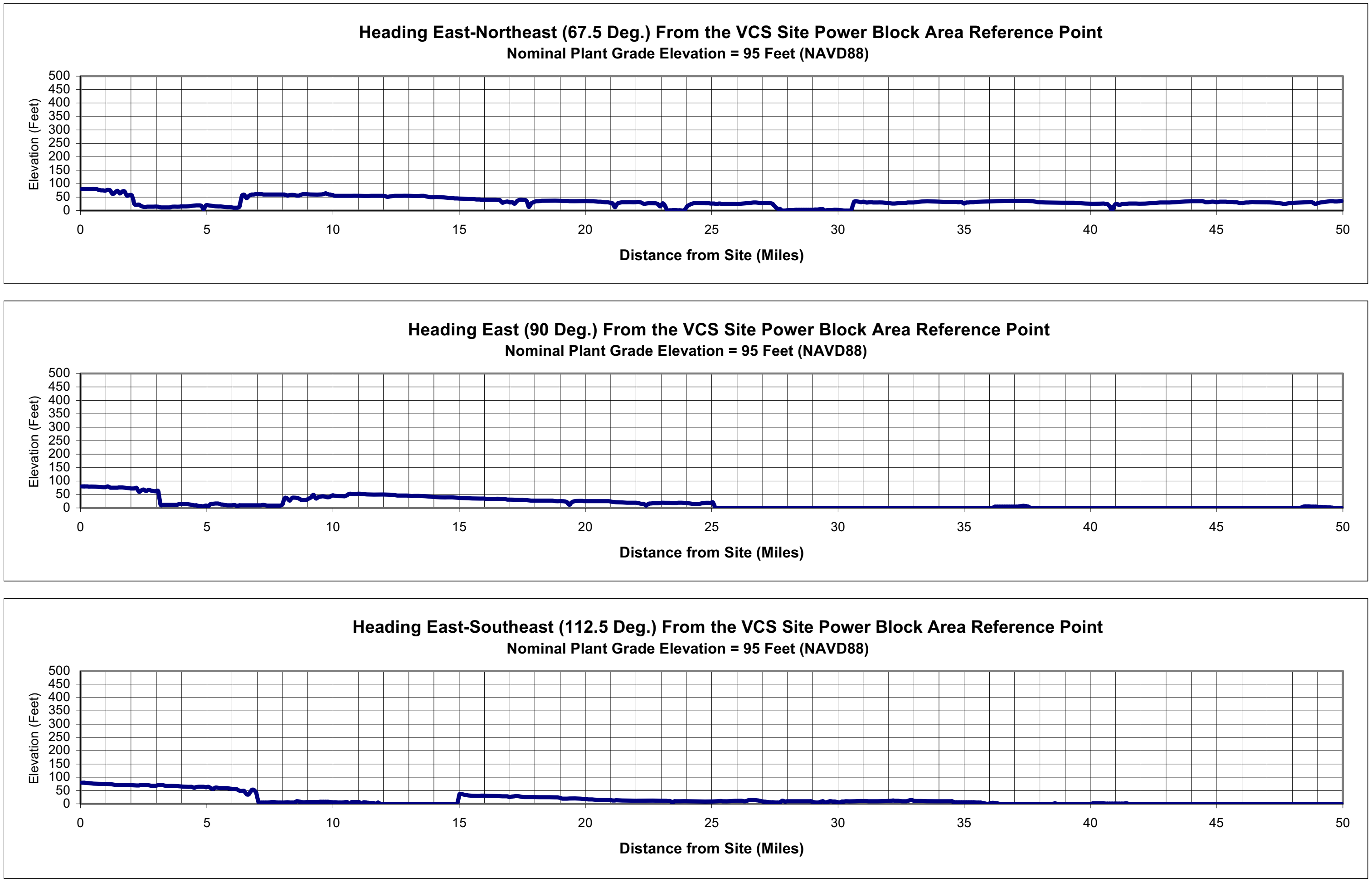
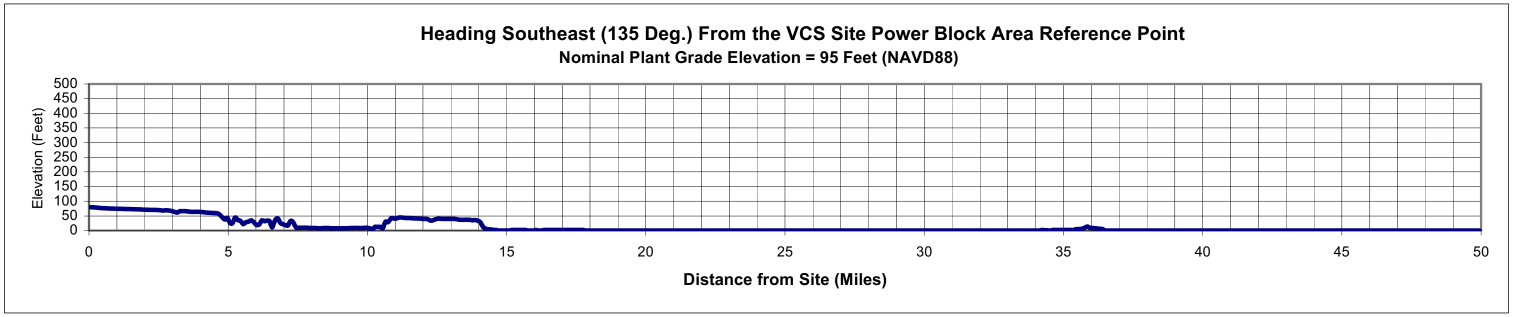
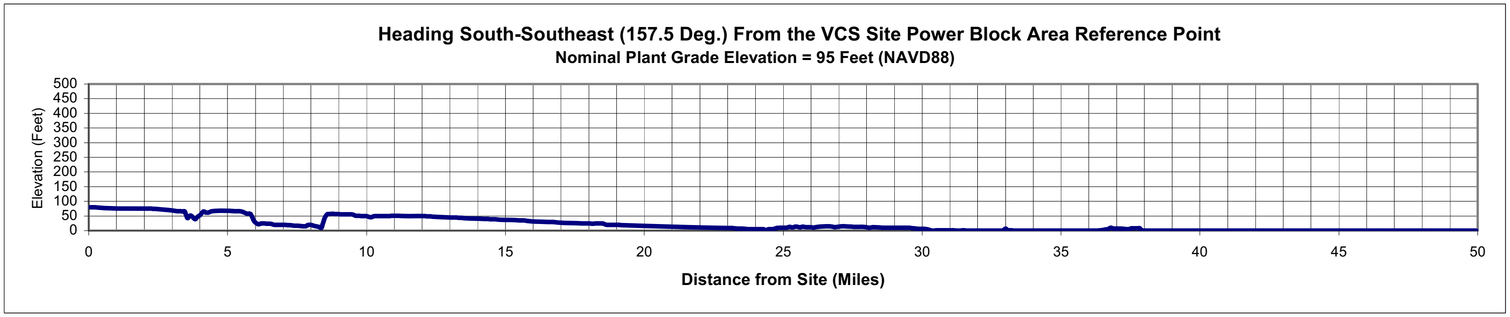


Figure 2.3.2-14 Terrain Elevation Profiles within 50 miles of the VCS Site (Sheet 2 of 6)





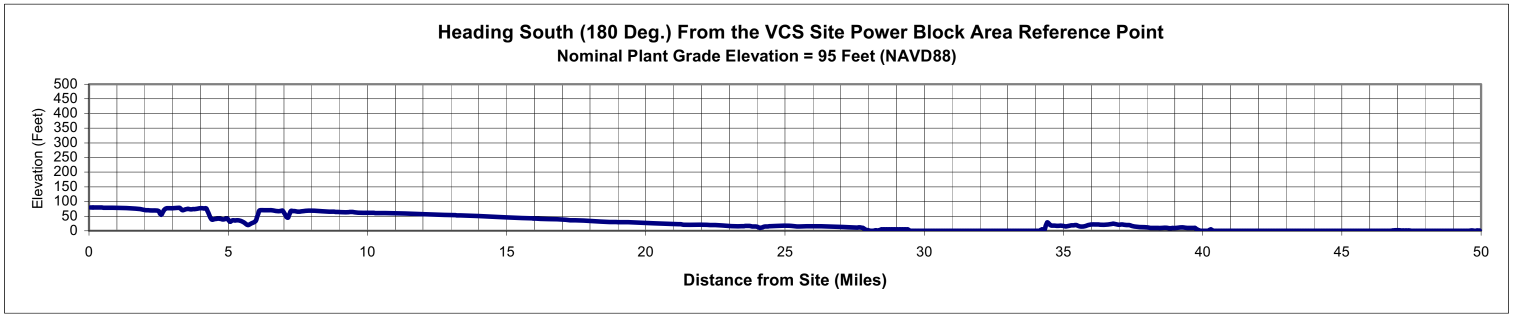
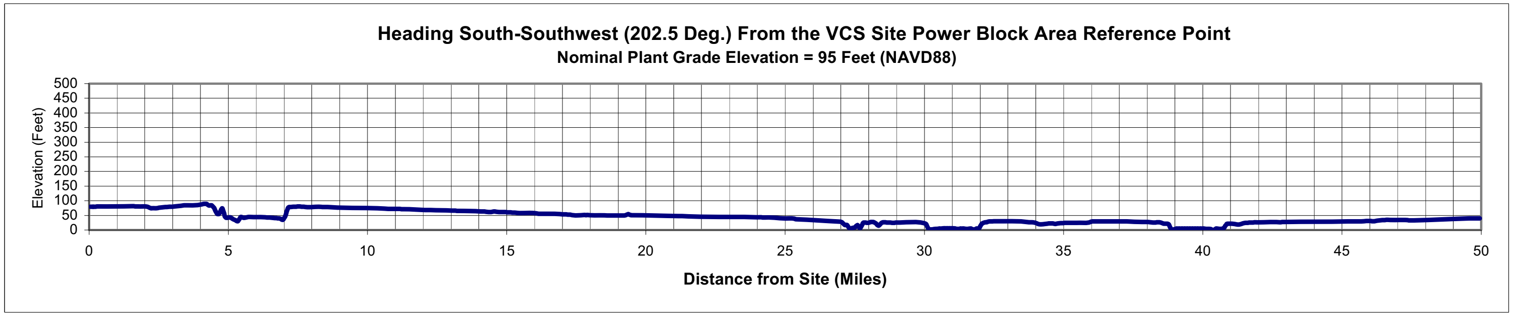
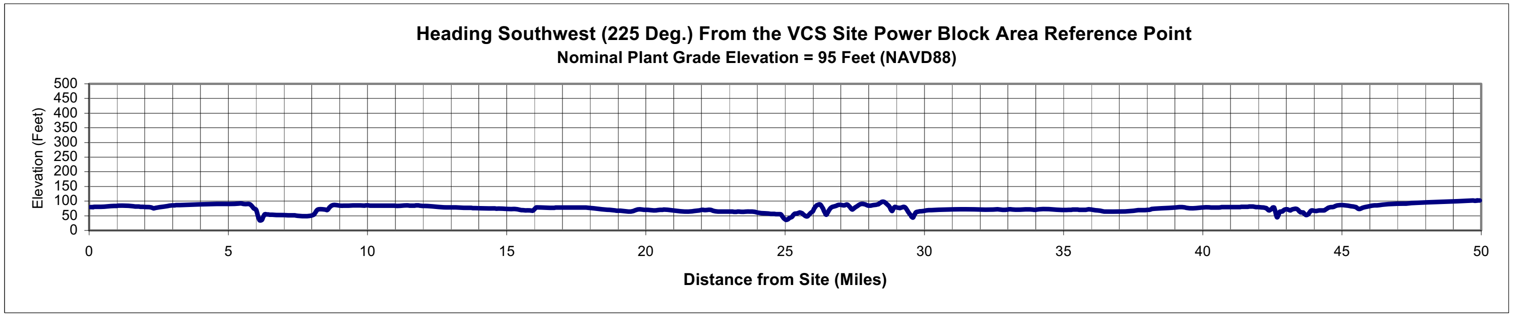


Figure 2.3.2-14 Terrain Elevation Profiles within 50 miles of the VCS Site (Sheet 3 of 6)





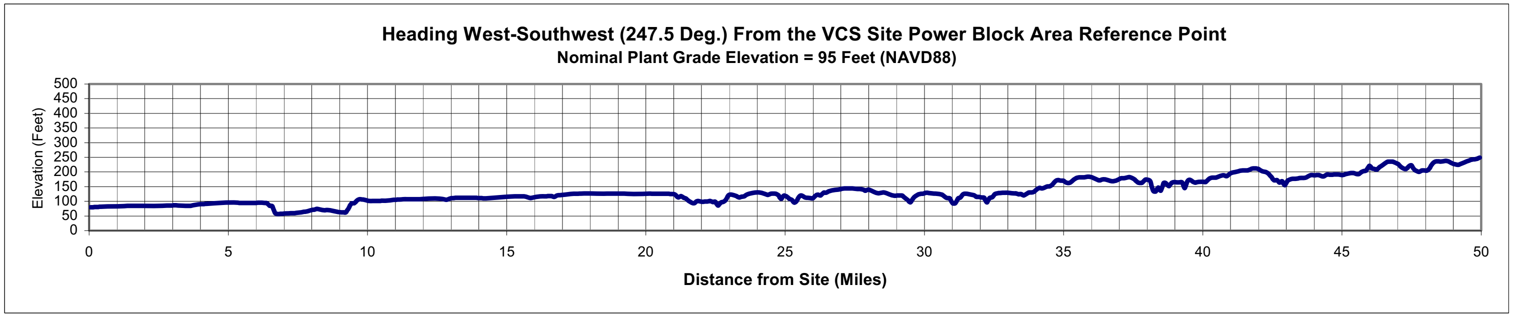
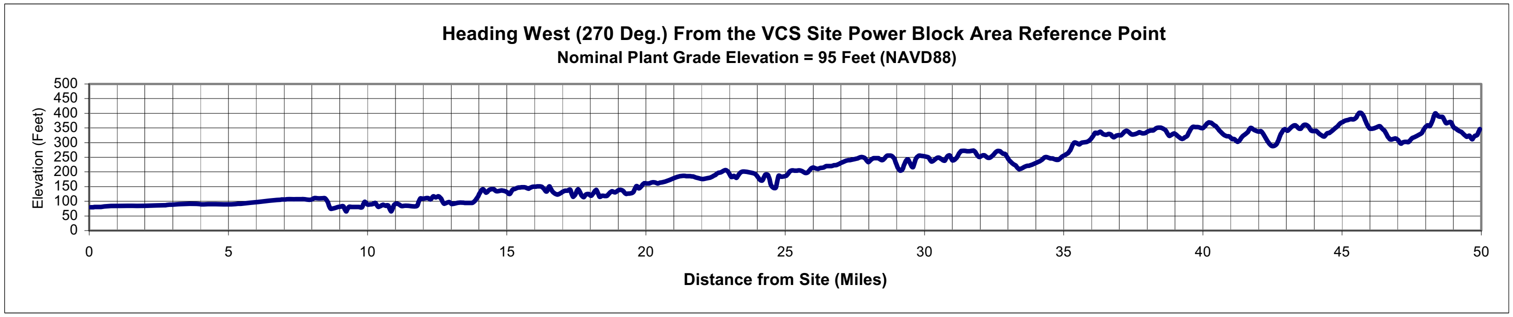
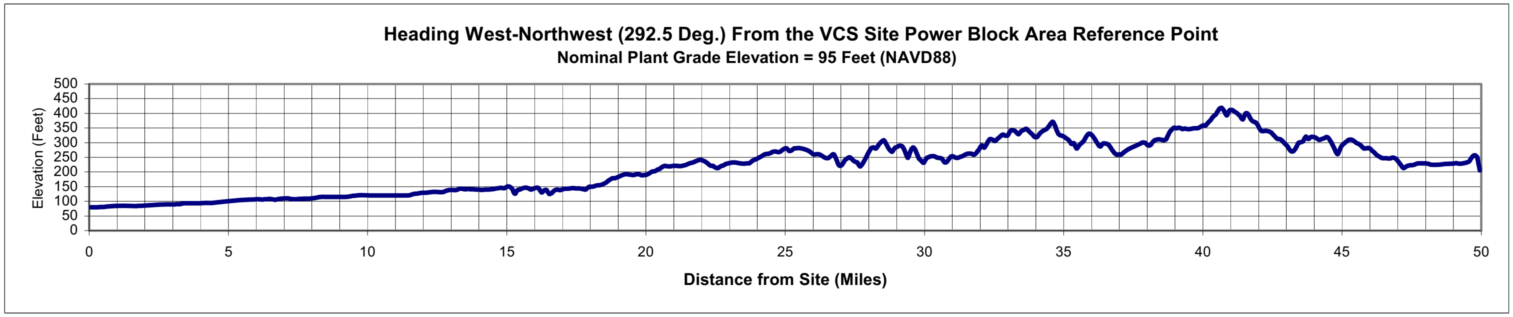


Figure 2.3.2-14 Terrain Elevation Profiles within 50 miles of the VCS Site (Sheet 4 of 6)





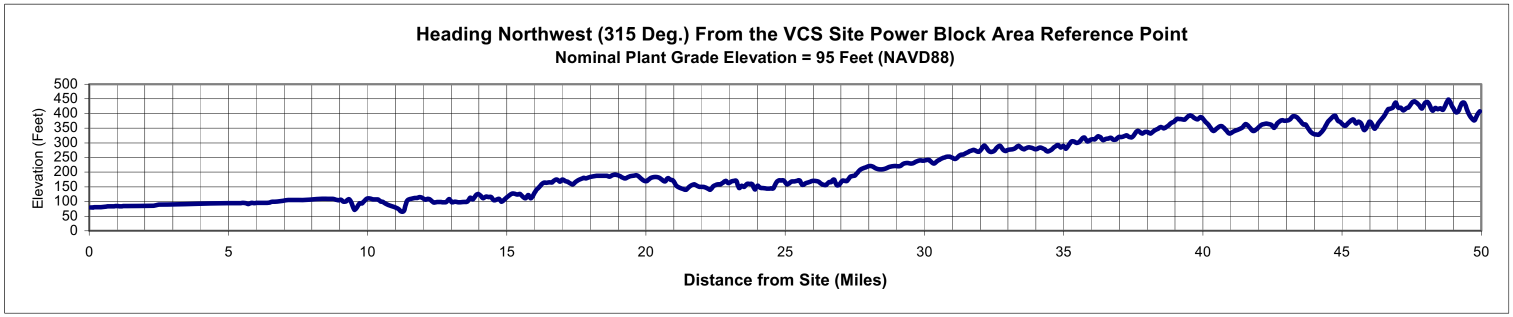


Figure 2.3.2-14 Terrain Elevation Profiles within 50 miles of the VCS Site (Sheet 5 of 6)

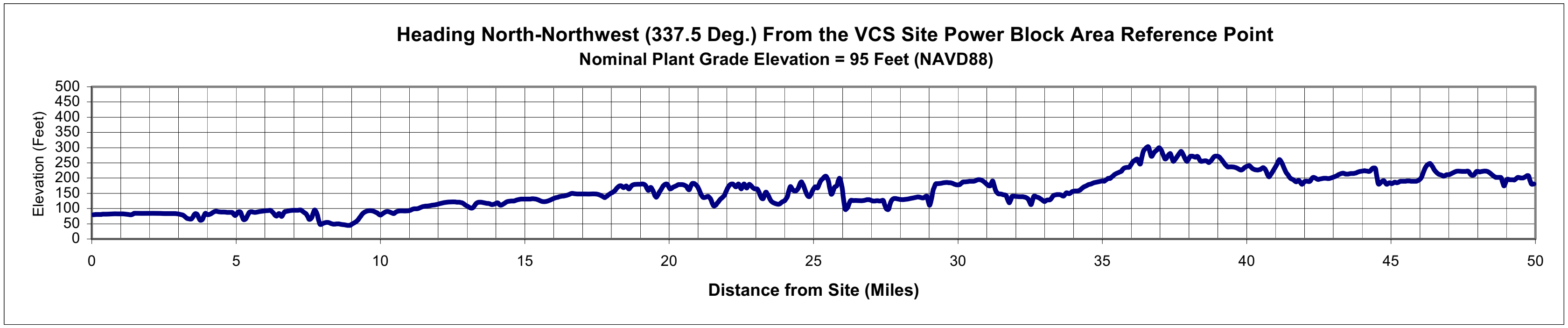


Figure 2.3.2-14 Terrain Elevation Profiles within 50 miles of the VCS Site (Sheet 6 of 6)

2.3.3 Meteorological Monitoring

This section describes the meteorological monitoring program at the VCS site, and its adequacy for characterizing atmospheric transport and diffusion conditions representative of the site and surrounding area and providing a meteorological database for evaluation of the effects of construction and operation and for accessing ongoing meteorological conditions used to support impact assessments and emergency preparedness, for a plant to be potentially built at the site.

This description of the meteorological monitoring program includes an evaluation of the:

- Tower location and instrument siting
- Meteorological parameters measured
- Meteorological sensors
- Data recording and transmission
- Instrument surveillance, maintenance, and calibration
- Data acquisition and reduction
- Data screening and validation
- Data display and archiving
- System accuracy
- Emergency preparedness and response support
- Annual data recovery rate and joint frequency distribution data
- Need for additional data sources for airflow trajectories

This evaluation demonstrates that the pre-application meteorological monitoring program for the site meets the relevant requirements of 10 CFR 50.47(b)(4), 10 CFR 50.47(b)(8), and 10 CFR 50.47(b)(9), Appendix E, Appendix I, 10 CFR 100.20(c)(2), 10 CFR 100.21(c); the guidance in Section C of RG 1.23, Revision 1; Section C.4 of RG 1.111, Revision 1; RG 1.21, Revision 2, Sections 3.1 through 3.3; and RG 1.206, Subsection C.I.1 (C.1.2.3.3).

2.3.3.1 General Monitoring Program Description

The onsite meteorological monitoring program consists of three phases:

1. Pre-Application Monitoring Phase — Two years of the meteorological data collected on site from July 1, 2007 through June 30, 2009 is used to support the ESP application, specifically for:
   - Description of atmospheric transport and diffusion characteristics of the site and surrounding area.
   - Calculation of the dispersion estimates for both postulated accidental and routine airborne releases of effluents.
   - Evaluation of the environmental risk from the radiological consequences of a spectrum of severe accidents.
   - Assessment of the nonradiological impacts due to site preparation and construction, and to plant operation.
2. Preoperational Monitoring Phase — Before plant operation, one year of onsite meteorological monitoring is planned to provide a basis for identifying and assessing environmental impacts resulting from plant operation.

   Monitoring during plant construction is not planned because no significant construction impacts have been identified that warrant onsite meteorological monitoring.
3. Operational Monitoring Phase — The operational monitoring program will be implemented to provide data for use in evaluating the environmental impacts of plant operations, including radiological and nonradiological impacts, and for emergency preparedness support.

The onsite meteorological measurements program includes an instrumented 60-meter, guyed tower. The program began operation on June 28, 2007. The location of the meteorological tower and instrumentation conforms to RG 1.23 (Reference 2.3.3-11). Instrument surveillance (i.e., operation, maintenance, and calibration), and data processing and validation in accordance with the applicable regulatory and relevant industry guidance were routinely performed during the pre-application monitoring phase to ensure data quality as well as to achieve acceptable annualized data recovery rates greater than or equal to 90 percent. No backup onsite meteorological data collection system was used, because the monthly data recovery rate from the 60-meter tower well exceeded 90 percent since the program began operation.

2.3.3.2 Meteorological Tower and Instrument Siting

The subsections that follow provide an evaluation of the general and local exposure of the meteorological tower and instruments relative to potential plant structures and other features of the plant site. In the evaluation, the location of the meteorological tower, surrounding terrain and vegetation, potential power block buildings, cooling towers, and cooling basin were examined to determine whether the measurements made on the tower represent the overall site meteorology. The conformance status of the tower and instrument siting is summarized in Tables 2.3.3-1 and 2.3.3-2, respectively.

2.3.3.2.1 Site Description and Topographic Features of the Site Area

The following briefly describes the topographic features of the VCS site. This description together with the description in Subsection 2.3.2 regarding the topographic features and dispersion characteristics of the site area forms the basis for assessing the adequacy of the meteorological monitoring program for the site.

The site is located in Victoria County in southern Texas, approximately 127 miles southwest of Houston, 60 miles north-northeast of Corpus Christi, and 13.3 miles south of the city of Victoria. The site area is approximately 11,500 acres and is bounded by Linn Lake to the east, U.S. Highway 77 and Kuy Creek on the west, and a Union Pacific railroad line on the south. The north-south running Guadalupe River flows between Linn Lake and the Victoria Barge Canal, which is approximately 5 miles east of the site. Most of the site has been used for a cattle ranch.

The site is located in the Texas coastal plain, midway between the southern and the eastern extremities of the Texas Gulf Coast. Terrain of the site is generally flat, ranging in elevation between 65 and 85 feet NAVD 88. To the east of the site, elevation decreases from approximately 85 feet NAVD 88 to approximately 12 feet NAVD 88 at Linn Lake. The area to the southwest of the site towards Kuy Creek decreases in elevation from approximately 80 feet to 50 feet NAVD 88.

Within 50 miles (80 kilometers) of the site, the terrain is generally flat to gently rolling, except towards the west and northwest. At the outer boundary of the 50-mile radius, measured from the power block area, the terrain rises to 550 feet NAVD 88. The major influence on local meteorological conditions is the Gulf of Mexico, located approximately 35 miles to the southeast of the site at its closest approach.

Site area maps within a 5-mile (8-kilometer), 10-mile (16-kilometer), and 50-mile (80-kilometer) radius are shown in Figures 2.3.3-1, 2.3.3-2, and 2.3.3-3, respectively. See Figure 2.3.2-14 for plots of terrain elevation by downwind direction sector to a distance of 50 miles from the site.

2.3.3.2.2 Meteorological Tower Exposure

The meteorological tower is located near the northwestern corner of the site. The geographical coordinates for the tower are: Latitude: N 28º 37’ 01.49” and Longitude: W 97º 02' 27.04".

The location of the meteorological tower with respect to the power block area, where the potential reactor units and other plant features would reside, is shown in Figure 2.3.3-4. The base of the meteorological tower, located in an open field, is 82.4 feet NAVD88. Finished plant grade at the new units will be 95 feet NAVD 88.

As shown in Figure 2.3.3-1, the area within a 5-mile radius of VCS is generally flat with terrain variations less than 100 feet. Because the base of the tower is at approximately the same elevation as finished plant grade and terrain variation is minimal in the vicinity of the site, it is concluded that the location of the tower and the plant site have similar meteorological exposures.

2.3.3.2.3 Potential Airflow Alteration

Wind sensors should be located over level, open terrain at a distance of at least 10 times the height of any nearby natural or man-made obstruction (e.g., terrain, trees, buildings), if the height of the obstruction exceeds one-half the height of the wind measurements (Reference 2.3.3-11). The surrounding terrain, nearby trees, and structures (existing and planned) were evaluated to determine whether they would affect the wind measurements on the tower. The findings are described below.

The tower is sited in an area clear of trees. Nearby trees and shrubs are more than 1000 feet from the tower and are relatively short (i.e., less than 15 feet) when compared to the upper wind sensor height (i.e., 197 feet or 60 meters) and the lower wind sensor height (i.e., 33 feet or 10 meters).

There are no existing structures higher than 16.4 feet or 5 meters located near the meteorological tower. An environmentally-controlled equipment shelter at the base of the tower, which housed the data processing and recording equipment, is 8 feet by 8 feet by 8 feet. The base of the shelter sits 4 feet above the ground to protect it from flooding. Therefore, the elevation of the shelter roof is 12 feet above ground, which is less than half the height of the lower-level wind sensor height (i.e., 33 feet or 10 meters above ground).

The meteorological tower is located approximately 3185 feet from the center of the power block area, where the plant structures would reside, and the shortest distance from the tower to the closest edge of the power block area is approximately 2230 feet. Typically, a plant vent stack is higher than the plant building that it serves. However, its width is much smaller when compared to its height. Airflow alteration caused by such a vent stack is not expected to be discernible beyond 5 times its height downwind. This is consistent with the regulatory guidance provided in NUREG-1555, Section 6.4 (Reference 2.3.3-13). Once constructed, the tallest plant building (i.e., either the reactor or turbine building) could be as tall as 230 feet above grade, depending on the selected reactor type; however, it is expected to be located approximately 10 times its height, or more, away from the meteorological tower at its closest point. With such a large distance separation, any airflow alteration caused by this potential tallest structure is considered to be minimal. Other potential obstructions within 5000 feet of the meteorological tower have also been evaluated against the “10 times the obstruction height” guideline (Reference 2.3.3-11) and have been found to be a distance of at least 10 times their height from the meteorological tower.

2.3.3.2.4 Heat and Moisture Sources Influence

Ambient temperature and atmospheric moisture measurements (e.g., dew point temperature, relative humidity or wet bulb temperature) should be made, avoiding air modification caused by the nearby sources of heat and moisture (e.g., ventilation sources, cooling towers, water bodies, and large parking lots). The potential for modifications of ambient temperature and relative humidity measurements made on the tower were assessed. The findings of this evaluation are described below.

Existing Environment

The meteorological tower is located in an open field with natural vegetation surrounding the tower. At the base of the tower, light-colored gravel has been placed inside a 25-foot by 25-foot fenced-in compound surrounding the tower. There are no large concrete or asphalt parking lots or other temporary land disturbances, such as plowed fields or storage areas, located nearby. The nearest asphalt surface is U.S.Highway 77, a four-lane divided highway lying approximately 1200 feet west of the tower. With this large-distance separation, the thin layer of warm air generated by the paved highway during hot sunny days is expected to have negligible heat effects on the temperature measurements made on the tower.

The nearest large body of water is Linn Lake located approximately 3 miles east of the meteorological tower. Because of the large-distance separation, relative humidity measurements made on the tower are not expected to be affected by the lake.

Potential As-Built Environment

Based on Figure 2.3.3-4, the minimum distances from the meteorological tower to the gravel substation construction maintenance area and the power block area are approximately 370 feet and 2230 feet, respectively. The closest planned large concrete or asphalt parking lot or ventilation source would potentially be located more than 1030 feet from the meteorological tower. With these large-distance separations between the existing and planned heat sources, the heat effect on the temperature measurements made on the tower is expected to be insignificant.

A mechanical draft cooling tower system is proposed to be used if the selected reactor type requires an external ultimate heat sink (UHS) and/or service water cooling system. The nearest cooling tower would be located more than 2230 feet from the meteorological tower. As indicated in Subsection 5.3.3.1.1 of the Environmental Report, the predicted annual average cooling tower plume length and plume height are 0.45 mile (2376 meters) and 295 feet (90 meters), respectively. In addition, the annual median plume length is 634 feet, while the predicted median plume height is 98 feet. Based on these predictions, it is concluded that the visible cooling tower plume height at 2400 feet downwind of the cooling tower would exceed the height of the relative humidity and temperature sensors installed at the 10-meter level (33 foot) of the meteorological tower. Therefore, operation of the proposed cooling towers onsite would have negligible effects on the relative humidity and temperature measurements made on the tower.

The plant cooling system would include an approximately 4900-acre cooling basin, which will be located approximately 4480 feet from the meteorological tower at its closest point. During plant operation, moisture content and temperature in the air immediately above the elevated basin are expected to increase slightly due to natural evaporation from the basin and basin warming from the plant thermal discharge, respectively. As shown in Figure 2.3.3-4, winds from the east-northeast through south-southeast directions could potentially carry moist air over the basin toward the meteorological tower location. However, given the approximately 4480-foot separation between the meteorological tower and the cooling basin, nonrepresentative influences on the ambient air temperature and relative humidity measurements on the tower during plant operation are expected to be minimal.

2.3.3.2.5 Potential Changes on Site Diffusion Climate

The influence of the planned cooling basin on the diffusion climate of the site and its relation to dispersion of accidental or routine radioactive releases has been examined. The findings are summarized as follows.

In general, the wind speed increases as air moves from land over a low-friction water surface that would enhance local dispersion. However, the mechanical turbulence tends to decrease when air moves from land over water, independent of temperature difference, and would hinder local diffusion. The surface roughness changes on both turbulence and wind speed could be significant when considered by itself. However, the combination of these changes is generally offsetting, thereby having negligible effects on the local diffusion climate of the area.

The presence of a cooling basin could alter the frictional effects on adjacent land surface; however, the impact of this on wind speed and direction is expected to be limited to the immediate vicinity of the basin.

Temperature differences between the cooling basin and the ambient air boundary layer could influence air flow at receptors downwind of the reactor. When the basin water is warmer than the adjacent air, the increases in lower-level ambient temperature would create thermal instability. Subsequently, more unstable atmospheric stability (i.e., favorable diffusion environment) is expected.

Given the 4480-foot separation between the meteorological tower and the cooling basin, influences of the cooling basin on the wind speed, wind direction, and vertical temperature differential measurements on the tower during plant operation are expected to be minimal.

2.3.3.2.6 Instrument Siting

For siting of wind sensors, data from Corpus Christi and Houston was initially used to determine the average wind direction characteristics of the site. This data indicated that the winds were predominantly from the southeast. This was consistent with the predominant winds (i.e., southeast to south-southeast) found at Victoria Regional Airport, Texas, approximately 17 miles from the site. Based on the results of this evaluation, the wind sensors were mounted on the south side of the tower (i.e., the upwind side of the tower, under the predominant wind directions expected at the site) to minimize the effects of the tower on those measurements.

Because the tower structure itself could affect downwind measurements, the wind sensors were mounted on an 8-foot retractable boom, which was oriented to the southeast and extended approximately 6.5 feet from the tower (greater than twice the tower's width of 1.5 feet), to minimize the effects of the tower structure on wind measurements. Thus, the wind speed and wind direction measurements were free from the influence of the tower.

Temperature and humidity sensors were mounted in fan-aspirated radiation shields, which point north with the shield inlet approximately 2.5 feet from the tower (more than 1.5 times the tower width of 1.5 feet) to minimize the impact of thermal radiation on the tower and radiation shield.

2.3.3.3 Pre-Application Monitoring Phase

Two years of onsite data were collected during the pre-application monitoring phase. In preparing the ESP application for the VCS site, the adequacy and accuracy of the onsite meteorological data collection system were evaluated, based on the guidance provided in RG 1.23 (Reference 2.3.3-11). The areas specifically examined include: tower siting and sensor location for determination of the representativeness of the 2 years of data collected by the system; accuracy of the sensor performance specifications; adequacy of the methods and equipment for recording sensor output; data acquisition, reduction, and validation procedures; and the quality assurance program for sensors, recorders, and data reduction to ensure accurate and valid data was collected. The representiveness of the meteorological tower and instrument siting has been established in Subsection 2.3.3.2. The findings of the remaining evaluations are described below.

2.3.3.3.1 Meteorological Parameters Measured

Meteorological measurements were made at two levels on the 60-meter tower: the 10-meter level and the 60-meter level. The parameters measured at each level are summarized in Table 2.3.3-3. A meteorological monitoring system block diagram for the configuration used during the ESP pre-application monitoring phase is provided in Figure 2.3.3-5. The monitoring system was equipped with lightning protection.

Wind speed and wind direction were measured at 33 feet (10 meters) and 197 feet (60 meters) above ground level. The routine and potential accident atmospheric release points are assumed to include the plant stack (no taller than 279 feet) and several other locations with elevations below the stack height. The meteorological parameters measured at the prescribed elevations for evaluation of the radiological impacts of these releases (i.e., wind speed and direction) are consistent with Regulatory Position 2.1 of RG 1.23 (Reference 2.3.3-11).

Ambient temperature was monitored at the 10- and 60-meter levels. Vertical differential temperature (i.e., delta-T) was based on the difference between the temperatures measured at the 60- and 10-meter levels. Relative humidity (RH) was directly measured using instrumentation located at both the 10- and 60-meter levels. The 60-meter level RH sensor was installed on November 28, 2008, to facilitate and provide flexibility in selection of the type of heat dissipation system for a UHS, if required, and/or a plant service water system. The dew point temperature was calculated based on the coincident ambient temperature and RH measurements. The atmospheric moisture content near the ground was quantified by the calculated dew point temperature for the 10-meter level and was used in the cooling basin fogging potential evaluation. Because the physical height of a typical wet mechanical draft cooling tower is approximately 60 feet (18.3 meters), the atmospheric moisture content at the height of the water vapor release from the cooling towers can be adequately represented by the dew point temperatures calculated for the 10-meter measurement level.

Precipitation was measured using an 8-inch diameter, tipping bucket precipitation gage mounted at ground level away from the tower shelter to prevent any interference in precipitation capture. The precipitation gage was equipped with a heating element in case of frozen precipitation. Windshields were provided to prevent wind-induced under-recording of precipitation. The rain gage windshield was one-half inch above the level plain of the rain gage orifice. This is consistent with the shield's installation instructions and the National Weather Service National Training Center documentation for Standard Rain Gages.

Solar radiation was measured at 4.6 meters above ground, but the data collected was not used in preparing the ESP application.

2.3.3.3.2 Meteorological Sensors Used

A description of the meteorological sensors, including type, manufacturer, model number, specifications (including starting threshold, range, and measurement resolution, as applicable), and accuracy for the data collection system at the site during the pre-application monitoring phase, is provided in Table 2.3.3-4.

The meteorological sensors installed on the tower are designed to operate under the range of environmental conditions expected at the site. Specifically, these sensors and the meteorological tower are capable of withstanding the following environmental conditions:

- Ambient temperature range of –22ºF to +122ºF (–30ºC to +50ºC).
- Relative humidity range of 0 to 100 percent.
- Tower design conforms to standard TIA/EIA-222-F for 100 mph (44.7 m/s) fastest-mile wind speed with no ice, and the 2003 International Building Code using a 120-mph (53.6 m/s) 3-second gust basic wind speed.

No adverse effects on the sensors from corrosion, blowing sand, salt, air pollutants, birds, or insects were observed during the pre-application monitoring period.

2.3.3.3.3 Data Recording and Storage

From the onsite meteorological tower, analog input signals from sensors were converted to digital signals via an A/D converter and displayed in meteorological units. The processing and recording equipment was housed in an environmentally controlled instrument shelter.

The Campbell Scientific data logger sampled sensor output once per second. For most parameters, hourly averaged values were based on 3600 data points per hour. Data averaging was arithmetic with the exception of that for wind direction, which was a vector average. Precipitation data was recorded as a cumulative hourly total. Values were archived as hourly averages in accordance with Regulatory Position 6 in Section C of RG 1.23 (Reference 2.3.3-11).

The data traces produced by an independent recorder software (from Darwin digital recorder) are to facilitate review and documentation of data collection. The traces were reviewed weekly for data quality assurance purposes.

Once each week, the data that had been stored on the local data collection computer was transferred to a computer dedicated for housing the site database. Once each week, the site database was also backed up to a server and a portable backup drive that was subsequently stored in an offsite fireproof safe deposit box.

2.3.3.3.4 Data Reduction and Reporting

The following data reduction and reporting program was implemented during the pre-application monitoring phase to ensure a valid, accurate, and representative meteorological database.

2.3.3.3.4.1 Data Screening and Validation

On a daily basis, the Campbell Scientific Loggernet software, which was located offsite at the environmental consultant's office, called the Campbell Scientific CR1000 data logger at the site. Data acquired since the last data collection (nominally 24 hours prior) was downloaded to a personal computer.

In the screening process, each parameter was analyzed by data screening software. A sample list of the data screening criteria is provided as follows:

- Wind speeds less than 1 mph, greater than 50 mph or invariant for 2 or more consecutive hours were flagged on the data printout.
- When the lower wind speed exceeded the upper wind speed or the upper wind speed exceeded the lower wind speed by 15 mph, the wind speeds were flagged on the data printout.
- Wind directions were flagged on the printout if invariant for 2 or more consecutive hours, or the (automatically calculated) sigma-theta value equaled or exceeded 50 degrees.
- Wind directions were flagged on the printout if direction shear greater than 60 degrees existed between the lower and upper level directions.
- Ambient temperature values were flagged on the printout if they were lower than a specified seasonally determined temperature, higher than a specified seasonally determined temperature, or more than a 6ºF change in an hour occurred.
- Vertical delta-T values were flagged on the printout if they were above 10ºF or below –10ºF.
- Dew point values, which were calculated using concurrent humidity and ambient temperature data, were flagged on the printout if they were below 0ºF, greater than 80ºF, or greater than a 6ºF change in a given hour.
- Precipitation values were flagged on the printout if they are greater than 0.25 inches per hour.

Subsequently, the data and screening results were reviewed by professional meteorologists to determine the data validity on a daily basis.

In addition, the daily data was also compared to measurements from a nearby observing station (i.e., Victoria Regional Airport). The data from the onsite monitoring program and the nearby offsite locations was not expected to match; however, the meteorologist looked for consistency in the temperatures, atmospheric moisture, precipitation (timing and, to a lesser extent, the amount), wind speed and wind direction. Information from maintenance logs and calibration results was taken into consideration as well in determining data validity.

As an integral part of the screening process, data from the Darwin digital recorder was retrieved via modem on a weekly basis. The data traces produced by the recorder software were reviewed and documented by a meteorologist. The field services manager and/or project manager were notified of any problems identified during the digital trace review.

If problems were discovered in the data screening or validation process, they were communicated to field services and management staff in a timely manner for corrective action. Routine site visitation logs, calibration logs, and equipment maintenance logs were generated in accordance with the project Procedures Manual (Reference 2.3.3-2) and included in the site monthly reports.

2.3.3.3.4.2 Identification and Handling of Suspect Data

At the end of each month, the designated project manager reviewed the data and edited the data as appropriate. Erroneous data was invalidated, questionable data was reviewed further, and a determination made as to whether the data would be invalidated or replaced. While the goal was to achieve full data recovery, a minimum of 90 percent valid data recovery was acceptable for all parameters measured, including the joint recovery of wind speed and wind direction for each level, and the joint recovery of wind speed and wind direction by atmospheric stability class for each level.

The following methodologies were followed, if required, for data substitution:

- Where data for a given parameter was missing for brief periods (e.g., 1 to 5 hours), interpolation may have been used to fill data gaps.
- If wind direction data was missing or was invalid from one level, data from the other level could be used as a substitute. The average difference in directions could be used as an offset to the available direction level.
- If wind speed data was missing or was invalid from one level, data from the other level could be substituted using the Power Law based on the surface roughness around the tower, time of the day, and stability class to correct for height differences.

- Delta-T was used to determine and classify atmospheric stability in accordance with Table 1 of RG 1.23. If interpolation was necessary to fill stability gaps; time of day, season, and weather conditions (e.g., variations in wind speed and the presence or absence of precipitation) at the time were considered. The atmosphere is generally more unstable during daylight hours (and in particular during the afternoon hours), more stable during the nighttime hours, and neutral when it is overcast. Unstable conditions are more common during the warmer months and extend over a greater period of time during the day.

- Missing precipitation data could have been estimated using data collected at either Victoria Regional Airport or other nearby local observation stations.

Based on 2 years (i.e., July 1, 2007 through June 30, 2009) of data collected on site, there were only 46 hours of data measured at the lower measurement level missing and 47 hours of data from the upper level missing. For a given missing hour of data, the data could be for wind speed, wind direction, stability class, or a combination of these parameters. The overall data recovery rate of the 2-year data well exceeds the RG 1.23 (Reference 2.3.3-11) specification of at least 90 percent. Because only a small amount of data was missing (i.e., less than 0.3 percent), no data substitution was necessary.

2.3.3.3.4.3 Data Reporting

After all data had been validated and verified by the project manager, a monthly report was generated. The monthly reports described:

- The activities that occurred at the site during the month.

- Valid data recovery rates for each parameter and a composite of wind speed, wind direction, and stability class.

- A summary of the data collection and reporting processes.

- Equipment maintenance logs, calibration logs, or routine site visitation logs that had been generated during the month.

2.3.3.3.5 Instrumentation Surveillance

Inspection, maintenance, and calibration of the onsite meteorological monitoring system were performed in accordance with Regulatory Position 5 (Instrument Maintenance and Servicing Schedules) in Section C of RG 1.23 (Reference 2.3.3-11) and Section 7 (System Performance) of ANSI/ANS-3.11-2005 (Reference 2.3.3-1).

Once each month, the meteorological monitoring site was visually inspected by field services personnel. A routine site visitation log was completed on site each month. The routine site visitation log was a means of logging the site visit, which included the following activities:

- Verification that the data logger, digital recorder, and the uninterruptible power supply were working properly.
- Visual check of the tower.
- Comparison of visual wind indications versus the data shown on the digital recorder.
- Verification that the rain gage was functioning properly (unless it was raining or snowing at the time of visit) and was free of debris and cleaned, if necessary.
- Verification of ambient temperature and atmospheric moisture measurements using a psychrometer. A psychrometer measurement was taken to provide dry bulb and wet bulb temperatures. The dry bulb temperature was compared to the 10-meter ambient temperature reading. The dry and wet bulb temperatures were then used to calculate a dew point, which was compared to that recorded at the 10-meter level.

Detailed instrument calibration procedures and acceptance criteria were strictly followed by qualified technicians during system calibrations. These calibrations helped to verify and, if necessary, reestablish the accuracies of sensors associated with signal processing equipment and data displays. Routine calibrations included obtaining both “as-found” (before maintenance) and “as-left” (final configuration for operation) results. The end-to-end results were compared with expected values. Any observed anomalies that might have affected equipment performance or reliability were reported to the field service manager for corrective action. If any acceptance criteria were not met during performance of calibration procedures, timely corrective measures (e.g., adjusting response on site to conform to desired results or replacing a sensor with a calibrated spare) were initiated. At the end of each month, the project manager performed a thorough data consistency check and edited the data accordingly.

Specifically, the pre-application meteorological monitoring system was calibrated once every 4 months as specified in site procedures. System calibrations included ambient temperature at the 10-meter level, delta-T between 60 and 10 meters, relative humidity at the 10- and 60-meter levels, wind speed and wind direction at the 10- and 60-meter levels, solar radiation, and precipitation. For each calibration, the wind speed sensors were replaced with calibrated sensors. The sensors that were removed were tested “as found.” The wind sensors were tested at variable speeds, while the wind direction was tested on the tower.

These calibrations also included checks of the power supply, data logger, and digital recorder. Site meteorological calibration logs were completed while on site and were included in the monthly report. For the pre-application monitoring phase, calibration logs were stored at the meteorological consultant’s offices.

At a minimum, routine bearing replacement occurred every 12 months for the wind direction sensors and every 6 months for the wind speed sensors. Those sensors removed from the tower were tested in an “as-found” condition. A spare set of calibrated sensors is installed upon removal to minimize downtime. An “as-left” calibration was then performed after the bearings had been replaced. The “as-found” and “as-left” values were recorded during the sensor calibration process.

The guy wires of the meteorological tower were inspected annually.

2.3.3.3.6 System Accuracy

Based on Regulatory Position 4 in Section C of RG 1.23 (Reference 2.3.3-11), determining the accuracy of time-averaged data from digital measurement systems should account for errors introduced by sensors, cables, signal conditioners, temperature environments for signal conditioning and recording equipment, recorders, processors, data displays, and the data reduction process.

System accuracy reflects the performance of the total system, from the sensors, through all processing components, to the display of measured values in their final form. System accuracy can be estimated by performing system calibrations, or by calculating the overall accuracy based on the system’s individual components. Accuracy tests involve configuring the system to near normal operation, exposing the system to multiple known operating conditions representative of normal operation, and observing the results. Industry guidance on methods for calculating system accuracy is provided in ANSI/ANS-3.11-2005 (Reference 2.3.3-1).

During the pre-application monitoring phase, data collected on the meteorological tower was recorded and processed at the base of the tower inside an environmentally controlled shelter. System accuracies of the site meteorological data collection system were estimated by performing system calibrations, as one of the options suggested in Section 7.1 of ANSI/ANS-3.11-2005 (Reference 2.3.3-1). Specifically, system accuracy for each measured parameter was determined by performing system calibration (i.e., from the meteorological sensor output to the output of the data loggers).

Both sensor accuracies and system accuracies were compared to the regulatory and industry requirements, and the findings are summarized in Table 2.3.3-4. As shown in the table, the sensor and system accuracies meet the regulatory guidance in RG 1.23 (Reference 2.3.3-11) and ANSI/ANS-3.11-2005 (Reference 2.3.3-1).

2.3.3.4 Preoperational Monitoring Phase

Before plant operation, one year of onsite meteorological monitoring is planned to provide a basis that reflects the as-built environment for identifying and assessing environmental impacts resulting from plant operation.

2.3.3.4.1 Meteorological Parameters Measured

Meteorological parameters measured on the tower include wind speed, wind direction, and ambient temperature at the 10- and 60-meter levels, the differential temperature between the 10- and 60-meter levels referenced to the 10-meter ambient temperature, relative humidity at the 10-meter levels, and precipitation at ground level.

The potential influence of plant structures and the potential effects of plant heat dissipation system operation on local meteorology were qualitatively examined. The results of this examination are described in Subsection 2.3.3.6.1.

2.3.3.4.2 Data Collection System

An onsite meteorological monitoring system similar to the ESP pre-application system is expected to be used for preoperational monitoring. The instrumentation and sensors used will conform to RG 1.23, while instrument surveillance and data processing and validation will be carried out in accordance with the applicable regulatory requirements and relevant industry guidance, such as those for the pre-application monitoring.

2.3.3.5 Operational Monitoring Phase

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 pre-application phase. The functional requirements of the operational phase monitoring program are described below relative to the system configuration for pre-application monitoring.

2.3.3.5.1 Description of Monitoring Program

The locations of the meteorological tower and instrumentation are not anticipated to change from those for the pre-application monitoring phase during the operational monitoring phase, although monitoring of certain parameters not related to atmospheric dispersion may be discontinued. Instrumentation surveillance and methods for data reporting, transmittal, acquisition, and reduction, while expected to be similar during the operational phase, would be controlled by plant-specific procedures to be developed during the COL phase. 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, the differential temperature between the 10- and 60-meter levels referenced to the 10-meter ambient temperature, relative humidity at the 10-meter level, and precipitation at ground level.

- During the ESP pre-application phase, meteorological data was collected locally at the tower and recorded as hourly average values. During the plant operational phase, 15-minute average values of wind speed, wind direction, and atmospheric stability class will also be required to be determined. Hourly averages would be compiled and archived for reporting purposes.

- Although RG 1.97, Revision 4 (Reference 2.3.3-10) allows flexible, performance-based criteria for the selection, performance, design, qualification, display, and quality assurance of accident monitoring variables, the 15-minute average data would be available to the plant control room, technical support center, and/or emergency operations facility designated to serve the new units to be built at the VCS site.

- For instrumentation surveillance, channel checks would be performed daily (Reference 2.3.3-11).

- During system servicing, channel calibrations would be performed no less than semiannually. System calibrations encompass 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) (Reference 2.3.3-11).

- Wind speed, wind direction, and atmospheric stability data collected by the plant computer system would be submitted as input to the NRC's Emergency Response Data System.

- Meteorological monitoring requirements for emergency preparedness and response support are described in Subsection 2.3.3.5.2.

Annual operating reports of effluent releases (both routine and batch) and waste disposal that include meteorological data collected on site would be prepared and submitted in accordance with RG 1.21, Revision 2 (Reference 2.3.3-4).

2.3.3.5.2 Emergency Preparedness Support

During the operational phase, the onsite meteorological monitoring program would also provide representative data for real-time atmospheric transport and diffusion estimates within the plume exposure pathway emergency planning zone (i.e., within approximately 10 miles) to support the dose assessments that are required during and following any accidental atmospheric radiological releases.

(References 2.3.3-6, 2.3.3-7, 2.3.3-9, and 2.3.3-12). At the COL stage, the meteorological tower and associated instrumentation will be re-evaluated to ensure that they comply with the requirements of the most current revisions of NRC regulations and industry standards for monitoring onsite meteorological conditions (e.g., air temperature, wind speed, and wind direction).

The dispersion estimates input to the dose assessment calculations would be made using the most recent 15-minute averages of wind speed, wind direction, and atmospheric stability class (based on data from the onsite meteorological measurement system or other alternative estimates) (Reference 2.3.3-11). These 15-minute average values would be compiled for real-time display in the control room, technical support center, and/or emergency operations facility designated to serve the new units. All the meteorological channels required for input to the dose assessment models would be available and presented in a format compatible for their use (Reference 2.3.3-11).

Provisions would be in place to obtain representative regional meteorological data such as that from the Victoria Regional Airport, Texas, a meteorological consulting contractor, or via the internet to provide real-time data and forecasts, if the onsite meteorological system is unavailable following a radiological accident.

2.3.3.6 Meteorological Data

The following subsections provide a description of the meteorological data that was used in preparing the ESP application.

2.3.3.6.1 Representativeness and Adequacy of Meteorological Data

As previously described, wind speed, wind direction, and temperature difference measurements collected on site were used to estimate the site-specific dispersion factors for the new units if built at the VCS site.

Subsection 2.3.3.2 describes topographical characteristics, natural and assumed plant-specific features in relation to siting the meteorological tower, and the installed instrumentation. Because terrain variations between the tower base and the planned finished plant grade in the power block area are minimal (i.e., <15 feet) and the assumed locations of plant structures and other nearby obstructions to airflow (e.g., trees) are all approximately at or more than 10 times their physical height away from the tower, no significant alteration to local airflow is expected and the meteorological tower location offers a local exposure similar to the area around the new units.

U.S. Highway 77 is the nearest asphalt surface, located approximately 1200 feet west of the tower. The closest edge of the plant gravel substation maintenance area would be approximately 370 feet east of the tower, while a large concrete or asphalt parking lot is planned for a location approximately 1030 feet from the tower. The closest ventilation source is located more than 2230 feet from the tower. An evaluation of their heat effects on the temperature measurements made on the tower was concluded to be negligible.

In addition, Linn Lake is approximately 3 miles east of the meteorological tower. The mechanical draft cooling towers are assumed to be located as close as 2230 feet from the meteorological tower. Figure 2.3.3-4 illustrates the relative positions of the meteorological tower and the planned plant cooling basin. Winds from the east-northeast through south-southeast directions could potentially carry moist air over the basin toward the meteorological tower. However, due to the large-distance (i.e., 4480 feet) separation between the meteorological tower and Linn Lake, the cooling towers, and the cooling basin, it has been previously concluded that nonrepresentative influences on the ambient air temperature and relative humidity measurements on the tower during plant operation are expected to be minimal.

Based on the description and findings above, it has been determined that the meteorological data collected from the onsite monitoring program is representative of the overall site meteorology and the multiphase onsite monitoring program provides an adequate database for making the required dispersion estimates.

2.3.3.6.2 Long-Term and Climatological Conditions

Meteorological data collected at Victoria Regional Airport, Texas, and that collected at the VCS site were examined to determine how well the onsite data represents long-term conditions at the site.

Evidence should be presented to demonstrate that the meteorological data collected at the VCS site represents long-term conditions at the site (Reference 2.3.3-12). If practical, the climate representativeness of the joint frequency distribution is checked by comparing with that of nearby stations which have collected reliable meteorological data over a long period of time (10–20 years). The distributions are compared with those of sites in similar geographical and topographical locations to ensure that the data is reasonable (Reference 2.3.3-14). The joint frequency distribution refers to the joint frequency distribution of wind speed and wind direction by stability class that is used for determining dispersion estimates.

Victoria Regional Airport is the closest observing station located approximately 17 miles north of VCS within the same climatological region. Terrain between the VCS site and the airport is relatively flat. The base of the VCS meteorological tower is 82.4 feet NAVD 88, while the airport observing station is at 104 feet NAVD 88. The overall meteorological exposure of these two observing stations is similar. Thus, data collected at the airport is expected to be reasonably representative of the VCS site.

Since long periods of meteorological records (i.e., 24 or more years of wind speed, wind direction, ambient temperature and precipitation) have been collected at the airport, these records can serve as a basis for comparison with the VCS data to demonstrate that the short-term VCS data is also representative of long-term conditions at the site.

Meteorological instrumentation (i.e., sensor exposure, instrument starting threshold, measurement elevation, and methods of data recording) at the airport observing station and the onsite monitoring system are different due to the nature of the data applications. Therefore, data comparison was limited to an assessment of consistency of the data collected at these two locations.

Specifically, comparisons of wind speed, wind direction, temperature, and precipitation were made. Vertical temperature difference (i.e., delta-T) was measured onsite for atmospheric stability class determination, but this meteorological parameter is not measured at the airport. Because of this difference, determinations of the stability classes at the two locations would have different bases, and any comparison of the resulting data would not be a meaningful exercise. Accordingly, a comparison of the stability classes for the airport and VCS data sets was not performed.

2.3.3.6.2.1 Comparison of Wind Speed and Wind Direction

Two years (i.e., July 1, 2007 through June 30, 2009) of wind data recorded at the VCS site were analyzed and the resulting average annual and seasonal wind direction and wind speed conditions are discussed in Subsection 2.3.2. In addition, comparisons of the wind data collected onsite with those listed in the Local Climatological Data (LCD) Summary (which reports mainly the normals, means and extremes) for the Victoria, Texas, NWS station at the Victoria Regional Airport were made in the same subsection.

In summary, these specific data analyses, discussions and comparisons conclude the following:

- The wind direction distribution at the 10-meter level of the onsite meteorological tower (see Table 2.3.2-5 Sheet 1) indicates a prevailing wind from the south-southeast on an annual basis with approximately 50 percent of the wind blowing from the southeast quadrant. Winds from the north and north-northeast sectors combined occur approximately 18 percent of the time annually. On a seasonal basis, winds from the southeast quadrant appear to predominate throughout the year, especially during the spring and summer. During the winter, winds from the north sector become more prevalent. Autumn represents a transitional season with winds from northeast and southeast quadrants occurring with about the same frequency.

- Wind measurements made at 6.1 meters (20 feet) above ground and summarized in the LCD for the Victoria, Texas NWS station (Reference 2.3.3-3) indicates a prevailing south-southeasterly wind direction on an annual basis, as well as seasonal variations, that appear to be reasonably similar to the 10-meter-level wind flow at the VCS site.

- Seasonal and annual mean wind speeds based on measurements from the lower (10-meter) level of the onsite meteorological tower over the 2-year period, and from instrumentation at the Victoria, Texas, NWS station based on a 24-year period of record that are summarized in the LCD are provided in Table 2.3.1-2. On an annual basis, mean wind speed at the 10-meter level is 4.0 meters per second at the VCS site. The annual mean wind speed at Victoria (4.2 meters per second) is similar to the 10-meter level at the VCS site, differing by only 0.2 meter per second. Seasonal average wind speeds are similar throughout the year, except during autumn when speeds average approximately 0.7 meters per second lower at the VCS site than Victoria. Seasonal mean wind speeds for both locations follow the same pattern.

In addition to these comparisons made in Subsection 2.3.2, a comparison of the wind frequency distribution based on the VCS data and the distribution associated with the Victoria Regional Airport data was made in this section to further confirm that the two years of VCS data reasonably represent the climatological conditions of the site area.

Wind measurements made at Victoria Regional Airport location are in 10-degree increments (i.e., 0 to 360 degrees rounded to the nearest 10 degrees). Five years (2003 through 2007) of hourly Victoria Regional Airport wind data were analyzed and the resulting wind frequency distribution is provided in Table 2.3.3-5.

Findings from the wind data comparison indicate the following:

- The wind frequency distribution of the 2-year combined VCS data collected at the 10-meter level as shown in Table 2.3.2-5 shows good agreement with the frequency distribution for the 5-year Victoria Regional Airport wind data set as shown in Table 2.3.3-5. Specifically, the 5-years of airport data indicate winds blowing from the southeast quadrant (i.e., 100 to 190 degrees) at approximately 45 percent while the winds from north and north-northeast sectors (i.e., 360 to 40 degrees) combined occur 16.3 percent on an annual basis.

- The prevailing (i.e., highest) wind direction was south-southeast (i.e., a 22.5 degrees sector centered at 157.5 degrees) and 160 degrees at the VCS site and the Victoria, Texas NWS station at the Victoria Regional Airport, respectively. The highest averaged wind speed for each location and time period was also found to be associated with the prevailing wind direction.

- As shown in the Victoria LCD, winds from the north sector become more prevalent from October through February. This pattern was in concert with the recent 5-years airport data and the 2 years of the VCS site data.

- The specific wind direction that was recorded least often was, in general, a west wind. Average wind speed was also the lowest when the wind direction had a westerly component.

In summary, there is strong evidence that winds from the southeast quadrant predominate throughout the year at both the VCS site and the nearby Victoria Regional Airport. Winds from the north sector are more prevalent during winter. West winds recorded the least at both sites. The highest averaged wind speed for each location is associated with the prevailing wind direction, while the lowest average wind speed is with a west wind.

As shown in Table 2.3.3-6, the wind data collected at the VCS meteorological monitoring site is consistent with the long-term LCD summary and the recent five years of data from the Victoria Regional Airport. Thus, the two years of VCS site data is considered to be reasonably representative of the climatological conditions of the site area.

2.3.3.6.2.2 Comparison of Temperature and Precipitation

A qualitative assessment was performed to determine how well the onsite temperature and precipitation data represents long-term conditions at the site.

Data examined include the following:

Victoria Regional Airport

- Long-term (i.e., >30 years) local climatological data summary
- Recent one-year (i.e., July 2007 through June 2008) local climatological data summary

Victoria County Station

- One year (i.e., July 2007 through June 2008) of VCS onsite data

Due to the nature of precipitation events, which are point observations, in southeast Texas, comparing precipitation totals from locations that are several miles distant from one another is difficult. Heavy rain that falls during thunderstorms, causes precipitation values to differ significantly over a short distance. Thunderstorms that are common in southeast Texas can be evidenced in the following example: On July 16, 2007, the Victoria Regional Airport recorded 1.18 inches less rainfall than the VCS site. On the following day, the VCS site recorded 1.26 inches less rain than the airport.

Monthly total precipitation and ambient temperature were reviewed for a one-year period (July 2007 through June 2008). The airport reported greater monthly precipitation totals than the VCS site for the year reviewed. Both sites recorded record-breaking rainfall during July 2007. Victoria Regional Airport recorded 20.34 inches of rain while the VCS site recorded 17.95 inches of rain. During July, the airport recorded more precipitation than the VCS site on 13 days, less precipitation on 9 days and an equal amount on 9 days.

Temperature was measured at 10 meters at the VCS site, while temperature was measured closer to ground level at the Victoria Regional Airport. The average monthly temperature was slightly higher at the airport during the warmer months (July through November) and slightly cooler at the airport during the colder months (December through February). This phenomenon is expected due to the difference of the measuring heights.

In conclusion, the precipitation and temperature data collected at the VCS meteorological monitoring tower can be considered to be consistent with data from the Victoria Regional Airport, due to the nature of the precipitation events occurring in southeast Texas and the difference in measurement height at both locations for temperature.

2.3.3.6.3 Need for Additional Data Sources for Airflow Trajectories

The site and its surroundings are considered to be situated in open terrain for the following reasons:

- As previously described in Subsection 2.3.3.2.1, the site area is generally flat, ranging in elevation between 10 and 85 feet NAVD 88, and the terrain within 50 miles (80 kilometers) of the site is generally flat to gently rolling, except towards the west and northwest with terrain rising to 550 feet NAVD 88. The major influence on local meteorological conditions is the Gulf of Mexico. Prolonged air stagnation that limits dispersion is infrequent in the area.

- Based on two years of data collected onsite, the predominant winds at the site are from southeast to south-southeast, and the VCS site is not a low-wind site that would be favorable for air stagnation.

As a result, data collected by the onsite meteorological monitoring program can be used for the description of atmospheric transport and diffusion characteristics within 50 miles (80 kilometers) of the plant site, such as that evaluated using the NRC-sponsored XOQDOQ dispersion model (Reference 2.3.3-8) referenced in RG 1.111 (Reference 2.3.3-5).

2.3.3.6.4 Supplemental Data for Environmental Impact Evaluation

Supplemental data from the Victoria Regional Airport is considered to be suitable for making impact predictions resulting from operation of the plant cooling towers, regarding visible plume, drift deposition, and fogging and icing. In particular, the bases/reasons for making this determination are summarized below:

- Victoria Regional Airport is located approximately 17 miles north of VCS within the same climatological region.

- Data (i.e., wind speed, wind direction and ambient temperature) collected at the airport are consistent with those collected at the VCS site.

- There is no body of water nearby that would significantly influence the relative humidity or wet bulb measurements made at these two locations (Subsection 2.3.3.6.1).
- The Seasonal and Annual Cooling Tower Impact (SACTI) model used for predicting cooling tower plume impacts requires input data twice daily for mixing height, cloud ceiling, cloud cover, dry bulb, wet bulb, wind speed, and wind directions, which are routinely measured at Victoria Regional Airport (except mixing height), but were not measured at the VCS site for all parameters.
- Long-term meteorological data at Victoria Regional Airport is readily available that allows the year-to-year variation in meteorological data to be factored into the cooling tower plume impact predictions.

2.3.3.6.5 Period of Data and Data Used to Support the Application

Data collected from July 1, 2007 through June 30, 2009 was used to support the application.

Specifically, an electronic sequential, hour-by-hour listing of the data set, in the format specified in Appendix A of RG 1.23 (Reference 2.3.3-11), is provided.

The annualized data recovery rates for the period from July 1, 2007 through June 30, 2009 are presented in Table 2.3.3-7 for the individual parameters (i.e., wind speed, wind direction, ambient temperature, delta-T, relative humidity, and precipitation) and for the composite dispersion-related parameters (i.e., wind speed, wind direction, and delta-T). All data recovery rates meet the RG 1.23 (Reference 2.3.3-11) specification of at least 90 percent.

Joint frequency distributions of wind speed, wind direction, and atmospheric stability class for the two years of onsite data are presented in Tables 2.3.2-5 and 2.3.2-6 for the 10- and 60-meter wind measurement levels. The format follows the example shown in Table 3 of RG 1.23 (Reference 2.3.3-11) for each stability class and for all stability classes combined.

The 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.

2.3.3.7 References

2.3.3-1 American National Standards Institute/American Nuclear Society, *American National Standard for Determining Meteorological Information at Nuclear Facilities*, ANSI/ANS-3.11-2005, December 2005.

2.3.3-2 Murray and Trettle, *P1009 Procedures Manual, P1009 Meteorological Monitoring Program Equipment Servicing and Data Recovery Procedures Manual, Revision 25,* July 2007.

2.3.3-3 U.S. NCDC 2007, National Climatic Data Center, *2007 Local Climatological Data, Annual Summary with Comparative Data, Victoria, Texas*, CD-ROM, LCD Annual 2007, NCDC, National Oceanic and Atmospheric Administration (NOAA).

2.3.3-4 U.S. NRC, *Measuring, Evaluating, and Reporting Radioactive Material in Liquid and Gaseous Effluents and Solid Waste*, Regulatory Guide 1.21, Revision 2, June 2009.

2.3.3-5 U.S. NRC, *Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors*, Regulatory Guide 1.111, Revision 1, July 1977.

2.3.3-6 U.S. NRC, *Clarification of TMI Action Plan Requirements*, NUREG-0737, November 1980.

2.3.3-7 U.S. NRC, *Functional Criteria for Emergency Response Facilities*, NUREG-0696, Final Report, February 1981.

2.3.3-8 U.S. NRC/CR-2919, *XOQDOQ Computer Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations.* NRC: Washington, D.C., September 1982.

2.3.3-9 U.S. NRC, *Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants*, NUREG-0654, Revision 1, Appendix 2, FEMA-REP-1, March 2002.

2.3.3-10 U.S. NRC, *Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants*, Regulatory Guide 1.97, Revision 4, June 2006.

2.3.3-11 U.S. NRC, *Meteorological Monitoring Programs for Nuclear Power Plants*, Regulatory Guide 1.23, Revision 1, March 2007.

2.3.3-12 U.S. NRC, *Combined License Applications for Nuclear Power Plants (LWR Edition),* Regulatory Guide 1.206, Revision 0, June 2007.

2.3.3-13 U.S. NRC, *Standard Review Plans for Environmental Reviews for Nuclear Power Plants,* NUREG-1555, Section 6.4, October 1999.

2.3.3-14 U.S. NRC, *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants*: *LWR Edition*, NUREG-0800, Section 2.3.3, March 2007.

Table 2.3.3-1
Meteorological Tower Siting Conformance Status

RG 1.23 Criteria for Tower Siting	Conformance Status	Remarks
The meteorological tower site has similar exposure as the site.	Conforms	The site is generally flat, ranging in elevation mostly between 65 and 85 feet NAVD 88. The meteorological tower is located in the northwestern part of the VCS site.
The tower base elevation is approximately the same as finished plant grade.	Conforms	Tower base elevation: 82.4 feet NAVD 88. Power Block finished grade: 95 feet NAVD 88.
Location of the tower is not near a large body of water, such that the wind speed, wind direction, relative humidity, ambient temperature, vertical temperature differential measurements made on the tower would be affected.	Conforms	Linn Lake is approximately 3 miles east of the meteorological tower, and it is too far to influence the measurements made on the tower. The meteorological tower is approximately 4480 feet from the cooling basin at its closest point. Considering the large distance of separation between the meteorological tower and the cooling basin, nonrepresentative influences on the wind speed, wind direction, relative humidity ambient temperature, and vertical temperature differential measurements are expected to be minimal.
Tower is not located on or near permanent man-made surfaces such that the ambient temperature measurements made on the tower would be affected.	Conforms	The meteorological tower is located in an area of open fields with natural vegetation (i.e., grasses and small shrubs). A 25-foot by 25-foot bed of light-colored gravel has been placed at the base of the tower. There is no existing large asphalt parking lot near the meteorological tower and U.S. Highway 77 is approximately 1200 feet from the tower. The minimum distance to the planned large gravel substation maintenance area is 370 feet, while the closest concrete or asphalt parking lot is more than 1030 feet from the tower. With the large-distance separation between these permanent man-made surfaces, the heat effect on the temperature measurements made on the tower is expected to be insignificant.

Table 2.3.3-2 (Sheet 1 of 2)
Meteorological Sensor Siting Conformance Status

RG 1.23 Criteria	Conformance Status	Remarks
Wind sensors should be located away from nearby obstructions to airflow (e.g., plant buildings, other structures, trees, nearby terrain) by a distance of at least 10 times the height of any such obstruction that exceeds one-half the height of the wind measurement level to avoid any modifications to airflow (i.e., turbulent wake effects).	Conforms	The only nearby existing structure is the meteorological equipment shelter which is 8 feet in height, sitting 4 feet above ground near the base of the tower. Therefore, the roof elevation of the shelter is at 12 feet above ground, which is less than half of the lower wind sensor height at 10 meters (33 feet). Nearby trees and shrubs are relatively short (less than 15 feet tall) and are located 1000 feet or more from the tower. The tallest plant structure to be built at the VCS site could be as high as 230 feet. All nearby plant buildings and other structures would be located at approximately or more than 10 times the structure height away from the tower.
Wind sensors should be located to reduce airflow modification and turbulence induced by the supporting structure itself.	Conforms	The wind sensors were boom-mounted more than 6.5 feet from the tower (more than twice the tower's width of 1.5 feet) on the south side of the tower.
Ambient air temperature and atmospheric moisture sensors should be located in such a way so as to avoid modification by heat and moisture sources (e.g., ventilation systems, water bodies, or the influence of large parking lots or other paved surfaces).	Conforms	No large water bodies, ventilation systems, large parking lots, or other paved or improved surfaces exist or are planned within 1030 feet of the tower. The planned gravel substation maintenance area is approximately 370 feet at its closest approach to the tower. With these large-distance separations between these heat sources, the heat effect on the temperature measurements made on the tower is expected to be insignificant. The ground surface at the base of the tower is natural vegetation and a small gravel-covered area around the base of the tower.
Temperature sensors should be mounted in fan-aspirated radiation shields to minimize adverse influences of thermal radiation and precipitation. Aspirated temperature shields should either be pointed downward or laterally towards the north. The shield inlet should be at least 1.5 times the tower horizontal width away from the nearest point on the tower.	Conforms	Temperature sensors were mounted in fan-aspirated radiation shields pointing to the north. The shield inlet was situated approximately 2.5 feet from the tower (more than 1.5 times the tower's width of 1.5 feet).

Table 2.3.3-2 (Sheet 2 of 2)
Meteorological Sensor Siting Conformance Status

RG 1.23 Criteria	Conformance Status	Remarks
Precipitation should be measured near ground level near the base of the tower. Precipitation gages should be equipped with wind shields to minimize wind-caused loss of precipitation and, where appropriate, equipped with heaters to melt frozen precipitation.	Conforms	Precipitation was measured using an 8-inch diameter heated tipping bucket gage, mounted at ground level but away from the tower shelter to prevent any interference in precipitation capture. Windshields were provided to prevent wind-caused under recording of precipitation. The rain gage wind shield was ½ inch above the level plain of the rain gage orifice. This is consistent with the shield's installation instructions and the National Weather Service National Training Center documentation for Standard Rain Gauges.

Table 2.3.3-3
Victoria County Station — Meteorological Tower Instrumentation

Parameter	Meteorological Tower Level (meters)
Wind Speed	10, 60
Wind Direction	10, 60
Ambient Temperature	10, 60
Differential Temperature (Delta-T)	The differential temperature between the 10- and 60-meter levels referenced to the 10-meter ambient temperature.
Precipitation	Ground level
Solar Radiation[a]	4.6
Relative Humidity/Temperature[b]	10, 60
Dew Point	Calculated from ambient temperature with the coincident relative humidity measurements

(a) Solar radiometer was installed at 4.6 meters above ground. Data collected is not used in preparing the ESP application.

(b) The relative humidity sensors for the 10- and 60-meter levels were installed on June 28, 2007, and during November 25-28, 2007, respectively.
(Note: The proposed plant normal cooling system is a cooling basin. The cooling towers considered for use at the VCS site are of conventional wet mechanical draft type with typical physical tower height of 60 feet [18.3 meters]. The moisture content in the ambient air at the height of the cooling tower plume can be adequately represented by the relative humidity measurements made at the 10-meter level.)

Table 2.3.3-4 (Sheet 1 of 2)
Meteorological Monitoring System Configuration

Sensed Parameter[a]	Sensor Type, Manufacturer/ Model No./ P/N	Range	Sensor Accuracy	System Accuracy	System Accuracy per RG 1.23[b]	Starting Threshold	Starting Threshold per RG 1.23[b]	Measurement Resolution	Measurement Resolution per RG 1.23[b]	Elevation
Wind Speed	3 Cup Anemometer, Climatronics/ F460/ P/N 100075	0–100 mph (0–49.7 m/s)	±0.15 mph (±0.07 m/s)	0.15<x<0.45 mph	±0.45 mph (±0.2 m/s) or 5% of observed wind speed	0.5 mph (0.22 m/s)	1 mph (<0.45 m/s)	0.1 mph	0.1 mph (0.1 m/s)	10 m 60 m
Wind Direction	Wind Vane, Climatronics/ F460/ P/N 100076	0°–540° (0°–360°) (mechanical)	±2°	±5°	±5°	0.5 mph (0.22 m/s)	1 mph (<0.45 m/s)	1.0°	1.0°	10 m 60 m
Ambient Temperature	Thermistor, Climatronics/ P/N 100093	–22°F to +122°F (–30°C to +50°C)	±0.27°F (±0.15°C)	<±0.9°F <(±0.5°C)	±0.9°F (±0.5°C)	N/A	N/A	0.1°F (0.1°C)	0.1°F (0.1°C)	10 m 60 m
Differential Temperature (Delta-T)[c]	Thermistor, Climatronics/ P/N 100093	–10°F to +10°F (–5.6°C to +5.6°C)	N/A	±0.18°F (±0.1°C)	±0.18°F (±0.1°C)	N/A	N/A	0.01°F (0.01°C)	0.01°F (0.01°C)	60–10 m
Precipitation	8-inch diameter tipping bucket (heated), Climatronics/ P/N 100097-1-10	N/A	±1% for rain rates up to 1”–3”/hr. (2.54 to 7.6 cm/hr.) & ±3% for rain rates of 0 to 6”/hr. (0 to 15.24 cm/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 (0.1 in) of precipitation at a rate <50 mm/h (<2 in/h)	N/A	N/A	0.01 in (0.24 mm)	0.25 mm or 0.01 in	Ground Elevation
Relative Humidity[d]	Capacitive, Climatronics/ P/N 102273	0%–100%	<±1% relative humidity from 0 to 100%	±4%	±4%	N/A	N/A	0.1%	0.1%	10 m 60 m

Table 2.3.3-4 (Sheet 2 of 2)
Meteorological Monitoring System Configuration

Sensed Parameter[(a)]	Sensor Type, Manufacturer/ Model No./ P/N	Range	Sensor Accuracy	System Accuracy	System Accuracy per RG 1.23[(b)]	Starting Threshold	Starting Threshold per RG 1.23[(b)]	Measurement Resolution	Measurement Resolution per RG 1.23[(b)]	Elevation
Dew Point	Calculated from ambient temperature with the coincident relative humidity measurements	N/A	N/A	±1.5°C (±2.7°F)	±1.5°C (±2.7°F)	N/A	N/A	0.1°C (0.1°F)	0.1°C (0.1°F)	Calculated as noted under sensor type

(a) All sensor output were recorded at the base of the tower inside an environmentally controlled shelter. Hourly average values were calculated by the data logger at the shelter, and this hourly data was reviewed daily.

(b) The criteria in ANSI/ANS-3.11-2005 is identical to that in RG 1.23, Revision 1, for the parameters shown.

(c) Differential temperature is the change of temperature with height of a 60-meter delta-T measurement being referenced to the 10-meter temperature.

(d) The onsite meteorological system began operation on June 28, 2007, with the exception of the 60-meter relative humidity sensor, which was installed during November 25–28, 2007.

Table 2.3.3-5
Five Year (2003–2007) Wind Frequency Data at Victoria Regional Airport

	Wind Speed (MPH)										
Wind Dir[(a)]	0-3	4-6	7-10	11-16	17-21	22-27	28-33	34-40	Over 40	Total Occurrences (%)	Avg Speed
01	0.25	0.87	1.34	1.00	0.30	0.04				3.81	9.65
02	0.21	0.70	1.22	0.72	0.13	0.03				3.01	9.09
03	0.33	0.91	1.21	0.55	0.07	0.01	0.00			3.08	8.05
04	0.30	0.93	1.19	0.39	0.05		0.00			2.86	7.67
05	0.29	0.94	1.14	0.36	0.06	0.01				2.80	7.67
06	0.31	0.88	1.09	0.40	0.04	0.00	0.01			2.74	7.67
07	0.26	0.84	0.96	0.30	0.01	0.00				2.38	7.35
08	0.27	0.71	0.81	0.30	0.02					2.11	7.37
09	0.31	0.72	0.81	0.22	0.02					2.08	7.14
10	0.32	0.81	0.81	0.29	0.03					2.27	7.29
11	0.32	0.85	1.00	0.49	0.09					2.76	8.04
12	0.27	0.81	1.40	1.12	0.32	0.02				3.94	9.70
13	0.21	0.95	2.45	1.51	0.29	0.03				5.43	9.64
14	0.19	0.88	2.49	1.44	0.39	0.07	0.00			5.46	9.93
15	0.19	0.87	1.96	1.93	0.65	0.13	0.00			5.72	11.07
16[(b)]	0.20	0.85	2.07	2.32	0.98	0.25	0.02			6.70	11.88
17	0.23	0.82	1.79	1.92	0.72	0.21	0.01			5.70	11.46
18	0.22	0.58	1.37	1.17	0.42	0.13	0.01			3.91	10.86
19	0.18	0.52	0.89	0.71	0.25	0.06	0.02			2.64	10.34
20	0.18	0.43	0.68	0.43	0.11	0.03				1.86	9.13
21	0.17	0.38	0.48	0.23	0.04					1.30	8.10
22	0.10	0.29	0.38	0.14	0.02					0.93	7.72
23	0.09	0.22	0.23	0.08	0.01					0.64	7.17
24	0.09	0.21	0.26	0.03		0.00				0.59	6.78
25	0.07	0.19	0.22	0.07	0.01					0.57	7.48
26	0.09	0.14	0.19	0.03	0.01					0.46	6.77
27	0.07	0.18	0.14	0.05	0.01	0.01				0.47	7.40
28	0.07	0.18	0.23	0.06	0.03					0.57	7.81
29	0.07	0.21	0.29	0.08	0.03	0.00	0.00			0.69	8.16
30	0.07	0.27	0.29	0.11	0.03	0.01	0.00			0.78	8.27
31	0.08	0.27	0.45	0.14	0.07	0.04	0.00			1.04	9.16
32	0.11	0.34	0.54	0.21	0.09	0.05	0.02			1.34	9.46
33	0.12	0.37	0.55	0.31	0.12	0.08	0.00			1.55	9.91
34	0.14	0.49	0.67	0.42	0.19	0.05	0.01			1.97	9.74
35	0.20	0.56	0.83	0.73	0.27	0.05	0.01			2.65	10.16
36	0.22	0.71	1.23	0.97	0.28	0.05	0.01			3.48	9.96
Calm	9.70									9.70	
	16.52	20.88	33.66	21.22	6.17	1.39	0.16	0.01	0	100	8.52

(a) Wind direction recorded at the Victoria Regional Airport is in 10-degree intervals. (e.g., direction 36 is north and direction 18 is south)

(b) Prevailing wind direction is a wind direction with the highest percentage of occurrence

Table 2.3.3-6
Summary of Wind Frequency Data

	Avg Wind Speed (mph)	Prevailing Wind Direction	Avg Wind Speed (mph) Associated with Prevailing Wind Direction	Least Wind Direction	Avg Wind Speed (mph) Associated with Least Wind Direction
Victoria Regional Airport					
Long-term (24 yrs)	9.7 (4.3 m/s)	SSE (Dir 16)	10.5 (4.7 m/s)	N/A	N/A
5 Years (2003–2007)	8.5 (3.8 m/s)	SSE (Dir 16)	11.9 (5.3 m/s)	W (Dir 26)	6.8 (3.0 m/s)
Victoria County Station					
Recent 2 years (7/2007–6/2009)	9.0 (4.0 m/s)	SSE (Dir 16)	11.2 (5.0 m/s)	WSW (Dir 25)	5.6 (2.5 m/s)

Table 2.3.3-7
Annual Data Recovery Rates (Percent) for the Victoria County Station Meteorological Monitoring System (7/1/2007–6/30/2009)[a]

Parameter	**7/1/07–6/30/09[b]**
Wind Speed (10 meter)	99.9
Wind Speed (60 meter)	99.7
Wind Direction (10 meter)	99.7
Wind Direction (60 meter)	99.9
Delta-Temperature (60 meter–10 meter)[c]	99.7
Ambient Temperature (10 meter)	99.7
Relative Humidity (10 meter)	99.7
Precipitation (Ground-Level)	99.9
Composite Parameters	
WS/WD (10m), Delta-T (60 meter–10 meter)[c]	99.7
WS/WD (60m), Delta-T (60 meter–10 meter)[c]	99.7

(a) Pre-application monitoring began in June 28, 2007. Meteorological data from July 1, 2007 to June 30, 2009 were used to make the dispersion estimates (i.e., X/Qs) in the ESP application.
(b) Relative humidity measured at the 60-meter level began on November 28, 2007.
(c) Delta-T between 60-meter and 10-meter levels.

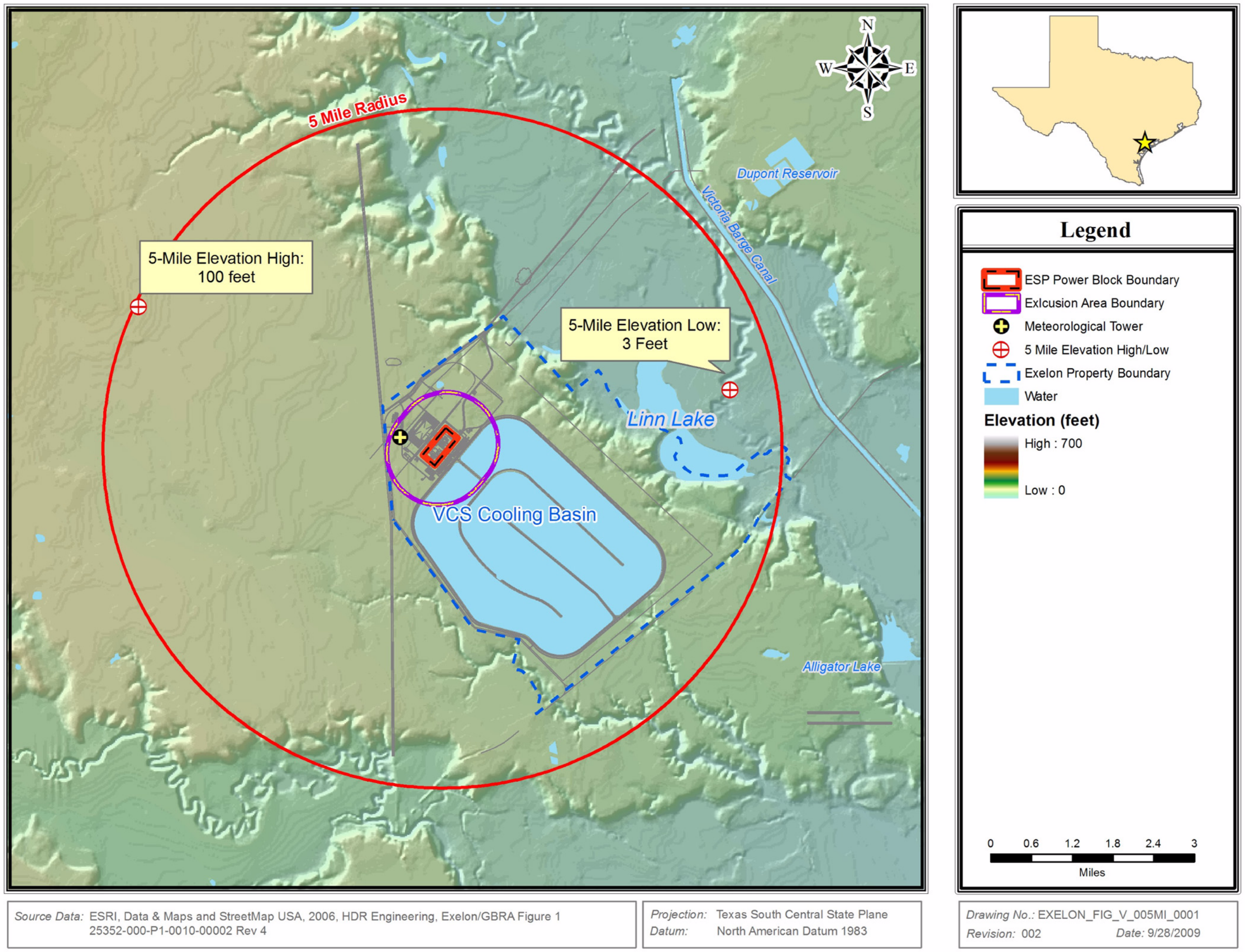


Figure 2.3.3-1 Site and Vicinity Map (5-Mile Radius)

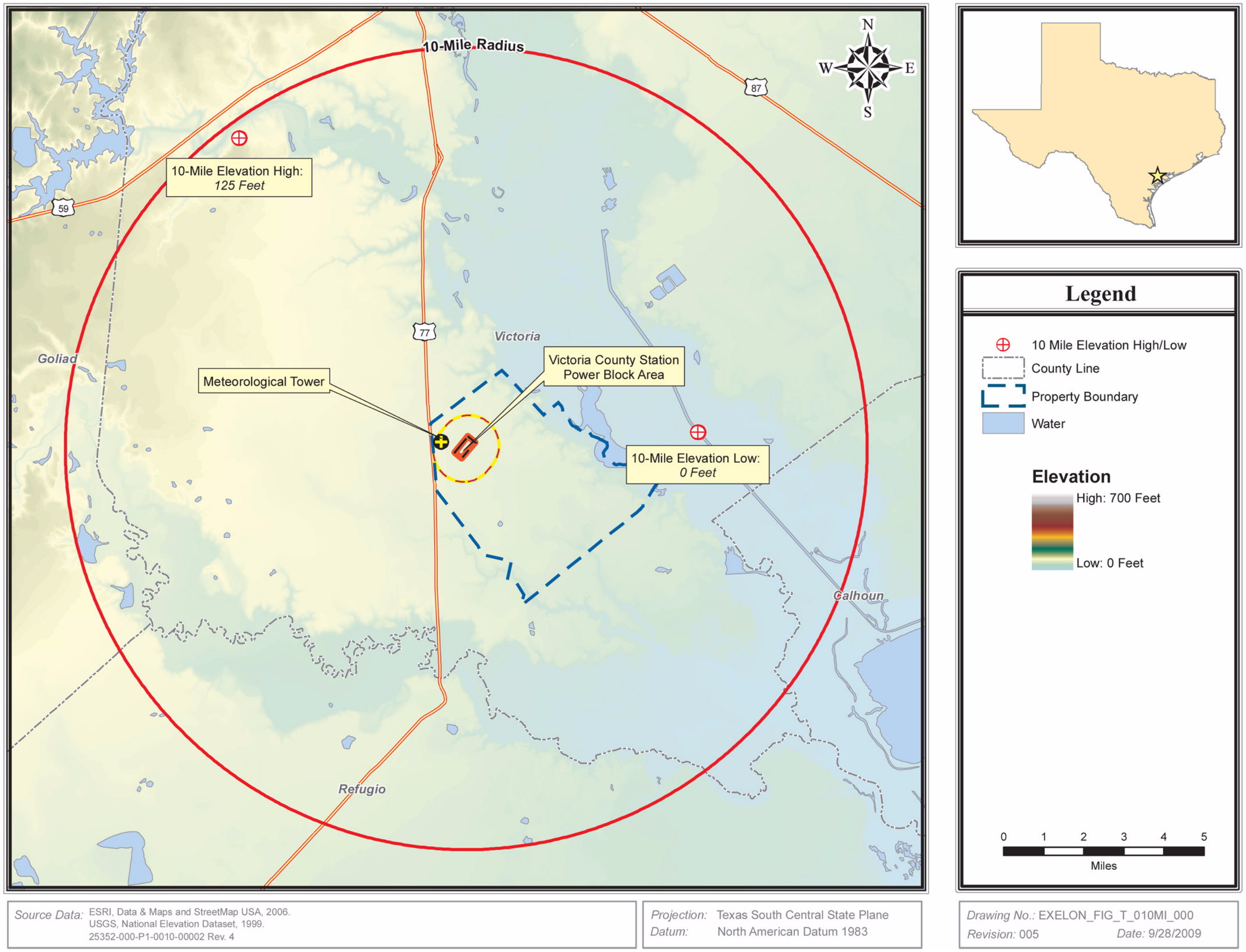


Figure 2.3.3-2 Site and Vicinity Map (10-Mile Radius)

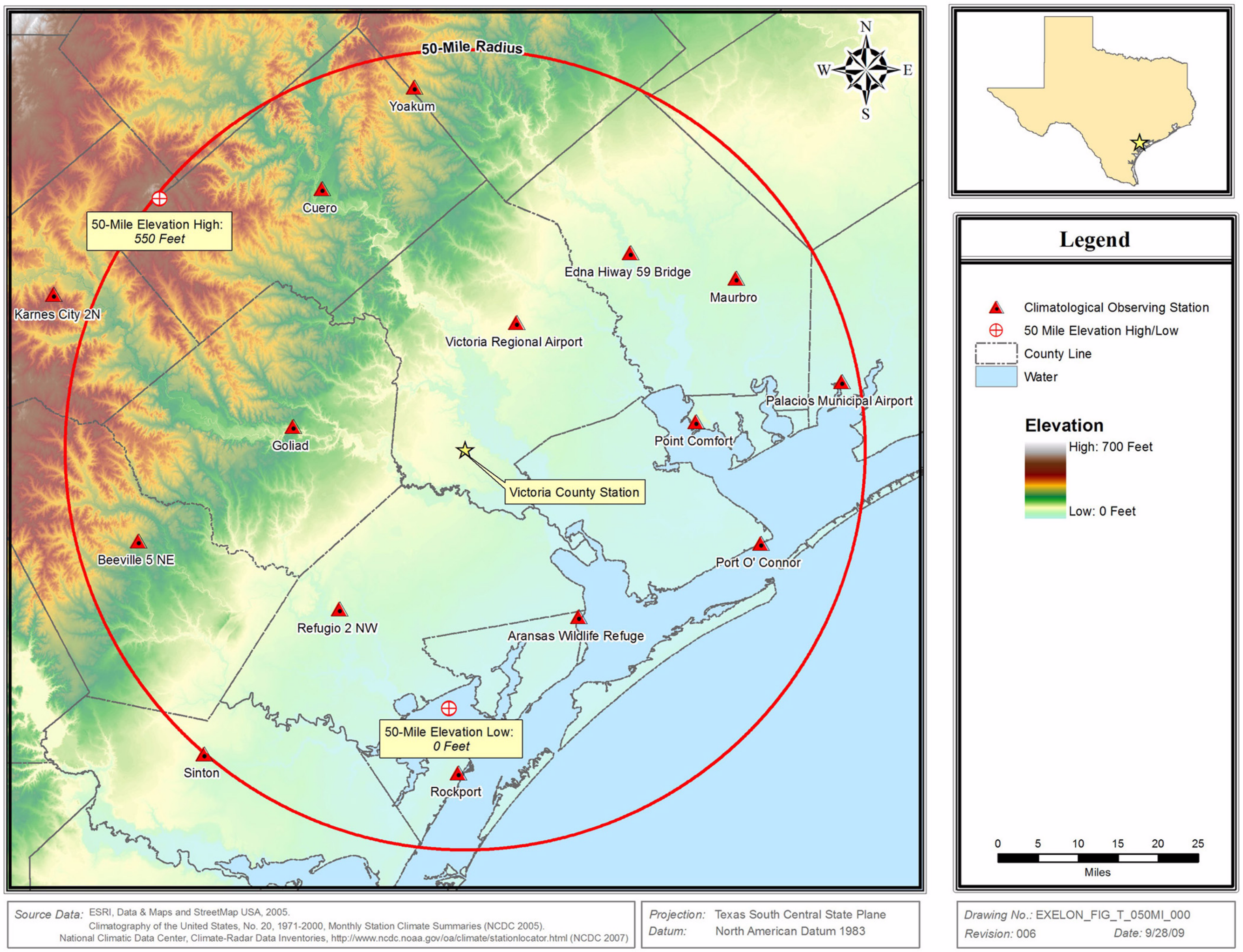


Figure 2.3.3-3 Climatological Observing Stations near the Victoria County Station

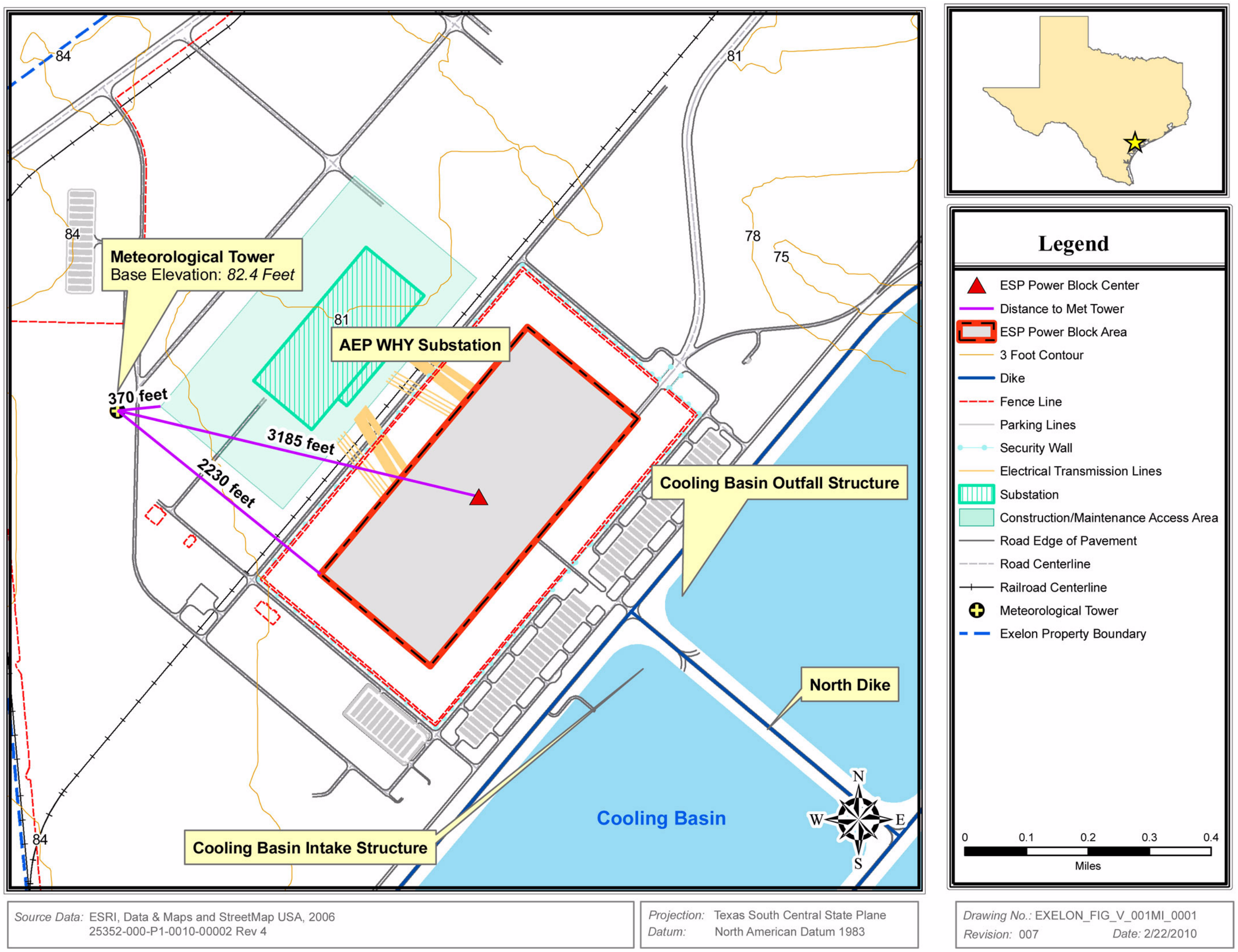


Figure 2.3.3-4 Location of Meteorological Tower Relative to Major Plant Structures and Other Features

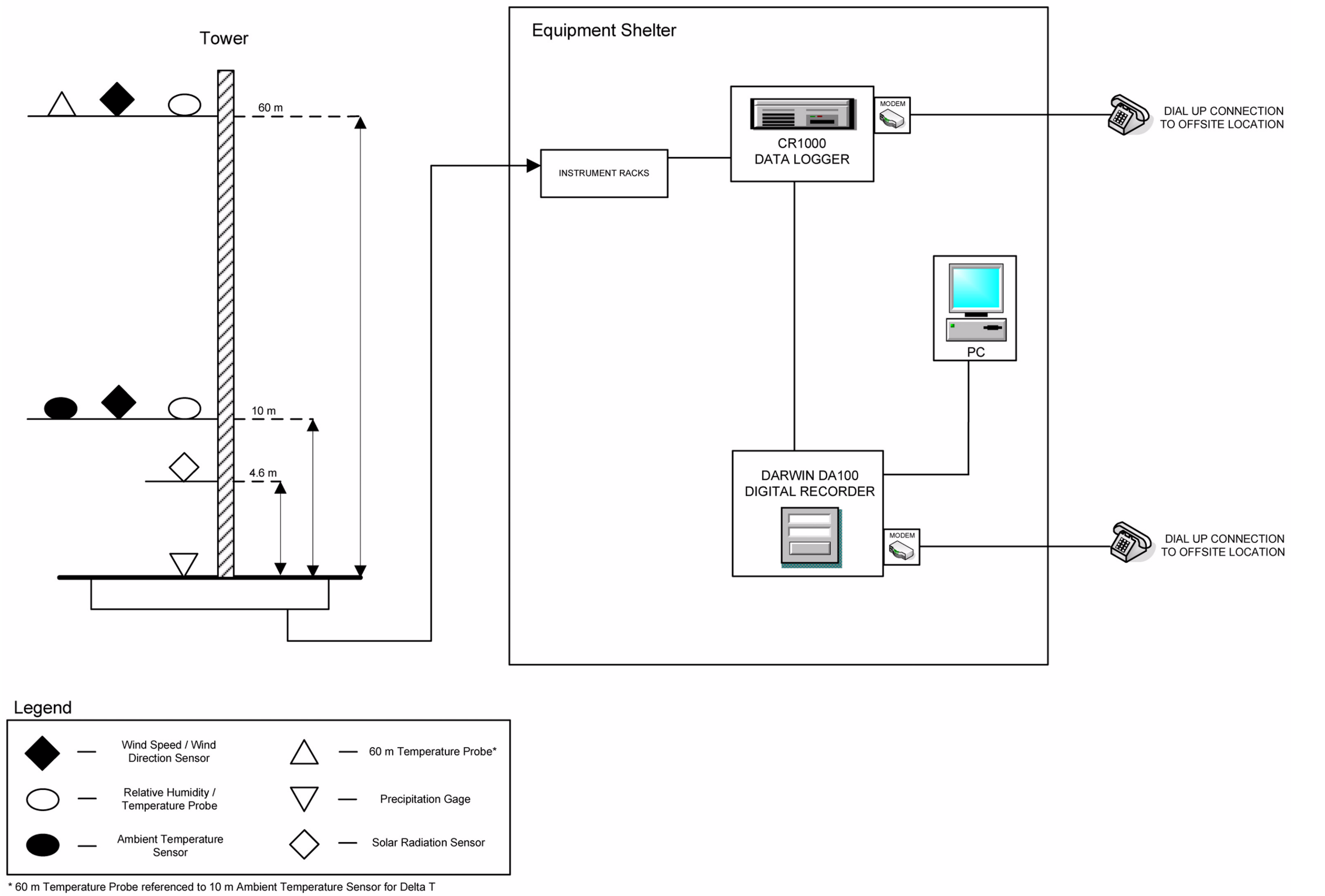


Figure 2.3.3-5 Onsite Meteorological Monitoring System Block Diagram

2.3.4 Short-Term Atmospheric Dispersion Estimates for Accident Releases

2.3.4.1 Basis

To evaluate potential health effects of design-basis accidents (DBAs) at the VCS site, a hypothetical accident is postulated to predict upper limit concentrations and doses that might occur in the event of a radiological release. The NRC-sponsored PAVAN computer code (Reference 2.3.4-1) was used to estimate ground-level atmospheric dispersion (X/Q) at the Exclusion Area Boundary (EAB) and Low Population Zone (LPZ) for potential accidental releases of radioactive material.

Site-specific meteorological data covering the 24-month period of record for July 2007 to June 2009 was used to evaluate quantitatively such a hypothetical accident at the site.

10 CFR 100 requires consideration of the doses at the EAB and LPZ for various time periods immediately following the onset of a postulated accidental release. Therefore, the relative X/Qs are estimated for various time periods ranging from 2 hours to 30 days.

Releases are assumed to occur at ground level because none of the release heights, for the reactor designs being considered, is greater than two-and-a-half times the height of the reactor building.

The PAVAN code implements the guidance provided in RG 1.145. The code computes X/Qs at the EAB and LPZ for each combination of wind speed and atmospheric stability class for each of 16 downwind direction sectors (i.e., north, north-northeast, northeast, etc.). The 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 percent of the total time becomes the maximum sector-dependent X/Q value.

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

The greater of the two values (i.e., the maximum sector-dependent 0.5 percent X/Q or the overall site 5 percent X/Q value) 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 RG 1.111. The program then uses logarithmic interpolation between the 0–2-hour X/Qs for each sector and the corresponding annual average X/Q to calculate the values for intermediate time periods (i.e., 0–8 hours, 8–24 hours, 1–4 days, and 4–30 days). As suggested in NUREG/CR-2858 (Reference 2.3.4-1), each of the sector-specific 0–2-hour X/Q values provided in the PAVAN output file were examined for “reasonability” by comparing them with the ordered X/Q values presented in the model output.

A portion of the EAB and the outer boundary of the LPZ extends over the 4900-acre cooling basin. As described in Section 2.3.3.2.5, during plant operation, moisture content and temperature in the air immediately above the cooling basin are expected to increase slightly due to natural evaporation from the cooling basin and cooling basin warming from the plant thermal discharge, respectively. The influence of the planned cooling basin on the diffusion climate of the site and its relation to dispersion of accidental or routine radioactive releases has been examined. The findings are summarized as follows.

- In general, the wind speed increases as air moves from land over a low-friction water surface that would enhance local dispersion. However, the mechanical turbulence tends to decrease when air moves from land over water, independent of temperature difference, and would hinder local diffusion. The surface roughness changes on both turbulence and wind speeds could be significant when considered by themselves. However, the combination of these changes is generally offsetting, thereby having negligible effects on the local diffusion climate of the area.
- The presence of a cooling basin would alter the frictional effects on adjacent land surface; however, the impact of this on wind speed and direction is expected to be limited to the immediate vicinity of the basin.
- Temperature difference between the cooling basin and the ambient air boundary layer could influence air flow at receptors downwind of the reactor. When the basin water is warmer than the adjacent air, the increases of lower level ambient temperature would create thermal instability. Subsequently, more unstable atmospheric stability (i.e., favorable diffusion environment) is expected.

Overall, the influence of the cooling basin on wind speed, wind direction, turbulence, and vertical temperature differential is expected to have minimal impact on the EAB and LPZ dispersion estimates.

To account for possible coastal sea breeze recirculation effects on local meteorological conditions from the Gulf of Mexico, and because the VCS site is generally flat, the default terrain adjustment factor is implemented in the PAVAN model. This factor is implemented to satisfy Section C.1.c of RG 1.111 and to properly account for possible recirculation due to land-water boundaries, which could raise X/Q values in an open terrain area such as the VCS site.

The PAVAN model input data are presented below:

- Meteorological data: 24 months (July 2007–June 2009) onsite joint frequency distributions (JFDs) of wind speed, wind direction, and atmospheric stability (see Subsection 2.3.2)
- Type of release: Ground-level
- Wind sensor height: 10 meters

- Vertical temperature difference: as measured at the 10-meter and 60-meter levels of the onsite meteorological tower
- Number of wind speed categories: 12 (including calm and the 11 categories listed in Table 2.3.2-5)
- Release height: 10 meters, default height
- Distances from release point to EAB for all downwind sectors
- Distances from release point to LPZ for all downwind sectors
- The EAB and the LPZ are both assumed to be located beyond the building wake influence zone.

General Design Criteria 19 of 10 CFR 50, Appendix A, sets forth the requirements for control rooms at nuclear power plants. Onsite X/Qs are estimated using the ARCON96 model as described in NUREG/CR-6331 and consider the air intake height, release height, release type, source-to-receptor distance, and building area. Accordingly, the onsite X/Qs would be analyzed at the COL stage in order to incorporate the required control room design parameters and the source and release characteristics for the selected technology.

2.3.4.2 Offsite Dispersion Estimates (PAVAN Modeling Results)

For all sectors, the EAB and LPZ are located beyond the wake influence zone induced by the reactor buildings. Therefore, the “wake-credit not allowed” scenario of the PAVAN results has been used for the X/Q analyses at both the EAB and the LPZ. The VCS power block area was conservatively treated as the source boundary in estimating the shortest distance to each boundary receptor in each direction. The source boundary was developed to enclose all possible release points for the selected reactor technologies (Figure 2.3.4-1). Using the source boundary approach, the shortest distance from the source boundary to the EAB is 879 meters in the north-northeast sector. The maximum direction-dependent 0.5 percent X/Q value and the overall site 5 percent X/Q value were conservatively estimated using this source boundary concept.

Similar to the above approach, the shortest distance from the source boundary to the LPZ (4.709 miles or 7576 meters), shown in Figure 2.3.4-2, was used in the PAVAN modeling run to determine the X/Q values at the LPZ.

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

Tables 2.3.4-1 and 2.3.4-2 present the X/Qs for the EAB and LPZ, respectively, for each of the 16 downwind sectors for the appropriate time period(s). At the EAB and LPZ, the sector dependent 0.5 percent X/Q values are greater than the overall site 5 percent X/Q values. The 5 percent X/Q values were calculated by logarithmic interpolation between the 0–2 hour time period and the annual average value. The maximum X/Qs are summarized below.

Summary of PAVAN Results, X/Q (sec/m^3)
(Limiting Case, 2007–2009 Meteorological Data)

Receptor Location	0–2 hrs	0–8 hrs	8–24 hrs	1–4 days	4–30 days	Annual Average
EAB	2.66×10^{-4}	1.77×10^{-4}	1.45×10^{-4}	9.35×10^{-5}	4.98×10^{-5}	2.31×10^{-5}
LPZ	3.75×10^{-5}	1.55×10^{-5}	1.01×10^{-5}	4.20×10^{-6}	1.19×10^{-6}	2.57×10^{-7}

2.3.4.3 References

2.3.4-1 U.S. Nuclear Regulatory Commission, *PAVAN: An Atmospheric Dispersion Program for Evaluating Design Basis Accidental Releases of Radioactive Materials from Nuclear Power Stations*, NUREG/CR-2858, PNL-4413, November 1982.

Table 2.3.4-1
PAVAN Results – X/Q Values at the EAB (Building Wake Credit Not Included)

```
1USNRC COMPUTER CODE-PAVAN, VERSION 2.0         RUN DATE: 9/24/2009

/PLANT NAME: Victoria Site                      METEOROLOGICAL INSTRUMENTATION
 DATA PERIOD: 2007-09 (24 months)               WIND SENSORS HEIGHT: 10.0 m
 TYPE OF RELEASE: Ground-Level Release          DELTA-T HEIGHTS: 10-m to 60-m
 SOURCE OF DATA: Onsite
 COMMENTS: Accidental Releases
 PROGRAM: PAVAN, 10/76, 8/79 REVISION, IMPLEMENTATION OF REGULATORY GUIDE 1.145
0                                    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	HOURS PER YEAR MAX 0-2 HR X/Q IS EXCEEDED IN SECTOR	DOWNWIND SECTOR
S	1087.	2.29E-04	1.44E-04	1.15E-04	6.93E-05	3.37E-05	1.39E-05	32.2	S
SSW	944.	2.52E-04	1.62E-04	1.29E-04	7.98E-05	3.98E-05	1.70E-05	39.3	SSW
SW	928.	1.95E-04	1.30E-04	1.06E-04	6.82E-05	3.62E-05	1.67E-05	25.5	SW
WSW	884.	2.28E-04	1.43E-04	1.14E-04	6.88E-05	3.34E-05	1.38E-05	31.9	WSW
W	965.	2.24E-04	1.43E-04	1.14E-04	6.96E-05	3.44E-05	1.45E-05	31.0	W
WNW	956.	2.54E-04	1.61E-04	1.29E-04	7.86E-05	3.88E-05	1.64E-05	39.8	WNW
NW	956.	2.66E-04	1.77E-04	1.45E-04	9.35E-05	4.98E-05	2.31E-05	43.7	NW
NNW	959.	2.53E-04	1.70E-04	1.40E-04	9.08E-05	4.89E-05	2.29E-05	39.4	NNW
N	951.	2.03E-04	1.29E-04	1.03E-04	6.28E-05	3.10E-05	1.31E-05	25.5	N
NNE	879.	1.57E-04	9.35E-05	7.21E-05	4.11E-05	1.83E-05	6.80E-06	18.9	NNE
NE	947.	1.32E-04	7.71E-05	5.89E-05	3.29E-05	1.43E-05	5.12E-06	15.8	NE
ENE	983.	1.07E-04	6.26E-05	4.79E-05	2.69E-05	1.17E-05	4.24E-06	12.5	ENE
E	1111.	1.43E-04	7.87E-05	5.85E-05	3.07E-05	1.22E-05	3.93E-06	12.5	E
ESE	1108.	1.52E-04	8.69E-05	6.58E-05	3.59E-05	1.51E-05	5.22E-06	11.3	ESE
SE	1108.	1.51E-04	8.91E-05	6.84E-05	3.85E-05	1.69E-05	6.14E-06	8.9	SE
SSE	1111.	2.24E-04	1.36E-04	1.06E-04	6.16E-05	2.83E-05	1.09E-05	30.8	SSE
MAX X/Q		2.66E-04				TOTAL HOURS AROUND SITE:		419.1	
SITE LIMIT		0.00E-00	0.00E-00	0.00E-00	0.00E-00	0.00E-00	0.00E-00		

Shaded Values represent maximum values.

Table 2.3.4-2
PAVAN Results – X/Q Values LPZ (Building Wake Credit Not Included)

```
1USNRC COMPUTER CODE-PAVAN, VERSION 2.0          RUN DATE: 9/24/2009

/PLANT NAME: Victoria Site                       METEOROLOGICAL INSTRUMENTATION
 DATA PERIOD: 2007-09 (24 months)                WIND SENSORS HEIGHT: 10.0 m
 TYPE OF RELEASE: Ground-Level Release           DELTA-T HEIGHTS: 10-m to 60-m
 SOURCE OF DATA: Onsite
 COMMENTS: Accidental Releases
 PROGRAM: PAVAN, 10/76, 8/79 REVISION, IMPLEMENTATION OF REGULATORY GUIDE 1.145
0                                     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	HOURS PER YEAR MAX 0-2 HR X/Q IS EXCEEDED IN SECTOR	DOWNWIND SECTOR
S	7797.	3.67E-05	1.55E-05	1.01E-05	3.95E-06	1.03E-06	1.99E-07	41.9	S
SSW	7622.	3.48E-05	1.48E-05	9.62E-06	3.80E-06	1.00E-06	1.95E-07	38.0	SSW
SW	7611.	3.52E-05	1.48E-05	9.61E-06	3.76E-06	9.77E-07	1.88E-07	39.0	SW
WSW	7601.	2.73E-05	1.15E-05	7.43E-06	2.89E-06	7.47E-07	1.43E-07	24.8	WSW
W	7740.	3.07E-05	1.30E-05	8.46E-06	3.32E-06	8.69E-07	1.69E-07	30.5	W
WNW	7777.	3.38E-05	1.43E-05	9.30E-06	3.66E-06	9.60E-07	1.87E-07	36.1	WNW
NW	7783.	3.38E-05	1.51E-05	1.01E-05	4.20E-06	1.19E-06	2.57E-07	35.9	NW
NNW	7766.	3.24E-05	1.45E-05	9.75E-06	4.09E-06	1.18E-06	2.57E-07	33.0	NNW
N	7701.	2.68E-05	1.13E-05	7.37E-06	2.90E-06	7.59E-07	1.47E-07	24.1	N
NNE	7576.	1.70E-05	6.85E-06	4.34E-06	1.62E-06	3.93E-07	6.94E-08	13.1	NNE
NE	7623.	1.49E-05	6.00E-06	3.80E-06	1.41E-06	3.40E-07	5.97E-08	13.5	NE
ENE	7669.	1.15E-05	4.73E-06	3.03E-06	1.16E-06	2.89E-07	5.31E-08	12.5	ENE
E	7854.	2.09E-05	7.92E-06	4.88E-06	1.70E-06	3.77E-07	5.94E-08	15.3	E
ESE	7920.	2.35E-05	9.14E-06	5.71E-06	2.05E-06	4.72E-07	7.84E-08	19.8	ESE
SE	7934.	2.21E-05	8.89E-06	5.64E-06	2.10E-06	5.11E-07	9.03E-08	16.7	SE
SSE	7899.	3.75E-05	1.53E-05	9.75E-06	3.68E-06	9.09E-07	1.64E-07	43.7	SSE
MAX X/Q		3.75E-05				TOTAL HOURS AROUND SITE:		438.0	
SITE LIMIT		0.00E-00	0.00E-00	0.00E-00	0.00E-00	0.00E-00	0.00E-00		

Shaded Values represent maximum values.

Table 2.3.4-3
EAP and LPZ Distances from the Source Boundary

	EAB	LPZ
Direction	**Distance (m)**	**Distance (m)**
S	1087	7797
SSW	944	7622
SW	928	7611
WSW	884	7601
W	965	7740
WNW	956	7777
NW	956	7783
NNW	959	7766
N	951	7701
NNE	879	7576
NE	947	7623
ENE	983	7669
E	1111	7854
ESE	1108	7920
SE	1108	7934
SSE	1111	7899

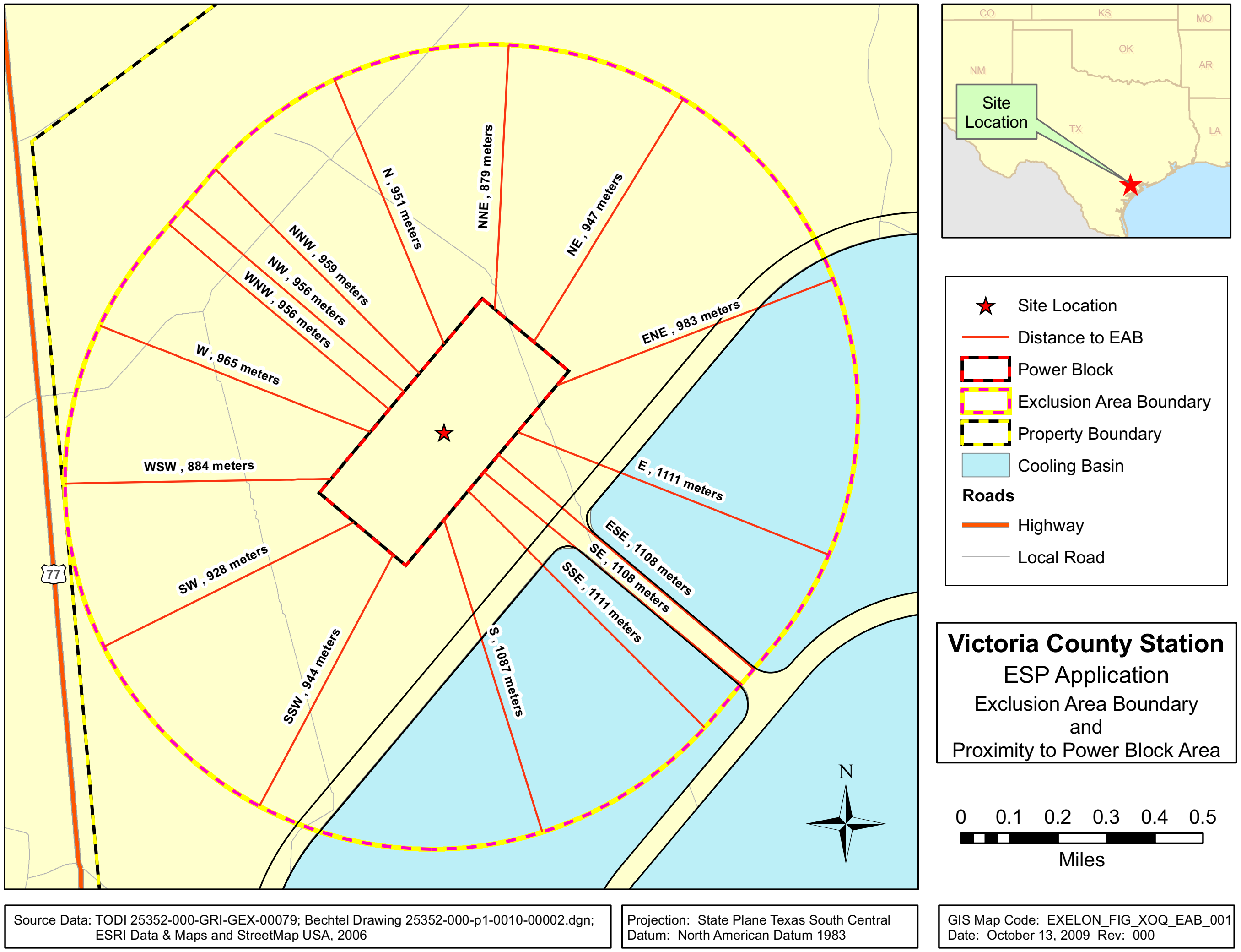


Figure 2.3.4-1 Distance to EAB from the Source Boundary

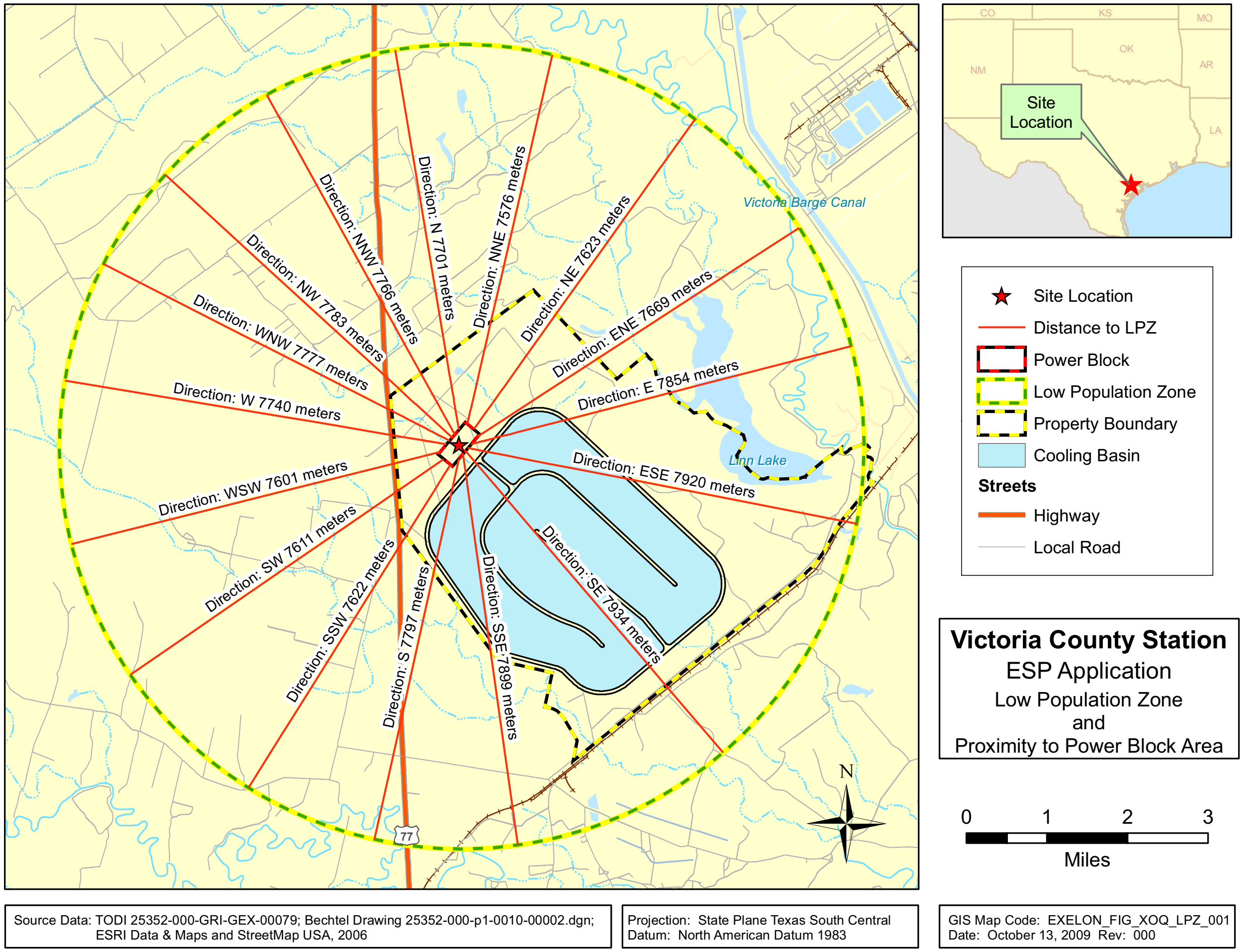


Figure 2.3.4-2 Distance to the LPZ from the Source Boundary

2.3.5 Long-Term Atmospheric Dispersion Estimates for Routine Releases

2.3.5.1 Basis

This section provides estimates of annual average atmospheric dispersion factors (X/Q values) and relative dry deposition factors (D/Q values) to a distance of 50 miles (80 kilometers) resulting from operation of the VCS for population dose calculations and person-rem estimates.

The NRC-sponsored XOQDOQ computer program (Reference 2.3.5-1) was used to estimate X/Q and D/Q values from routine releases of gaseous effluents to the atmosphere. The XOQDOQ computer code has the primary function of calculating annual average X/Q and D/Q values at the locations of the general public and individuals within 50 miles of the VCS site, including the receptors of interest (e.g., property boundaries, nearest resident, nearest vegetable garden, and nearest meat animal). RG 1.206 requires X/Q and D/Q estimates at the above receptor locations.

As stated in Subsection 2.3.4, the source boundary approach was used to obtain the shortest distance from the release source boundary to the property boundary in each of the 16 sectors. Although routine releases are from a stack, the releases are conservatively assumed to be ground-level sources, because the release height is less than two and a half times the height of the tallest nearby structure. In addition to 11 wind speed categories provided in the joint frequency distributions, XOQDOQ also considers calm wind distributions for all atmospheric stability classes. Therefore, a total of 12 wind speed categories are used in the XOQDOQ modeling runs.

The XOQDOQ dispersion model implements the assumptions outlined in RG 1.111. The program assumes that the material released to the atmosphere follows a Gaussian distribution around the plume centerline. In estimating annual average X/Q values, the Gaussian distribution is assumed to be evenly distributed within a given directional sector.

Because the XOQDOQ model is used in the analysis, diffusion parameters (σ_y and σ_z), as specified in RG 1.145 and implemented by the XOQDOQ code, are used in estimating the X/Q and D/Q values. The following input data and assumptions are used in the XOQDOQ modeling analysis:

- Meteorological data: 2-year (July 2007–June 2009) onsite joint frequency distributions of wind speed, wind direction, and atmospheric stability (see Subsection 2.3.2).
- Type of release: Ground-level
- Wind sensor height: 10 meters
- Vertical temperature difference: (10–60 meters)

- Number of wind speed categories: 12 (including calm and the 11 categories listed in Table 2.3.2-5)
- Release height: 10 meter (default height)
- Minimum reactor building cross-sectional area: 1263 square meters
- Reactor building height: 24.38 meters above grade
- The shortest distances from the release point along the source boundary to the nearest residence, nearest property boundaries, vegetable garden, and meat animal (Table 2.3.5-1)
- For technologies considering the placement of multiple units, the impact to construction workers, once a first unit is operational, was evaluated to the north-northeast at 0.25 miles (Table 2.3.5-3).
- No milk cows/goats are identified within 5 miles of the VCS site, and no dairies are identified within 50 miles.

A minimum building cross-sectional area as called for in NUREG/CR-2919 (Reference 2.3.5-1) is used for evaluating building downwash effects on dispersion. Based on the width (51.82 meters) and effective height above grade (24.38 meters) of the reactor building, the cross-sectional area of the reactor structure is calculated to be 1263 square meters (associated with the mPower design).

The shortest distances from the source boundary to various receptors of interest (i.e., nearest residence, meat animal, and vegetable garden) are calculated for each directional sector. The results are presented in Table 2.3.5-1. Sensitive receptors were evaluated based on guidance in Subsection 2.3.5 of NUREG-0800. The shortest distance from the sensitive receptor to the source boundary was used for each sector. X/Q and D/Q were also determined for a construction worker at a subsequent unit after the initial unit has begun operation.

The distance from the source boundary to the site boundary was determined for each directional sector. The results are presented in Table 2.3.5-2. Distances provided in Table 2.3.5-2 are the shortest distance within each directional sector.

To account for possible effects from the Gulf of Mexico on local meteorological conditions, default correction factors are implemented in the XOQDOQ model. These factors are implemented to satisfy section C.1.c of RG 1.111 and properly account for possible recirculation due to land-water boundaries, which could raise X/Q values in an open terrain area such as the VCS site.

As discussed in Subsection 2.3.4, site-specific meteorological data covering the 24-month period of record is used to quantitatively evaluate diffusion estimates. Therefore, the lower level (10 meters)

24-month (July 2007–June 2009) joint frequency distributions of wind speed, wind direction, and atmospheric stability are used as input in the XOQDOQ modeling analysis.

2.3.5.2 Summary of Calculation Results

Table 2.3.5-3 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 of interest, individuals and general public in the VCS 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: no decay and the default half-life decay periods of 2.26 and 8 days.

The maximum annual average X/Q values with no decay (along with the direction and distance of the receptor locations relative to the VCS site) for the site-specific sensitive receptor types are:

- 2.8×10^{-6} sec/m^3 for the nearest resident and meat animal occurring in the north-northwest sector at a distance of 1.40 miles
- 2.0×10^{-6} sec/m^3 for the nearest vegetable garden in the northwest sector at a distance of 1.65 miles
- 1.3×10^{-5} sec/m^3 for the property boundary occurring in the southwest sector at a distance of 0.62 miles (nearest sector)
- 1.6×10^{-5} sec/m^3 for the adjacent reactor (under construction) occurring in the north-northeast sector at a distance of 0.25 miles

Table 2.3.5-8 presents the annual average X/Q and D/Q values at sensitive receptors.

In addition, the XOQDOQ model calculates the X/Q and D/Q values at prescribed downwind distances out to 50 miles and at various distance-segment boundaries from the VCS site for individual and population dose estimates.

Tables 2.3.5-4 through 2.3.5-7 summarize the annual average X/Q values (for no decay, 2.26-day decay and 8-day decay) and D/Q values for 22 standard radial distances between 0.25 miles and 50 miles, and for 10 distance-segment boundaries between 0.5 miles and 50 miles downwind along each of the 16 standard direction radials separated by 22.5 degrees. Table 2.3.5-8 presents the annual average X/Q and D/Q values at sensitive receptors.

2.3.5.3 References

2.3.5-1 U.S. Nuclear Regulatory Commission, XOQDOQ *Computer Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations*, NUREG/CR-2919, September 1982.

Table 2.3.5-1
Distances to Sensitive Receptors from the Source Boundary

Distance (Meters)	Type of Receptor	Directional Sector
4773	Residence, Meat, Garden	N
2261	Residence, Meat	NNW
4033	Garden	NNW
2651	Residence, Meat, Garden	NW
7267	Residence, Meat, Garden	WNW
7227	Residence, Meat, Garden	W
9838	Residence, Meat, Garden	WSW
3467	Residence, Meat, Garden	SW
3656	Residence, Meat, Garden	SSW
9524	Residence, Meat, Garden	S
6795	Residence, Meat, Garden	SSE
N/A[a]	N/A[a]	SE
8430	Residence, Meat, Garden	ESE
12929	Residence, Meat, Garden	E
9172	Residence, Meat, Garden	ENE
3479	Residence, Meat, Garden	NE
6687	Residence, Meat, Garden	NNE

(a) N/A – No identified sensitive receptors in this directional sector.

Table 2.3.5-2
Distances from the Source Boundary to EAB and Property Boundary

Exclusion Area Boundary		Property Boundary	
Length (m)	**Directional Sector**	**Length (m)**	**Directional Sector**
951	N	1401	N
879	NNE	1701	NNE
947	NE	2776	NE
983	ENE	2818	ENE
1111	E	3961	E
1108	ESE	5392	ESE
1108	SE	6176	SE
1111	SSE	3248	SSE
1087	S	2079	S
944	SSW	1417	SSW
928	SW	1003	SW
884	WSW	889	WSW
965	W	1033	W
956	WNW	1107	WNW
956	NW	1305	NW
959	NNW	1387	NNW

Table 2.3.5-3
XOQDOQ-Predicted X/Q and D/Q Values at Receptors of Interest

	Type of Location	Direction from Site	Distance (miles)	χ/Q (sec/m^3)
X/Q - No Decay	EAB	NNW	0.60	1.790×10^{-5}
	Property Boundary	SW	0.62	1.274×10^{-5}
	Resident	NNW	1.40	2.843×10^{-6}
	Meat Animal	NNW	1.40	2.843×10^{-6}
	Vegetable Garden	NW	1.65	1.983×10^{-6}
	Construction Worker	NNE	0.25	1.603×10^{-5}
X/Q - 2.26 Day Decay	EAB	NNW	0.60	1.787×10^{-5}
	Property Boundary	SW	0.62	1.265×10^{-5}
	Resident	NNW	1.40	2.831×10^{-6}
	Meat Animal	NNW	1.40	2.831×10^{-6}
	Vegetable Garden	NW	1.65	1.973×10^{-6}
	Construction Worker	NNE	0.25	1.602×10^{-5}
X/Q - 8 Day Decay	EAB	NNW	0.60	1.616×10^{-5}
	Property Boundary	SW	0.62	1.146×10^{-5}
	Resident	NNW	1.40	2.424×10^{-6}
	Meat Animal	NNW	1.40	2.424×10^{-6}
	Vegetable Garden	NW	1.65	1.668×10^{-6}
	Construction Worker	NNE	0.25	1.517×10^{-5}
D/Q				**D/Q (m^{-2})**
	EAB	NNW	0.60	1.048×10^{-7}
	Property Boundary	NW	0.81	5.315×10^{-8}
	Resident	NNW	1.40	1.448×10^{-8}
	Meat Animal	NNW	1.40	1.448×10^{-8}
	Vegetable Garden	NW	1.65	8.836×10^{-9}
	Construction Worker	NNE	0.25	5.979×10^{-8}

Note: The values in this table are obtained by log-log interpolation of the data presented in Tables 2.3.5-4 through 2.3.5-7, based on specific receptor locations. These interpolated values are consistent with the output of the XOQDOQ computer program as presented in Table 2.3.5-8, although the values in Table 2.3.5-8 are shown to two digits. The more precise values in Table 2.3.5-3 are needed to perform the dose analysis in Chapter 11.

Table 2.3.5-4 (Sheet 1 of 2)
No Decay Undepleted X/Qs Along Various Segments (July 2007 through June 2009)

NO DECAY, UNDEPLETED
CORRECTED USING STANDARD OPEN TERRAIN FACTORS
ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	.250	.500	.750	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500
S	5.016E-05	1.657E-05	8.970E-06	4.501E-06	1.783E-06	9.620E-07	6.099E-07	4.265E-07	3.184E-07	2.491E-07	2.017E-07
SSW	4.755E-05	1.585E-05	8.577E-06	4.302E-06	1.702E-06	9.181E-07	5.818E-07	4.067E-07	3.036E-07	2.374E-07	1.922E-07
SW	5.390E-05	1.765E-05	9.693E-06	4.907E-06	1.965E-06	1.068E-06	6.811E-07	4.784E-07	3.585E-07	2.813E-07	2.285E-07
WSW	4.361E-05	1.443E-05	7.918E-06	4.006E-06	1.603E-06	8.715E-07	5.556E-07	3.902E-07	2.924E-07	2.295E-07	1.863E-07
W	4.121E-05	1.393E-05	7.543E-06	3.781E-06	1.496E-06	8.068E-07	5.114E-07	3.575E-07	2.669E-07	2.087E-07	1.690E-07
WNW	4.491E-05	1.523E-05	8.274E-06	4.158E-06	1.650E-06	8.921E-07	5.664E-07	3.965E-07	2.963E-07	2.320E-07	1.880E-07
NW	6.804E-05	2.319E-05	1.242E-05	6.188E-06	2.429E-06	1.303E-06	8.225E-07	5.731E-07	4.266E-07	3.329E-07	2.689E-07
NNW	6.889E-05	2.348E-05	1.255E-05	6.238E-06	2.444E-06	1.309E-06	8.258E-07	5.750E-07	4.277E-07	3.335E-07	2.693E-07
N	3.753E-05	1.257E-05	6.749E-06	3.368E-06	1.325E-06	7.118E-07	4.498E-07	3.137E-07	2.337E-07	1.824E-07	1.475E-07
NNE	1.603E-05	5.301E-06	2.870E-06	1.441E-06	5.708E-07	3.081E-07	1.954E-07	1.366E-07	1.020E-07	7.984E-08	6.466E-08
NE	1.355E-05	4.453E-06	2.427E-06	1.223E-06	4.867E-07	2.635E-07	1.675E-07	1.174E-07	8.782E-08	6.880E-08	5.579E-08
ENE	1.142E-05	3.754E-06	2.064E-06	1.046E-06	4.193E-07	2.281E-07	1.455E-07	1.023E-07	7.668E-08	6.019E-08	4.889E-08
E	1.380E-05	4.514E-06	2.483E-06	1.259E-06	5.048E-07	2.747E-07	1.753E-07	1.232E-07	9.237E-08	7.251E-08	5.891E-08
ESE	1.844E-05	5.962E-06	3.296E-06	1.676E-06	6.749E-07	3.682E-07	2.354E-07	1.658E-07	1.244E-07	9.781E-08	7.954E-08
SE	3.254E-05	1.046E-05	5.801E-06	2.957E-06	1.195E-06	6.533E-07	4.183E-07	2.949E-07	2.216E-07	1.743E-07	1.418E-07
SSE	3.846E-05	1.245E-05	6.874E-06	3.493E-06	1.405E-06	7.664E-07	4.898E-07	3.447E-07	2.587E-07	2.033E-07	1.653E-07

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

SECTOR	5.000	7.500	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	50.000
S	1.678E-07	8.810E-08	5.808E-08	3.420E-08	2.362E-08	1.777E-08	1.411E-08	1.162E-08	9.824E-09	8.479E-09	7.436E-09
SSW	1.598E-07	8.386E-08	5.526E-08	3.251E-08	2.244E-08	1.687E-08	1.338E-08	1.102E-08	9.314E-09	8.037E-09	7.046E-09
SW	1.905E-07	1.010E-07	6.699E-08	3.979E-08	2.764E-08	2.088E-08	1.663E-08	1.374E-08	1.164E-08	1.007E-08	8.850E-09
WSW	1.554E-07	8.232E-08	5.461E-08	3.242E-08	2.251E-08	1.700E-08	1.354E-08	1.118E-08	9.474E-09	8.193E-09	7.197E-09
W	1.406E-07	7.378E-08	4.863E-08	2.861E-08	1.975E-08	1.485E-08	1.178E-08	9.695E-09	8.196E-09	7.071E-09	6.198E-09
WNW	1.565E-07	8.235E-08	5.438E-08	3.208E-08	2.217E-08	1.669E-08	1.325E-08	1.092E-08	9.234E-09	7.971E-09	6.991E-09
NW	2.233E-07	1.164E-07	7.632E-08	4.459E-08	3.063E-08	2.294E-08	1.814E-08	1.489E-08	1.256E-08	1.082E-08	9.465E-09
NNW	2.235E-07	1.163E-07	7.617E-08	4.443E-08	3.048E-08	2.281E-08	1.803E-08	1.479E-08	1.247E-08	1.073E-08	9.386E-09
N	1.225E-07	6.399E-08	4.203E-08	2.463E-08	1.695E-08	1.272E-08	1.007E-08	8.279E-09	6.991E-09	6.025E-09	5.278E-09
NNE	5.381E-08	2.831E-08	1.869E-08	1.103E-08	7.629E-09	5.748E-09	4.567E-09	3.764E-09	3.186E-09	2.752E-09	2.415E-09
NE	4.647E-08	2.452E-08	1.622E-08	9.604E-09	6.659E-09	5.025E-09	3.998E-09	3.299E-09	2.795E-09	2.416E-09	2.122E-09
ENE	4.078E-08	2.163E-08	1.436E-08	8.536E-09	5.932E-09	4.484E-09	3.572E-09	2.951E-09	2.502E-09	2.165E-09	1.902E-09
E	4.914E-08	2.607E-08	1.731E-08	1.030E-08	7.160E-09	5.414E-09	4.315E-09	3.566E-09	3.024E-09	2.617E-09	2.300E-09
ESE	6.640E-08	3.535E-08	2.352E-08	1.403E-08	9.769E-09	7.396E-09	5.900E-09	4.879E-09	4.141E-09	3.585E-09	3.153E-09
SE	1.185E-07	6.322E-08	4.215E-08	2.519E-08	1.757E-08	1.332E-08	1.064E-08	8.803E-09	7.477E-09	6.478E-09	5.700E-09
SSE	1.380E-07	7.338E-08	4.882E-08	2.909E-08	2.025E-08	1.533E-08	1.223E-08	1.011E-08	8.579E-09	7.426E-09	6.530E-09

VENT AND BUILDING PARAMETERS:

RELEASE HEIGHT	(METERS)	.00	REP. WIND HEIGHT	(METERS)	10.0
DIAMETER	(METERS)	.00	BUILDING HEIGHT	(METERS)	24.4
EXIT VELOCITY	(METERS)	.00	BLDG.MIN.CRS.SEC.AREA	(SQ.METERS)	1263.0
			HEAT EMISSION RATE	(CAL/SEC)	.0

Table 2.3.5-4 (Sheet 2 of 2)
No Decay Undepleted X/Qs Along Various Segments (July 2007 through June 2009)

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	8.673E-06	2.022E-06	6.304E-07	3.229E-07	2.032E-07	9.246E-08	3.481E-08	1.787E-08	1.164E-08	8.491E-09
SSW	8.294E-06	1.931E-06	6.015E-07	3.078E-07	1.936E-07	8.803E-08	3.309E-08	1.696E-08	1.104E-08	8.048E-09
SW	9.335E-06	2.220E-06	7.033E-07	3.634E-07	2.301E-07	1.058E-07	4.043E-08	2.098E-08	1.377E-08	1.009E-08
WSW	7.625E-06	1.812E-06	5.737E-07	2.964E-07	1.876E-07	8.623E-08	3.295E-08	1.709E-08	1.120E-08	8.204E-09
W	7.291E-06	1.697E-06	5.286E-07	2.706E-07	1.702E-07	7.744E-08	2.912E-08	1.493E-08	9.720E-09	7.081E-09
WNW	7.991E-06	1.871E-06	5.853E-07	3.004E-07	1.893E-07	8.639E-08	3.263E-08	1.678E-08	1.094E-08	7.982E-09
NW	1.204E-05	2.764E-06	8.509E-07	4.328E-07	2.710E-07	1.223E-07	4.544E-08	2.307E-08	1.493E-08	1.083E-08
NNW	1.217E-05	2.783E-06	8.544E-07	4.339E-07	2.714E-07	1.223E-07	4.528E-08	2.294E-08	1.483E-08	1.075E-08
N	6.539E-06	1.507E-06	4.652E-07	2.370E-07	1.486E-07	6.723E-08	2.508E-08	1.279E-08	8.301E-09	6.034E-09
NNE	2.775E-06	6.474E-07	2.019E-07	1.035E-07	6.514E-08	2.970E-08	1.122E-08	5.777E-09	3.773E-09	2.756E-09
NE	2.342E-06	5.511E-07	1.731E-07	8.903E-08	5.619E-08	2.571E-08	9.766E-09	5.050E-09	3.307E-09	2.419E-09
ENE	1.987E-06	4.736E-07	1.503E-07	7.771E-08	4.923E-08	2.265E-08	8.673E-09	4.505E-09	2.957E-09	2.167E-09
E	2.390E-06	5.701E-07	1.810E-07	9.361E-08	5.932E-08	2.730E-08	1.046E-08	5.440E-09	3.574E-09	2.620E-09
ESE	3.168E-06	7.611E-07	2.430E-07	1.261E-07	8.009E-08	3.699E-08	1.425E-08	7.431E-09	4.890E-09	3.590E-09
SE	5.571E-06	1.346E-06	4.316E-07	2.245E-07	1.428E-07	6.614E-08	2.557E-08	1.338E-08	8.822E-09	6.486E-09
SSE	6.611E-06	1.585E-06	5.055E-07	2.622E-07	1.664E-07	7.681E-08	2.955E-08	1.540E-08	1.013E-08	7.436E-09

Table 2.3.5-5 (Sheet 1 of 2)
2.26 Day Decay, Undepleted X/Qs Along Various Segments (July 2007 through June 2009)

2.260 DAY DECAY, UNDEPLETED
CORRECTED USING STANDARD OPEN TERRAIN FACTORS

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

SECTOR	.250	.500	.750	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500
S	5.012E-05	1.654E-05	8.948E-06	4.486E-06	1.774E-06	9.556E-07	6.048E-07	4.222E-07	3.147E-07	2.457E-07	1.986E-07
SSW	4.752E-05	1.583E-05	8.557E-06	4.288E-06	1.694E-06	9.122E-07	5.772E-07	4.028E-07	3.002E-07	2.343E-07	1.894E-07
SW	5.374E-05	1.755E-05	9.606E-06	4.848E-06	1.929E-06	1.042E-06	6.599E-07	4.606E-07	3.430E-07	2.674E-07	2.158E-07
WSW	4.345E-05	1.433E-05	7.834E-06	3.949E-06	1.568E-06	8.460E-07	5.352E-07	3.731E-07	2.775E-07	2.161E-07	1.742E-07
W	4.118E-05	1.391E-05	7.523E-06	3.768E-06	1.488E-06	8.010E-07	5.068E-07	3.537E-07	2.635E-07	2.057E-07	1.663E-07
WNW	4.487E-05	1.521E-05	8.252E-06	4.144E-06	1.642E-06	8.857E-07	5.613E-07	3.923E-07	2.926E-07	2.286E-07	1.850E-07
NW	6.799E-05	2.316E-05	1.240E-05	6.170E-06	2.418E-06	1.295E-06	8.164E-07	5.681E-07	4.222E-07	3.289E-07	2.653E-07
NNW	6.884E-05	2.344E-05	1.252E-05	6.220E-06	2.433E-06	1.302E-06	8.198E-07	5.700E-07	4.234E-07	3.296E-07	2.658E-07
N	3.750E-05	1.254E-05	6.732E-06	3.357E-06	1.318E-06	7.069E-07	4.459E-07	3.104E-07	2.308E-07	1.799E-07	1.452E-07
NNE	1.602E-05	5.291E-06	2.862E-06	1.435E-06	5.675E-07	3.057E-07	1.934E-07	1.350E-07	1.006E-07	7.858E-08	6.351E-08
NE	1.353E-05	4.444E-06	2.419E-06	1.218E-06	4.836E-07	2.613E-07	1.657E-07	1.159E-07	8.649E-08	6.761E-08	5.470E-08
ENE	1.140E-05	3.746E-06	2.057E-06	1.041E-06	4.165E-07	2.261E-07	1.439E-07	1.009E-07	7.547E-08	5.910E-08	4.790E-08
E	1.378E-05	4.505E-06	2.476E-06	1.254E-06	5.018E-07	2.725E-07	1.735E-07	1.217E-07	9.109E-08	7.137E-08	5.787E-08
ESE	1.841E-05	5.943E-06	3.281E-06	1.666E-06	6.687E-07	3.638E-07	2.319E-07	1.628E-07	1.219E-07	9.552E-08	7.746E-08
SE	3.238E-05	1.036E-05	5.719E-06	2.901E-06	1.161E-06	6.284E-07	3.984E-07	2.781E-07	2.070E-07	1.613E-07	1.300E-07
SSE	3.843E-05	1.243E-05	6.856E-06	3.481E-06	1.398E-06	7.610E-07	4.855E-07	3.411E-07	2.555E-07	2.004E-07	1.627E-07

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

SECTOR	5.000	7.500	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	50.000
S	1.649E-07	8.586E-08	5.611E-08	3.247E-08	2.204E-08	1.629E-08	1.271E-08	1.029E-08	8.551E-09	7.254E-09	6.254E-09
SSW	1.573E-07	8.183E-08	5.347E-08	3.094E-08	2.100E-08	1.553E-08	1.212E-08	9.816E-09	8.164E-09	6.929E-09	5.977E-09
SW	1.789E-07	9.197E-08	5.929E-08	3.340E-08	2.212E-08	1.602E-08	1.228E-08	9.789E-09	8.038E-09	6.750E-09	5.770E-09
WSW	1.442E-07	7.369E-08	4.724E-08	2.632E-08	1.727E-08	1.240E-08	9.430E-09	7.470E-09	6.098E-09	5.094E-09	4.335E-09
W	1.380E-07	7.180E-08	4.689E-08	2.709E-08	1.836E-08	1.355E-08	1.056E-08	8.534E-09	7.085E-09	6.004E-09	5.169E-09
WNW	1.537E-07	8.015E-08	5.244E-08	3.037E-08	2.062E-08	1.524E-08	1.189E-08	9.615E-09	7.988E-09	6.773E-09	5.835E-09
NW	2.200E-07	1.138E-07	7.403E-08	4.259E-08	2.880E-08	2.124E-08	1.654E-08	1.337E-08	1.111E-08	9.417E-09	8.116E-09
NNW	2.202E-07	1.137E-07	7.393E-08	4.247E-08	2.870E-08	2.115E-08	1.647E-08	1.331E-08	1.105E-08	9.368E-09	8.072E-09
N	1.204E-07	6.231E-08	4.056E-08	2.334E-08	1.577E-08	1.162E-08	9.041E-09	7.298E-09	6.053E-09	5.124E-09	4.409E-09
NNE	5.275E-08	2.747E-08	1.795E-08	1.038E-08	7.035E-09	5.193E-09	4.044E-09	3.266E-09	2.710E-09	2.294E-09	1.973E-09
NE	4.546E-08	2.373E-08	1.553E-08	8.990E-09	6.099E-09	4.503E-09	3.506E-09	2.831E-09	2.347E-09	1.986E-09	1.707E-09
ENE	3.986E-08	2.090E-08	1.372E-08	7.971E-09	5.414E-09	4.001E-09	3.116E-09	2.517E-09	2.087E-09	1.765E-09	1.517E-09
E	4.817E-08	2.531E-08	1.664E-08	9.704E-09	6.617E-09	4.908E-09	3.837E-09	3.110E-09	2.588E-09	2.197E-09	1.895E-09
ESE	6.449E-08	3.386E-08	2.224E-08	1.292E-08	8.775E-09	6.484E-09	5.051E-09	4.080E-09	3.385E-09	2.865E-09	2.464E-09
SE	1.076E-07	5.485E-08	3.502E-08	1.933E-08	1.256E-08	8.945E-09	6.756E-09	5.320E-09	4.322E-09	3.597E-09	3.052E-09
SSE	1.355E-07	7.146E-08	4.711E-08	2.758E-08	1.886E-08	1.403E-08	1.099E-08	8.928E-09	7.445E-09	6.333E-09	5.472E-09

VENT AND BUILDING PARAMETERS:

RELEASE HEIGHT	(METERS)	.00	REP. WIND HEIGHT	(METERS)	10.0
DIAMETER	(METERS)	.00	BUILDING HEIGHT	(METERS)	24.4
EXIT VELOCITY	(METERS)	.00	BLDG.MIN.CRS.SEC.AREA	(SQ.METERS)	1263.0
			HEAT EMISSION RATE	(CAL/SEC)	.0

Table 2.3.5-5 (Sheet 2 of 2)
2.26 Day Decay, Undepleted X/Qs Along Various Segments (July 2007 through June 2009)

2.260 DAY 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	8.653E-06	2.013E-06	6.253E-07	3.191E-07	2.001E-07	9.021E-08	3.309E-08	1.639E-08	1.032E-08	7.268E-09
SSW	8.275E-06	1.923E-06	5.968E-07	3.044E-07	1.908E-07	8.599E-08	3.153E-08	1.563E-08	9.846E-09	6.942E-09
SW	9.257E-06	2.183E-06	6.820E-07	3.478E-07	2.174E-07	9.675E-08	3.414E-08	1.615E-08	9.832E-09	6.769E-09
WSW	7.550E-06	1.776E-06	5.533E-07	2.814E-07	1.755E-07	7.759E-08	2.695E-08	1.251E-08	7.507E-09	5.110E-09
W	7.273E-06	1.689E-06	5.240E-07	2.673E-07	1.675E-07	7.545E-08	2.761E-08	1.364E-08	8.561E-09	6.015E-09
WNW	7.971E-06	1.862E-06	5.802E-07	2.967E-07	1.863E-07	8.417E-08	3.094E-08	1.533E-08	9.644E-09	6.786E-09
NW	1.202E-05	2.753E-06	8.448E-07	4.283E-07	2.674E-07	1.197E-07	4.345E-08	2.138E-08	1.341E-08	9.436E-09
NNW	1.215E-05	2.772E-06	8.484E-07	4.295E-07	2.678E-07	1.197E-07	4.334E-08	2.129E-08	1.335E-08	9.386E-09
N	6.524E-06	1.500E-06	4.613E-07	2.342E-07	1.463E-07	6.555E-08	2.380E-08	1.170E-08	7.321E-09	5.134E-09
NNE	2.768E-06	6.440E-07	2.000E-07	1.021E-07	6.399E-08	2.885E-08	1.057E-08	5.224E-09	3.276E-09	2.298E-09
NE	2.335E-06	5.479E-07	1.713E-07	8.769E-08	5.510E-08	2.491E-08	9.158E-09	4.530E-09	2.840E-09	1.990E-09
ENE	1.981E-06	4.707E-07	1.486E-07	7.650E-08	4.824E-08	2.192E-08	8.112E-09	4.024E-09	2.524E-09	1.769E-09
E	2.384E-06	5.670E-07	1.792E-07	9.234E-08	5.828E-08	2.654E-08	9.874E-09	4.935E-09	3.119E-09	2.201E-09
ESE	3.154E-06	7.547E-07	2.395E-07	1.235E-07	7.801E-08	3.550E-08	1.315E-08	6.522E-09	4.093E-09	2.870E-09
SE	5.497E-06	1.311E-06	4.116E-07	2.099E-07	1.310E-07	5.776E-08	1.981E-08	9.034E-09	5.350E-09	3.610E-09
SSE	6.594E-06	1.578E-06	5.012E-07	2.590E-07	1.638E-07	7.488E-08	2.805E-08	1.410E-08	8.952E-09	6.343E-09

Table 2.3.5-6 (Sheet 1 of 2)
8 Day Decay, Depleted X/Qs at Various Distances (July 2007 through June 2009)

8.000 DAY DECAY, DEPLETED
CORRECTED USING STANDARD OPEN TERRAIN FACTORS
ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) DISTANCE IN MILES FROM THE SITE

SECTOR	.250	.500	.750	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500
S	4.746E-05	1.512E-05	7.988E-06	3.936E-06	1.512E-06	7.951E-07	4.929E-07	3.378E-07	2.476E-07	1.905E-07	1.518E-07
SSW	4.500E-05	1.447E-05	7.639E-06	3.762E-06	1.444E-06	7.588E-07	4.702E-07	3.222E-07	2.361E-07	1.816E-07	1.447E-07
SW	5.097E-05	1.610E-05	8.616E-06	4.281E-06	1.660E-06	8.782E-07	5.467E-07	3.759E-07	2.762E-07	2.128E-07	1.699E-07
WSW	4.123E-05	1.315E-05	7.034E-06	3.492E-06	1.353E-06	7.155E-07	4.452E-07	3.060E-07	2.247E-07	1.731E-07	1.381E-07
W	3.900E-05	1.272E-05	6.716E-06	3.307E-06	1.268E-06	6.667E-07	4.132E-07	2.831E-07	2.075E-07	1.596E-07	1.272E-07
WNW	4.249E-05	1.390E-05	7.368E-06	3.636E-06	1.400E-06	7.372E-07	4.576E-07	3.140E-07	2.304E-07	1.773E-07	1.415E-07
NW	6.438E-05	2.117E-05	1.106E-05	5.412E-06	2.060E-06	1.077E-06	6.649E-07	4.541E-07	3.319E-07	2.547E-07	2.026E-07
NNW	6.519E-05	2.143E-05	1.117E-05	5.456E-06	2.073E-06	1.082E-06	6.675E-07	4.556E-07	3.328E-07	2.552E-07	2.029E-07
N	3.551E-05	1.147E-05	6.010E-06	2.946E-06	1.124E-06	5.883E-07	3.634E-07	2.484E-07	1.817E-07	1.395E-07	1.110E-07
NNE	1.517E-05	4.838E-06	2.556E-06	1.260E-06	4.840E-07	2.545E-07	1.578E-07	1.082E-07	7.931E-08	6.101E-08	4.864E-08
NE	1.282E-05	4.064E-06	2.161E-06	1.069E-06	4.126E-07	2.177E-07	1.353E-07	9.291E-08	6.823E-08	5.255E-08	4.195E-08
ENE	1.080E-05	3.426E-06	1.838E-06	9.144E-07	3.554E-07	1.884E-07	1.175E-07	8.093E-08	5.956E-08	4.597E-08	3.675E-08
E	1.305E-05	4.120E-06	2.211E-06	1.101E-06	4.280E-07	2.270E-07	1.416E-07	9.752E-08	7.179E-08	5.541E-08	4.431E-08
ESE	1.745E-05	5.439E-06	2.933E-06	1.464E-06	5.717E-07	3.039E-07	1.899E-07	1.310E-07	9.653E-08	7.458E-08	5.968E-08
SE	3.076E-05	9.523E-06	5.148E-06	2.575E-06	1.006E-06	5.350E-07	3.341E-07	2.303E-07	1.695E-07	1.308E-07	1.045E-07
SSE	3.639E-05	1.137E-05	6.121E-06	3.054E-06	1.192E-06	6.334E-07	3.958E-07	2.730E-07	2.012E-07	1.554E-07	1.244E-07

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

SECTOR	5.000	7.500	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	50.000
S	1.245E-07	6.165E-08	3.864E-08	2.096E-08	1.353E-08	9.593E-09	7.222E-09	5.664E-09	4.578E-09	3.786E-09	3.188E-09
SSW	1.186E-07	5.871E-08	3.678E-08	1.993E-08	1.286E-08	9.119E-09	6.863E-09	5.382E-09	4.350E-09	3.597E-09	3.029E-09
SW	1.394E-07	6.920E-08	4.334E-08	2.338E-08	1.498E-08	1.053E-08	7.859E-09	6.110E-09	4.895E-09	4.013E-09	3.351E-09
WSW	1.133E-07	5.612E-08	3.508E-08	1.885E-08	1.203E-08	8.427E-09	6.265E-09	4.853E-09	3.875E-09	3.167E-09	2.636E-09
W	1.042E-07	5.162E-08	3.233E-08	1.752E-08	1.130E-08	8.006E-09	6.022E-09	4.720E-09	3.812E-09	3.151E-09	2.651E-09
WNW	1.160E-07	5.761E-08	3.616E-08	1.964E-08	1.268E-08	9.000E-09	6.776E-09	5.315E-09	4.296E-09	3.553E-09	2.991E-09
NW	1.657E-07	8.152E-08	5.083E-08	2.737E-08	1.758E-08	1.242E-08	9.320E-09	7.291E-09	5.881E-09	4.854E-09	4.081E-09
NNW	1.659E-07	8.147E-08	5.074E-08	2.728E-08	1.750E-08	1.235E-08	9.265E-09	7.245E-09	5.840E-09	4.819E-09	4.050E-09
N	9.086E-08	4.477E-08	2.796E-08	1.508E-08	9.698E-09	6.859E-09	5.151E-09	4.032E-09	3.253E-09	2.686E-09	2.258E-09
NNE	3.988E-08	1.979E-08	1.241E-08	6.740E-09	4.354E-09	3.090E-09	2.327E-09	1.825E-09	1.475E-09	1.220E-09	1.027E-09
NE	3.442E-08	1.713E-08	1.077E-08	5.861E-09	3.793E-09	2.695E-09	2.031E-09	1.594E-09	1.289E-09	1.066E-09	8.981E-10
ENE	3.020E-08	1.510E-08	9.524E-09	5.206E-09	3.376E-09	2.402E-09	1.812E-09	1.424E-09	1.152E-09	9.534E-10	8.033E-10
E	3.642E-08	1.823E-08	1.150E-08	6.296E-09	4.089E-09	2.913E-09	2.201E-09	1.731E-09	1.403E-09	1.162E-09	9.805E-10
ESE	4.908E-08	2.461E-08	1.555E-08	8.514E-09	5.526E-09	3.934E-09	2.969E-09	2.333E-09	1.888E-09	1.563E-09	1.317E-09
SE	8.585E-08	4.271E-08	2.675E-08	1.439E-08	9.175E-09	6.418E-09	4.762E-09	3.680E-09	2.931E-09	2.389E-09	1.984E-09
SSE	1.023E-07	5.135E-08	3.247E-08	1.782E-08	1.159E-08	8.271E-09	6.256E-09	4.926E-09	3.995E-09	3.314E-09	2.798E-09

VENT AND BUILDING PARAMETERS:

RELEASE HEIGHT	(METERS)	.00	REP. WIND HEIGHT	(METERS)	10.0
DIAMETER	(METERS)	.00	BUILDING HEIGHT	(METERS)	24.4
EXIT VELOCITY	(METERS)	.00	BLDG.MIN.CRS.SEC.AREA	(SQ.METERS)	1263.0
			HEAT EMISSION RATE	(CAL/SEC)	.0

Table 2.3.5-6 (Sheet 2 of 2)
8 Day Decay, Depleted X/Qs at Various Distances (July 2007 through June 2009)

8.000 DAY DECAY, DEPLETED
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	7.773E-06	1.732E-06	5.114E-07	2.516E-07	1.531E-07	6.538E-08	2.158E-08	9.693E-09	5.696E-09	3.799E-09
SSW	7.434E-06	1.655E-06	4.880E-07	2.399E-07	1.460E-07	6.227E-08	2.053E-08	9.214E-09	5.412E-09	3.610E-09
SW	8.351E-06	1.895E-06	5.668E-07	2.805E-07	1.713E-07	7.330E-08	2.408E-08	1.065E-08	6.147E-09	4.029E-09
WSW	6.819E-06	1.545E-06	4.616E-07	2.283E-07	1.393E-07	5.947E-08	1.943E-08	8.523E-09	4.884E-09	3.180E-09
W	6.535E-06	1.454E-06	4.288E-07	2.108E-07	1.283E-07	5.474E-08	1.805E-08	8.090E-09	4.746E-09	3.162E-09
WNW	7.162E-06	1.602E-06	4.747E-07	2.341E-07	1.427E-07	6.106E-08	2.022E-08	9.093E-09	5.344E-09	3.565E-09
NW	1.080E-05	2.368E-06	6.905E-07	3.374E-07	2.044E-07	8.659E-08	2.823E-08	1.255E-08	7.334E-09	4.872E-09
NNW	1.091E-05	2.385E-06	6.934E-07	3.383E-07	2.047E-07	8.658E-08	2.815E-08	1.249E-08	7.287E-09	4.837E-09
N	5.861E-06	1.291E-06	3.774E-07	1.847E-07	1.120E-07	4.754E-08	1.555E-08	6.933E-09	4.055E-09	2.695E-09
NNE	2.487E-06	5.544E-07	1.637E-07	8.059E-08	4.906E-08	2.097E-08	6.940E-09	3.122E-09	1.835E-09	1.224E-09
NE	2.099E-06	4.719E-07	1.403E-07	6.931E-08	4.230E-08	1.814E-08	6.032E-09	2.722E-09	1.603E-09	1.070E-09
ENE	1.780E-06	4.054E-07	1.218E-07	6.049E-08	3.706E-08	1.598E-08	5.352E-09	2.426E-09	1.431E-09	9.566E-10
E	2.142E-06	4.881E-07	1.467E-07	7.291E-08	4.468E-08	1.928E-08	6.472E-09	2.942E-09	1.740E-09	1.166E-09
ESE	2.837E-06	6.510E-07	1.967E-07	9.801E-08	6.017E-08	2.602E-08	8.749E-09	3.972E-09	2.345E-09	1.568E-09
SE	4.977E-06	1.145E-06	3.461E-07	1.721E-07	1.054E-07	4.520E-08	1.482E-08	6.491E-09	3.704E-09	2.400E-09
SSE	5.923E-06	1.357E-06	4.100E-07	2.043E-07	1.254E-07	5.428E-08	1.831E-08	8.350E-09	4.952E-09	3.325E-09

Table 2.3.5-7 (Sheet 1 of 2)
D/Qs At Various Distances (July 2007 through June 2009)

CORRECTED USING STANDARD OPEN TERRAIN FACTORS
******************** 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	2.235E-07	7.558E-08	3.881E-08	1.845E-08	6.627E-09	3.287E-09	1.935E-09	1.267E-09	8.916E-10	6.608E-10	5.092E-10
SSW	1.808E-07	6.115E-08	3.140E-08	1.493E-08	5.362E-09	2.659E-09	1.566E-09	1.025E-09	7.213E-10	5.346E-10	4.120E-10
SW	1.365E-07	4.616E-08	2.370E-08	1.127E-08	4.047E-09	2.007E-09	1.182E-09	7.739E-10	5.445E-10	4.036E-10	3.110E-10
WSW	1.000E-07	3.383E-08	1.737E-08	8.258E-09	2.966E-09	1.471E-09	8.662E-10	5.672E-10	3.991E-10	2.958E-10	2.279E-10
W	1.425E-07	4.819E-08	2.474E-08	1.176E-08	4.226E-09	2.096E-09	1.234E-09	8.079E-10	5.685E-10	4.213E-10	3.247E-10
WNW	1.578E-07	5.335E-08	2.739E-08	1.302E-08	4.678E-09	2.320E-09	1.366E-09	8.944E-10	6.293E-10	4.664E-10	3.594E-10
NW	3.745E-07	1.266E-07	6.503E-08	3.091E-08	1.110E-08	5.507E-09	3.243E-09	2.123E-09	1.494E-09	1.107E-09	8.532E-10
NNW	4.138E-07	1.399E-07	7.184E-08	3.415E-08	1.227E-08	6.084E-09	3.582E-09	2.346E-09	1.651E-09	1.223E-09	9.426E-10
N	1.994E-07	6.742E-08	3.462E-08	1.646E-08	5.912E-09	2.932E-09	1.726E-09	1.130E-09	7.954E-10	5.895E-10	4.542E-10
NNE	5.979E-08	2.022E-08	1.038E-08	4.935E-09	1.773E-09	8.792E-10	5.177E-10	3.390E-10	2.385E-10	1.768E-10	1.362E-10
NE	3.871E-08	1.309E-08	6.721E-09	3.195E-09	1.148E-09	5.692E-10	3.352E-10	2.195E-10	1.544E-10	1.144E-10	8.819E-11
ENE	2.678E-08	9.056E-09	4.650E-09	2.210E-09	7.940E-10	3.938E-10	2.319E-10	1.518E-10	1.068E-10	7.917E-11	6.101E-11
E	3.540E-08	1.197E-08	6.146E-09	2.922E-09	1.050E-09	5.205E-10	3.065E-10	2.007E-10	1.412E-10	1.046E-10	8.064E-11
ESE	4.110E-08	1.390E-08	7.136E-09	3.392E-09	1.219E-09	6.043E-10	3.558E-10	2.330E-10	1.639E-10	1.215E-10	9.363E-11
SE	6.744E-08	2.280E-08	1.171E-08	5.566E-09	1.999E-09	9.916E-10	5.839E-10	3.823E-10	2.690E-10	1.994E-10	1.536E-10
SSE	1.169E-07	3.954E-08	2.030E-08	9.652E-09	3.467E-09	1.719E-09	1.012E-09	6.629E-10	4.664E-10	3.457E-10	2.664E-10

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	4.045E-10	1.797E-10	1.089E-10	5.502E-11	3.330E-11	2.233E-11	1.600E-11	1.201E-11	9.341E-12	7.462E-12	6.091E-12
SSW	3.273E-10	1.454E-10	8.807E-11	4.452E-11	2.694E-11	1.806E-11	1.294E-11	9.720E-12	7.557E-12	6.037E-12	4.927E-12
SW	2.471E-10	1.098E-10	6.648E-11	3.360E-11	2.034E-11	1.364E-11	9.771E-12	7.337E-12	5.705E-12	4.557E-12	3.720E-12
WSW	1.811E-10	8.044E-11	4.873E-11	2.463E-11	1.491E-11	9.995E-12	7.162E-12	5.378E-12	4.181E-12	3.340E-12	2.726E-12
W	2.579E-10	1.146E-10	6.941E-11	3.508E-11	2.123E-11	1.424E-11	1.020E-11	7.660E-12	5.956E-12	4.758E-12	3.883E-12
WNW	2.855E-10	1.268E-10	7.684E-11	3.884E-11	2.351E-11	1.576E-11	1.129E-11	8.480E-12	6.593E-12	5.267E-12	4.299E-12
NW	6.778E-10	3.011E-10	1.824E-10	9.220E-11	5.580E-11	3.741E-11	2.681E-11	2.013E-11	1.565E-11	1.250E-11	1.021E-11
NNW	7.489E-10	3.327E-10	2.015E-10	1.019E-10	6.165E-11	4.133E-11	2.962E-11	2.224E-11	1.729E-11	1.381E-11	1.127E-11
N	3.609E-10	1.603E-10	9.711E-11	4.908E-11	2.971E-11	1.992E-11	1.427E-11	1.072E-11	8.333E-12	6.656E-12	5.433E-12
NNE	1.082E-10	4.807E-11	2.912E-11	1.472E-11	8.908E-12	5.973E-12	4.280E-12	3.214E-12	2.499E-12	1.996E-12	1.629E-12
NE	7.006E-11	3.112E-11	1.885E-11	9.530E-12	5.768E-12	3.867E-12	2.771E-12	2.081E-12	1.618E-12	1.292E-12	1.055E-12
ENE	4.847E-11	2.153E-11	1.304E-11	6.592E-12	3.990E-12	2.675E-12	1.917E-12	1.439E-12	1.119E-12	8.940E-13	7.297E-13
E	6.406E-11	2.846E-11	1.724E-11	8.714E-12	5.274E-12	3.536E-12	2.534E-12	1.903E-12	1.479E-12	1.182E-12	9.645E-13
ESE	7.438E-11	3.304E-11	2.002E-11	1.012E-11	6.123E-12	4.106E-12	2.942E-12	2.209E-12	1.718E-12	1.372E-12	1.120E-12
SE	1.220E-10	5.422E-11	3.284E-11	1.660E-11	1.005E-11	6.737E-12	4.827E-12	3.625E-12	2.818E-12	2.251E-12	1.838E-12
SSE	2.116E-10	9.401E-11	5.695E-11	2.878E-11	1.742E-11	1.168E-11	8.370E-12	6.285E-12	4.887E-12	3.904E-12	3.186E-12

Table 2.3.5-7 (Sheet 2 of 2)
D/Qs At Various Distances (July 2007 through June 2009)

*********************** 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	3.793E-08	7.770E-09	2.028E-09	9.110E-10	5.154E-10	1.982E-10	5.733E-11	2.272E-11	1.213E-11	7.511E-12
SSW	3.069E-08	6.286E-09	1.641E-09	7.370E-10	4.169E-10	1.603E-10	4.638E-11	1.838E-11	9.817E-12	6.076E-12
SW	2.317E-08	4.745E-09	1.239E-09	5.564E-10	3.147E-10	1.210E-10	3.501E-11	1.388E-11	7.411E-12	4.587E-12
WSW	1.698E-08	3.478E-09	9.079E-10	4.078E-10	2.307E-10	8.871E-11	2.566E-11	1.017E-11	5.432E-12	3.362E-12
W	2.419E-08	4.954E-09	1.293E-09	5.808E-10	3.286E-10	1.264E-10	3.656E-11	1.449E-11	7.737E-12	4.789E-12
WNW	2.677E-08	5.484E-09	1.432E-09	6.430E-10	3.637E-10	1.399E-10	4.047E-11	1.604E-11	8.565E-12	5.301E-12
NW	6.356E-08	1.302E-08	3.399E-09	1.526E-09	8.635E-10	3.321E-10	9.607E-11	3.808E-11	2.033E-11	1.258E-11
NNW	7.022E-08	1.438E-08	3.755E-09	1.686E-09	9.540E-10	3.669E-10	1.061E-10	4.206E-11	2.246E-11	1.390E-11
N	3.384E-08	6.931E-09	1.809E-09	8.126E-10	4.597E-10	1.768E-10	5.114E-11	2.027E-11	1.082E-11	6.700E-12
NNE	1.015E-08	2.078E-09	5.426E-10	2.437E-10	1.379E-10	5.301E-11	1.534E-11	6.079E-12	3.246E-12	2.009E-12
NE	6.570E-09	1.346E-09	3.513E-10	1.578E-10	8.926E-11	3.432E-11	9.930E-12	3.936E-12	2.102E-12	1.301E-12
ENE	4.545E-09	9.309E-10	2.430E-10	1.091E-10	6.175E-11	2.374E-11	6.869E-12	2.723E-12	1.454E-12	8.999E-13
E	6.007E-09	1.230E-09	3.212E-10	1.443E-10	8.161E-11	3.139E-11	9.080E-12	3.599E-12	1.922E-12	1.189E-12
ESE	6.975E-09	1.429E-09	3.730E-10	1.675E-10	9.476E-11	3.644E-11	1.054E-11	4.178E-12	2.231E-12	1.381E-12
SE	1.144E-08	2.344E-09	6.120E-10	2.748E-10	1.555E-10	5.979E-11	1.730E-11	6.856E-12	3.661E-12	2.266E-12
SSE	1.984E-08	4.065E-09	1.061E-09	4.766E-10	2.696E-10	1.037E-10	2.999E-11	1.189E-11	6.348E-12	3.929E-12

VENT AND BUILDING PARAMETERS:

RELEASE HEIGHT	(METERS)	.00	REP. WIND HEIGHT	(METERS)	10.0
DIAMETER	(METERS)	.00	BUILDING HEIGHT	(METERS)	24.4
EXIT VELOCITY	(METERS)	.00	BLDG.MIN.CRS.SEC.AREA	(SQ.METERS)	1263.0
			HEAT EMISSION RATE	(CAL/SEC)	.0

Table 2.3.5-8
X/Qs and D/Qs at Sensitive Receptors (July 2007 through June 2009)

Release Point - Ground Level - No Intermittent Releases
CORRECTED USING STANDARD OPEN TERRAIN FACTORS
SPECIFIC POINTS OF INTEREST

0RELEASE ID	TYPE OF LOCATION	DIRECTION FROM SITE	DISTANCE (MILES)	DISTANCE (METERS)	X/Q (SEC/CUB.METER) NO DECAY UNDEPLETED	X/Q (SEC/CUB.METER) 2.260 DAY DECAY UNDEPLETED	X/Q (SEC/CUB.METER) 8.000 DAY DECAY DEPLETED	D/Q (PER SQ.METER)
A	Res/Meat	S	5.92	9524.	1.3E-07	1.2E-07	9.1E-08	2.8E-10
A	Res/Meat	SSW	2.27	3656.	7.1E-07	7.0E-07	5.8E-07	2.0E-09
A	Res/Meat	SW	2.15	3467.	9.2E-07	8.9E-07	7.5E-07	1.7E-09
A	Res/Meat	WSW	6.11	9838.	1.1E-07	1.0E-07	7.8E-08	1.2E-10
A	Res/Meat	W	4.49	7227.	1.7E-07	1.7E-07	1.3E-07	3.3E-10
A	Res/Meat	WNW	4.52	7267.	1.9E-07	1.8E-07	1.4E-07	3.6E-10
A	Res/Meat	NW	1.65	2651.	2.0E-06	2.0E-06	1.7E-06	8.8E-09
A	Res/Meat	NNW	1.40	2261.	2.8E-06	2.8E-06	2.4E-06	1.4E-08
A	Res/Meat	N	2.97	4773.	3.2E-07	3.2E-07	2.5E-07	1.2E-09
A	Res/Meat	NNE	4.16	6687.	7.5E-08	7.3E-08	5.7E-08	1.6E-10
A	Res/Meat	NE	2.16	3479.	2.2E-07	2.2E-07	1.8E-07	4.7E-10
A	Res/Meat	ENE	5.70	9172.	3.3E-08	3.2E-08	2.4E-08	3.7E-11
A	Res/Meat	E	8.03	12929.	2.4E-08	2.3E-08	1.6E-08	2.5E-11
A	Res/Meat	ESE	5.24	8430.	6.1E-08	6.0E-08	4.5E-08	6.7E-11
A	Res/Meat	SSE	4.22	6795.	1.8E-07	1.8E-07	1.4E-07	3.1E-10
A	Veg	S	5.92	9524.	1.3E-07	1.2E-07	9.1E-08	2.8E-10
A	Veg	SSW	2.27	3656.	7.1E-07	7.0E-07	5.8E-07	2.0E-09
A	Veg	SW	2.15	3467.	9.2E-07	8.9E-07	7.5E-07	1.7E-09
A	Veg	WSW	6.11	9838.	1.1E-07	1.0E-07	7.8E-08	1.2E-10
A	Veg	W	4.49	7227.	1.7E-07	1.7E-07	1.3E-07	3.3E-10
A	Veg	WNW	4.52	7267.	1.9E-07	1.8E-07	1.4E-07	3.6E-10
A	Veg	NW	1.65	2651.	2.0E-06	2.0E-06	1.7E-06	8.8E-09
A	Veg	NNW	2.51	4033.	8.2E-07	8.2E-07	6.6E-07	3.6E-09
A	Veg	N	2.97	4773.	3.2E-07	3.2E-07	2.5E-07	1.2E-09
A	Veg	NNE	4.16	6687.	7.5E-08	7.3E-08	5.7E-08	1.6E-10
A	Veg	NE	2.16	3479.	2.2E-07	2.2E-07	1.8E-07	4.7E-10
A	Veg	ENE	5.70	9172.	3.3E-08	3.2E-08	2.4E-08	3.7E-11
A	Veg	E	8.03	12929.	2.4E-08	2.3E-08	1.6E-08	2.5E-11
A	Veg	ESE	5.24	8430.	6.1E-08	6.0E-08	4.5E-08	6.7E-11
A	Veg	SSE	4.22	6795.	1.8E-07	1.8E-07	1.4E-07	3.1E-10

Table 2.3.5-8
X/Qs and D/Qs at Sensitive Receptors (July 2007 through June 2009)

A	Property Bndry	S	1.29	2079.	2.5E-06	2.5E-06	2.1E-06	9.6E-09
A	Property Bndry	SSW	.88	1417.	5.8E-06	5.8E-06	5.1E-06	2.1E-08
A	Property Bndry	SW	.62	1003.	1.3E-05	1.3E-05	1.1E-05	3.2E-08
A	Property Bndry	WSW	.55	889.	1.3E-05	1.2E-05	1.1E-05	2.9E-08
A	Property Bndry	W	.64	1033.	9.6E-06	9.5E-06	8.6E-06	3.2E-08
A	Property Bndry	WNW	.69	1107.	9.4E-06	9.4E-06	8.4E-06	3.2E-08
A	Property Bndry	NW	.81	1305.	1.0E-05	1.0E-05	9.1E-06	5.3E-08
A	Property Bndry	NNW	.86	1387.	8.9E-06	8.9E-06	7.9E-06	5.0E-08
A	Property Bndry	N	.87	1401.	4.7E-06	4.7E-06	4.2E-06	2.4E-08
A	Property Bndry	NNE	1.06	1701.	1.3E-06	1.3E-06	1.1E-06	4.3E-09
A	Property Bndry	NE	1.72	2776.	3.6E-07	3.6E-07	3.0E-07	8.1E-10
A	Property Bndry	ENE	1.75	2818.	3.0E-07	3.0E-07	2.5E-07	5.4E-10
A	Property Bndry	E	2.46	3961.	1.8E-07	1.8E-07	1.5E-07	3.2E-10
A	Property Bndry	ESE	3.35	5392.	1.3E-07	1.3E-07	1.1E-07	1.8E-10
A	Property Bndry	SE	3.84	6176.	1.9E-07	1.7E-07	1.4E-07	2.2E-10
A	Property Bndry	SSE	2.02	3248.	7.5E-07	7.5E-07	6.2E-07	1.7E-09
A	EAB	S	.68	1087.	1.1E-05	1.0E-05	9.4E-06	4.6E-08
A	EAB	SSW	.59	944.	1.3E-05	1.2E-05	1.1E-05	4.7E-08
A	EAB	SW	.58	928.	1.4E-05	1.4E-05	1.3E-05	3.7E-08
A	EAB	WSW	.55	884.	1.3E-05	1.3E-05	1.1E-05	2.9E-08
A	EAB	W	.60	965.	1.1E-05	1.1E-05	9.6E-06	3.6E-08
A	EAB	WNW	.59	956.	1.2E-05	1.2E-05	1.1E-05	4.0E-08
A	EAB	NW	.59	956.	1.8E-05	1.8E-05	1.6E-05	9.6E-08
A	EAB	NNW	.60	959.	1.8E-05	1.8E-05	1.6E-05	1.1E-07
A	EAB	N	.59	951.	9.8E-06	9.7E-06	8.8E-06	5.1E-08
A	EAB	NNE	.55	879.	4.7E-06	4.6E-06	4.2E-06	1.8E-08
A	EAB	NE	.59	947.	3.5E-06	3.5E-06	3.2E-06	1.0E-08
A	EAB	ENE	.61	983.	2.8E-06	2.8E-06	2.5E-06	6.5E-09
A	EAB	E	.69	1111.	2.8E-06	2.8E-06	2.5E-06	7.1E-09
A	EAB	ESE	.69	1108.	3.7E-06	3.7E-06	3.3E-06	8.2E-09
A	EAB	SE	.69	1108.	6.6E-06	6.5E-06	5.9E-06	1.4E-08
A	EAB	SSE	.69	1111.	7.8E-06	7.7E-06	6.9E-06	2.3E-08

VENT AND BUILDING PARAMETERS:

RELEASE HEIGHT	(METERS)	.00	REP. WIND HEIGHT	(METERS)	10.0
DIAMETER	(METERS)	.00	BUILDING HEIGHT	(METERS)	24.4
EXIT VELOCITY	(METERS)	.00	BLDG.MIN.CRS.SEC.AREA	(SQ.METERS)	1263.0
			HEAT EMISSION RATE	(CAL/SEC)	.0