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2.3 Local Meteorology

2.3.1 Regional Climatology

The following site-specific information addresses ESBWR DCD COL Item 2.0-7-A.

VCS COL 2.0-7-A

This subsection addresses various aspects of the climate in the site region and area around VCS Units 1 and 2; Subsection 2.3.1.1 identifies data sources used to develop these descriptions. Subsection 2.3.1.2 describes large-scale general climatic features and their relationship to conditions in the site area and vicinity.

Severe weather phenomena considered in the design and operating bases for Units 1 and 2 are presented in Subsections 2.3.1.3.1 through 2.3.1.3.7, respectively, and include:

- 2.3.1.3.1: observed and probabilistic extreme wind conditions
- 2.3.1.3.2: tornadoes and related wind and pressure characteristics
- 2.3.1.3.3: tropical cyclones and related effects
- 2.3.1.3.4: observed and probabilistic precipitation extremes
- 2.3.1.3.5: the frequency and magnitude of hail, snowstorms, and ice storms
- 2.3.1.3.6: the frequency of thunderstorms and lightning
- 2.3.1.3.7: droughts and dust (sand) storms

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

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 site's 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 area and region.

Climate-related site parameters on which the ESBWR design is based (i.e., wind speed, tornadoes, precipitation, and air temperatures) are identified in DCD Tier 1, Table 5.1-1 and DCD Tier 2, Table 2.0-1. Site-specific characteristics that correspond to these site parameters are presented or addressed in Subsections 2.3.1.3.1 and 2.3.1.3.3 (for wind speed), 2.3.1.3.2 (for tornadoes), 2.3.1.3.4 (for precipitation), and 2.3.1.3.5 (for air temperatures). FSAR Table 2.0-201 compares the applicable site parameters and corresponding site-specific characteristic values.

2.3.1.1 **Data Sources**

Several sources of data are used to characterize regional climatological conditions pertinent to the VCS site. This includes data acquired by the National Weather Service (NWS) at its Victoria, Texas, first-order station and from 14 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 2.3.1-201 identifies the specific stations and lists their approximate distance and direction from the midpoint between the Unit 1 and Unit 2 reactor buildings at the site. Figure 2.3.1-201 illustrates these station locations relative to the site for VCS Units 1 and 2.

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 2.3.1-201 provides a relative indication of the distance between the climate observing stations and the VCS site.

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

- Proximity to the site (i.e., within the nominal 50-mile radius indicated above, to the extent practicable).

- Coverage in all directions surrounding the site (to the extent possible).
- Where more than one station exists for a given direction relative to the site, a station was included if it contributed one or more extreme conditions (e.g., rainfall, snowfall, maximum, or minimum temperatures) for that general direction or added context for variation of conditions over the site area.

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

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

- *2007 Local Climatological Data, Annual Summary with Comparative Data for Victoria, Texas* (Reference 2.3.1-201)
- *Climatography of the United States, No. 20, 1971–2000, Monthly Station Climate Summaries* (Reference 2.3.1-202)
- *Climatography of the United States, No. 81, 1971–2000, U.S. Monthly Climate Normals* (Reference 2.3.1-203)
- *Utah Climate Center, Utah State University, Climate Data Base for Texas* (Reference 2.3.1-204)
- *Cooperative Summary of the Day, TD3200, Period of Record Through 2001, for the Central United States* (Reference 2.3.1-205).
- *U.S. Summary of Day Climate Data (DS 3200/3210), Period of Record, 2002-2005* (Reference 2.3.1-206).

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 2.3.1-202 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 2.3.1-207).
- *Hourly United States Weather Observations, 1990-1995* (Reference 2.3.1-208).
- *Integrated Surface Hourly Data, Central United States, 1995-1999* (Reference 2.3.1-209)
- *Hourly Weather Data for Victoria Regional Airport, Texas (1996-2000)*, *NCDC hourly data obtained through Weather Warehouse, Weather Source, LLC* (Reference 2.3.1-210)
- *2005 ASHRAE Handbook, Chapter 28, "Climatic Design Conditions"* (Reference 2.3.1-211)
- *Minimum Design Loads for Buildings and Other Structures* (Reference 2.3.1-212)
- *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 2.3.1-213)
- *Historical Hurricane Tracks Storm Query, 1851 through 2007* (Reference 2.3.1-214)
- *The Climate Atlas of the United States* (Reference 2.3.1-215)
- *Storm Events for Texas, Hail, Snow and Ice, Tornado, Hurricane and Tropical Storm, and Dust Storm Event Summaries* (References 2.3.1-216, 2.3.1-217, and 2.3.1-229)
- *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 2.3.1-217)
- *Air Stagnation Climatology for the United States (1948–1998)* (Reference 2.3.1-218)
- *Ventilation Climate Information System* (References 2.3.1-219 and 2.3.1-226)
- *Climatography of the United States, No. 85, Divisional Normals and Standard Deviations of Temperature, Precipitation, and Heating and Cooling Degree Days 1971–2000 (and previous normal periods)* (Reference 2.3.1-220)

2.3.1.2 General Climate

The VCS site is located in the south-central Texas Coastal Plain, situated about 35 miles to the northwest of the Gulf of Mexico (see Figure 2.3.1-201). 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 2.3.1-220).

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 2.3.1-232).

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 2.3.1.5).

Larger and relatively more persistent outbreaks of very cold, dry air, associated with massive high-pressure systems that move southward out of Canada, also occasionally affect the site region. However, these weather conditions are moderated significantly 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 areas push southward over eastern Texas or Louisiana (Reference 2.3.1-232) 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 2.3.1-202). The late spring/early summer maximum is due primarily to thunderstorm activity. The early to mid-autumn secondary maximum is associated with thunderstorms and very heavy rains which accompany tropical cyclones 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**

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

- Observed and probabilistic extreme wind conditions (Subsection 2.3.1.3.1)
- Tornadoes and related wind and pressure characteristics (Subsection 2.3.1.3.2)
- Tropical cyclones and related effects (Subsection 2.3.1.3.3)
- Observed and probabilistic precipitation extremes (Subsection 2.3.1.3.4)
- Frequencies and magnitude of hail, snowstorms, and ice storms (Subsection 2.3.1.3.5)
- Frequencies of thunderstorms and lightning (Subsection 2.3.1.3.6)
- Droughts and dust (sand) storms (Subsection 2.3.1.3.7).

Included in the information provided in several of these subsections is climate-related site characteristics and corresponding values with counterparts among the site parameters in DCD Tier 1, Table 5.1-1 and DCD Tier 2, Table 2.0-1 — see Subsection 2.3.1.3.1, 2.3.1.3.2, 2.3.1.3.3, and 2.3.1.3.4.

2.3.1.3.1 **Extreme Winds**

From a climatological standpoint, the frequency of peak wind speed gusts can be characterized from information in the *Climate Atlas of the United States* (Reference 2.3.1-212), 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 2.3.1-212).

The "basic" wind speed is approximately 110 mph, as estimated by linear interpolation from the plot of basic wind speeds in Figure 6-1A of ASCE 7-05 (Reference 2.3.1-212) 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; that is, along the U.S. Atlantic Ocean and Gulf of Mexico coasts where the basic wind speed is greater than 90 mph (Reference 2.3.1-212).

From a probabilistic standpoint, 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 3-second-gust wind speeds for other recurrence intervals (Reference 2.3.1-212). Based on this guidance, the 100-year return period value is determined by multiplying the 50-year return period value by a scaling factor of 1.07, which yields a 100-year return period 3 second-gust wind speed for the site of approximately 118 mph.

Subsection 2.3.1.3.3 addresses rainfall extremes associated with tropical cyclones that have passed within 100 nautical miles of the VCS site. It concludes with a discussion of observed or estimated sustained wind speeds and wind gusts accompanying several of the more intense hurricanes that have made landfall and tracked through this radial area.

This climate-related site characteristic value (i.e., the 3-second gust wind speed) is one of the wind speed-related site parameters listed in DCD Tier 1, Table 5.1-1 and DCD Tier 2, Table 2.0-1. Refer to Table 2.0-201 for a comparison of the corresponding site parameter values.

2.3.1.3.2 **Tornadoes**

The design basis tornado characteristics applicable to SSCs, and components important to safety include the following parameters as identified in RG 1.76 (Reference 2.3.1-221):

- Maximum wind speed
- Translational speed
- Maximum rotational speed
- Radius of maximum rotational speed
- Pressure drop
- Rate of pressure drop

Based on Figure 1 of Regulatory Guide 1.76 and the coordinates for the midpoint between the VCS Units 1 and 2 reactors (see Subsection 2.1.1.2), the VCS site is located within Tornado Intensity Region II, about 25 miles south of the southern boundary of Tornado Intensity Region I (at 29^{o} north latitude). Due to the site's proximity to this boundary, the design basis tornado characteristics for Tornado Intensity Region I (Reference 2.3.1-221) have been conservatively assumed to apply to the VCS site and are:

- Maximum wind speed = 230 mph
- Translational speed = 46 mph
- Maximum rotational speed = 184 mph
- Radius of maximum rotational speed = 150 ft
- Pressure drop = 1.2 pounds per square inch (psi)
- Rate of pressure drop = 0.5 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 2.3.1-222) describes the relationship between and previous use of the original Fujita scale of wind speed ranges for different tornado intensity classifications and the Enhanced Fujita Scale wind speed ranges in the revised analysis of tornado characteristics. That document was the basis for most of the technical revisions to RG 1.76.

The tornado-related site parameters listed in DCD Tier 1, Table 5.1-1 and DCD Tier 2, Table 2.0-1 correspond directly to the design basis tornado characteristics listed above. Refer to Table 2.0-201 for a comparison between these site parameters and the corresponding site-specific design-basis tornado characteristics.

Tornadoes observed within a 2° 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 2.3.1-227).

The 2° square area for this evaluation includes all or portions of 25 counties in Texas. All tornado occurrences for a given county were included even if some portion of the county was not within the 2° 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 one of these counties (Reference 2.3.1-227).

Tornado F-scale classifications (with corresponding wind speed range based on the original Fujita scale of wind speeds) and respective frequencies of occurrence are as follows:

- F5 (wind speed >117 meters per second) = 0
- F4 (wind speed 93 to 116 meters per second) = 1
- F3 (wind speed 70 to 92 meters per second) = 23
- F2 (wind speed 50 to 69 meters per second) = 81
- F1 (wind speed 33 to 49 meters per second) = 230
- F0 (wind speed 18 to 32 meters per second) = 372

An additional 77 tornadoes were not assigned an F-scale in the *Storm Events* database and so are assumed to be comparable to an F0 classification (Reference 2.3.1-227).

Tornadoes have occurred in the VCS site area during all months of the year with nearly identical peak frequencies in the autumn and spring (about 36% and 33%, 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 nearly 40% of the tornadoes that occur in the site area on an annual basis. Less than 10% of all tornadoes have occurred during the winter months. (Reference 2.3.1-227)

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, extending from 1851 through 2007, of tropical cyclone tracks based on information compiled by the National Hurricane Center. This database indicates that a total of 60 tropical cyclone centers or storm tracks have passed within a 100-nautical-mile radius of the VCS site, during this historical period (Reference 2.3.1-214). Storm classifications and respective frequencies of occurrence over this 157-year period of record are as follows:

- Hurricanes — Category 5 (1), Category 4 (4), Category 3 (5), Category 2 (6), Category 1 (14)
- Tropical storms — 24
- Tropical depressions — 6
- Subtropical storms — 0
- Subtropical depressions — 0
- Extratropical storms — 0

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

Hurricane Classification	Wind Speed (mph)
Category 1	74–95
Category 2	96–110
Category 3	111–130
Category 4	131–155
Category 5	>155

Tropical cyclones within this 100-nautical-mile radius have occurred as early as June and as late as October, with the highest frequency (18 out of 60 events) recorded during September, including all classifications at and above tropical depression status. June, July, and August account for 13, 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, 5, 7, and 8, respectively). The only Category 5 hurricane to track within 100 nautical miles of the VCS site was Hurricane Carla in September 1961. Of the four Category 4 hurricanes that have occurred within this radial distance, three were recorded in August and one in September. Two Category 3 hurricanes have 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 2.3.1-214)

Tropical cyclones are responsible for at least 16 separate rainfall records among the 15 NWS and cooperative observer network stations listed in Table 2.3.1-201—four 24-hour (daily) rainfall totals and 12 monthly rainfall totals (see Table 2.3.1-203). 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 2.3.1-202, 2.3.1-204, 2.3.1-205, and 2.3.1-214)

Monthly station records were established due to partial contributions from the following tropical cyclones (References 2.3.1-201, 2.3.1-204, 2.3.1-205, 2.3.1-214, and 2.3.1-233):

- 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:

- <u>Hurricane Carla (September 1961)</u>. Carla was one of the most violent storms in Texas history. 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.

The eye of the hurricane (30 miles in diameter) moved into the Port O'Connor area about 40 miles east-southeast of the proposed VCS site and the city of Victoria. Peak wind gusts estimated at the following locations include: 175 mph at Port Lavaca (about 25 miles from the site); 150 mph at Victoria, Austwell, Edna, Aransas Pass, and Port Aransas (at distances ranging from about 20 to 70 miles away), and 160 mph at Matagorda (about 65 miles distant) (References 2.3.1-214, 2.3.1-217, and 2.3.1-228).

- Hurricane Celia (August 1970). Celia crossed the Texas coastline about 50 miles south-southwest of the VCS site, between Corpus Christi and Aransas Pass. It remained a Category 3 hurricane for about 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 about 135 miles inland from the coast.

  Celia's damage was primarily from high-intensity winds. Unlike other tropical cyclone events, flooding occurred relatively less with this storm. Sustained wind speeds of 130 mph were measured at Aransas Pass about 50 miles south-southwest of the VCS site. Peak wind gusts of 180 mph were estimated at both Aransas Pass (along the coast) and at Robstown, west of Corpus Christ, about 70 miles southwest of the site. (References 2.3.1-214 and -217).

- 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. Estimates of sustained winds between 70 and 80 mph with gusts to near 100 mph were also reported for DeWitt County, to the northwest of Victoria County. 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 2.3.1-214 and 2.3.1-229).

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 2.3.1-203 for the 15 nearby climatological observing stations listed in Table 2.3.1-201. 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., six 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 2.3.1-204), 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 instability and supported widespread and continual thunderstorm development. (Reference 2.3.1-217)

Similarly, the highest monthly rainfall total in the site area, 34.44 inches during July 2006, was recorded at the Port O'Connor cooperative observing station (References 2.3.1-204 and 2.3.1-233), located approximately 39 miles to the east-southeast of the VCS site. This total represents the accumulation of 14 days of measurable precipitation during that month, with less than 20% being recorded from July 1 to 7, and the period from July 23 to 29 accounting for approximately 80% of the total. Over 24 inches fell in a period of only four days between July 23 and July 26 (References 2.3.1-204 and 2.3.1-233).

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 2.3.1-201). 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.

Site characteristic values corresponding to the precipitation (for roof design) site parameters; that is, 1-hour and 5-minute rainfall rates (intensities), are addressed in Subsection 2.4.2.3.

Although the disruptive effects of any winter storm accompanied by frozen precipitation can be significant in South Texas, storms that produce measurable amounts of snow are rare. As Table 2.3.1-203 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 2.3.1-204, 2.3.1-206, and 2.3.1-233). Twenty-four hour snowfall records set at six other nearby observing stations on this date (see Table 2.3.1-202) range from 4.5 inches at

Beeville 5 NE, about 42 miles to the west-southwest, to 9.5 inches at Refugio 2 NW, about 25 miles to the southwest (References 2.3.1-204 and 2.3.1-206).

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

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

Based on Figure 7-1 of the ASCE-SEI design standard, *Minimum Design Loads for Buildings and Other Structures* (Reference 2.3.1-212), 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 1:10 applies (Reference 2.3.1-233). This ratio represents a value typically used by the NCDC in estimating liquid precipitation equivalents during snowfall events. Therefore, the liquid equivalent for this maximum snowfall event would be 1.2 inches of water. Based on the relationship of one inch of water being equivalent to 5.2 pounds per square foot, the estimated weight of the maximum recorded snowfall event would be 6.2 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 2.3.1-213). The highest winter season (December through February) PMP values for the VCS site area occur in December and are about 18, 29, and 37 inches, respectively, for these time intervals (Figures 25, 35, and 45 of Reference 2.3.1-213). The 24- and 72-hour PMP values for January and February are essentially the same as the December values for these two time intervals (Figures 26, 35, 36, and 45 of Reference 2.3.1-213).

The 48-hour PMWP value (unadjusted), estimated by logarithmic interpolation on the curve defined by the 6-, 24-, and 72-hour PMP values for December, is 34.0 inches liquid depth. Subsection 2.4.2 describes roof design provisions that relate to the prevention of rainfall accumulation. The weight of the 48-hour PMWP is reported and applied in Section 3.8, which describes the design of Seismic Category I structures.

The climate-related site characteristic values (i.e., the 100-year return period ground snow load [or, in this case, the estimated weight of the maximum recorded snowfall event in the site area in lieu of that value], and the 48-hour PMWP) are two of the precipitation (for roof design)-related site parameters. Refer to Table 2.0-201 in Section 2.0 for a comparison of the corresponding site parameter values.

2.3.1.3.5 **Hail, Snowstorms, and Ice Storms**

Frozen precipitation in the VCS site area 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 2.3.1-215), 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 2.3.1-216) based on observations over the period of January 1950 to March 2007.

Though hail can occur at any time of the year in the site area and is associated with well-developed 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 2.3.1-216).

The *Climate Atlas* (Reference 2.3.1-215) 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 one to two 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, about one 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 expect 0.75-inch or greater hail about one 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 2.3.1-215)

NCDC cautions that 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 one to two 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 (about 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 2.3.1-214). 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 2.3.1-203). The *Climate Atlas* (Reference 2.3.1-215) indicates that the occurrence of snowfalls 0.1 inch or greater in the VCS site area average less than one day per year (see also Table 2.3.1-202). 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 2.3.1-215) indicates that, on average, freezing precipitation occurs about 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 2.3.1-217 and 2.3.1-216, 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 about 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—about 10 days. Annually, more than half (about 57%) 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 about 2 days per month (Reference 2.3.1-201).

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 2.3.1-224). This methodology assumes a relationship between the average number of thunderstorm-days per year (T) and the number of lightning strokes to earth per square mile per year (N), where:

$$N = 0.31T$$

Based on the average number of thunderstorm-days per year at Victoria, Texas (i.e., 56; see Table 2.3.1-202), the frequency of lightning strokes to earth per square mile is about 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 2.3.1-225)—and, therefore, is considered to be a reasonable indicator.

The VCS power block area is shown on Figure 1.1-201 as a rectangular area encompassing both units and covering 41.1 acres or approximately 0.064 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 (0.064 square miles) = 1.09 lightning strokes/year, or about once 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 2.3.1-234). 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 2.3.1-234) The NCDC *Storm Events* database indicates no occurrences of dust storms near the VCS site since 1993 (Reference 2.3.1-229).

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

The ESBWR design, as employed at the VCS site, does not use a cooling tower or cooling pond to release heat to the atmosphere following a LOCA. Rather, in the event of an accident, the ultimate heat sink function is provided by the isolation condenser/passive containment cooling pools, which serve as the heat transfer mechanism for the reactor and containment to the atmosphere.

The isolation condenser/passive containment cooling pools are located within the reactor building; consequently the ultimate heat sink components of the ESBWR design are not significantly influenced by local weather conditions. As a result, the identification of meteorological conditions that are associated with maximum evaporation and drift loss of water, or with minimum cooling by the ultimate heat sink (i.e., periods of maximum wet bulb temperatures) is not necessary.

2.3.1.5 **Design Basis Dry and Wet Bulb Temperatures**

Long-term, engineering-related climatological data summaries, prepared by the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) for the Victoria Regional Airport observing station (Reference 2.3.1-211) are used to characterize typical design basis 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%, 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% (interpreted as the minimum dry bulb temperatures with values that are lower only 1.0 and 0.4% of the time, respectively).
- Maximum ambient threshold wet bulb temperatures at annual exceedance probabilities of 2.0%, 1.0%, and 0.4% (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% 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% 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% annual exceedance probability is 96.2°F with a corresponding mean coincident wet bulb temperature value of 76.3°F (Reference 2.3.1-211).

For the same period of record, the minimum dry bulb temperatures with 99.0% and 99.6% annual exceedance probabilities are 33.3°F and 29.1°F, respectively (Reference 2.3.1-211).

The same ASHRAE summary for Victoria lists the maximum noncoincident wet bulb temperature with a 2.0% annual exceedance probability as 78.7°F. The maximum noncoincident wet bulb temperature with a 1.0% annual exceedance probability is 79.3°F; and the maximum noncoincident wet bulb temperature with a 0.4% annual exceedance probability is 80.0°F (Reference 2.3.1-211).

These climate-related site characteristic values are among the air temperature-related site parameters listed in DCD Tier 1, Table 5.1-1 and DCD Tier 2, Table 2.0-1 as:

- Maximum 2%, 1%, and 0% exceedance dry bulb temperatures
- Maximum coincident 2%, 1%, and 0% exceedance wet bulb temperatures
- Maximum noncoincident 2%, 1%, and 0% exceedance wet bulb temperatures
- Minimum 2%, 1%, and 0% exceedance dry bulb temperatures.

The ESBWR DCD indicates that the 0% exceedance site parameter values represent conservative estimates of historical high and low temperatures for potential sites. 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% 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 2.3.1-207, 2.3.1-208, 2.3.1-209, and 2.3.1-210). Over this same period of record, the 0% exceedance historical maximum noncoincident wet bulb temperature is 84.4°F; the 0% exceedance historical minimum dry bulb temperature is 10°F at this station (References 2.3.1-207, 2.3.1-208, 2.3.1-209, and 2.3.1-210).

Record minimum temperatures observed in the VCS site area are presented in Table 2.3.1-203 and summarized in Subsection 2.3.2.2.4. Among the NWS and cooperative observer network stations listed in Table 2.3.1-203, the overall lowest temperature recorded was 6°F at a station (Yoakum) (References 2.3.1-202, 2.3.1-205, 2.3.1-204) 46 miles to the north of the site.

The data summaries from which the preceding statistical values were 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 were derived 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 2.3.1-207, 2.3.1-208, 2.3.1-209, and 2.3.1-210).

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 about 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 about 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 had to be 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 2.3.1-231), over the 43-year period from 1953 through 1995. This type of summary is a bivariate distribution of dry bulb temperatures in 2° ranges by wet bulb depression (i.e., the difference between concurrent dry bulb and wet bulb observations), also in 2° ranges.

For the Victoria NWS station, this threshold dry bulb temperature occurs at about 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.

Refer to Table 2.0-201 in Section 2.0 of this chapter for a comparison between the applicable site characteristic values and the corresponding air temperature-related site parameter values.

2.3.1.6 **Restrictive Dispersion Conditions**

Atmospheric dispersion can be described as the horizontal and vertical transport and diffusion of pollutants released into the atmosphere. Horizontal and along-wind dispersion is controlled primarily by wind direction variation, 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 represent less turbulent air flow, which is restrictive to both horizontal and vertical dispersion. And, although wind direction tends to be more variable under lower wind speed conditions (which increases horizontal transport), air parcels containing pollutants often recirculate within a limited area, thereby increasing cumulative exposure.

Major air pollution episodes are usually related to the presence of stagnating high-pressure weather systems (or anti-cyclones) that influence a region with light and variable wind conditions for four consecutive days or more. An updated air stagnation climatology has been published with data for the continental United States based on over 50 years of observations—from 1948 through 1998 (Reference 2.3.1-218). In this study, stagnation conditions were defined as four or more consecutive days when meteorological conditions were conductive 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 about 30 days per year with stagnation conditions, or about five to six cases per year, with a mean duration of about five days for each case (Reference 2.3.1-218).

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 2.3.1-218, 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 2.3.1-202 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 2.3.1-218).

The dispersion of air pollutants is also a function of the mixing height. The mixing height (or depth) is defined as the height above the surface through which relatively vigorous vertical mixing takes place. Lower mixing heights (and wind speeds), therefore, are a relative indicator of more restrictive dispersion conditions. In (Reference 2.3.1-230), Holzworth reported mean seasonal and annual morning and afternoon mixing heights and wind speeds for the contiguous United States based on observations over the 5-year period from 1960 to 1964 from a network of 62 NWS stations at which daily surface and upper air sounding measurements were routinely made.

However, an interactive, spatial database developed by the U.S. Department of Agriculture—Forest Service, referred to as the Ventilation Climate Information System, is readily available and provides monthly and annual graphical and tabular summaries of relevant dispersion-related characteristics (e.g., morning and afternoon modeled mixing heights, modeled surface wind speeds, and resultant ventilation indices) (Reference 2.3.1-219). The system, although developed primarily for fire management and related air quality purposes, extends the period of record to climatologically representative durations of 30 to 40 years depending on the parameter.

Table 2.3.1-204 summarizes minimum, maximum, and mean morning and afternoon mixing heights, surface wind speeds, and ventilation indices on a monthly, seasonal, and annual basis for the 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 2.3.1-226)—in this case, the VCS site. The seasonal and annual values listed in Table 2.3.1-204 were derived as weighted means based on the corresponding monthly values.

From a climatological standpoint, the lowest morning mixing heights occur in the autumn, and 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 2.3.1-204, representing the VCS site area, are reasonably consistent with the LCD summary for Victoria, Texas (Table 2.3.1-202) although about one 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 2.3.1-204) are shown to generally occur during the summer and autumn as in the LCD (References 2.3.1-219 and 2.3.1-201). This period of minimum wind speeds also coincides with the “extended” summer season described by Wang and Angell (Reference 2.3.1-218) that is characterized by relatively higher air stagnation conditions.

The ventilation index is based on the product of the wind speed and the mixing height. Because it uses surface winds instead of higher trajectory winds, the index values represent conservative estimates of ventilation potential. 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 2.3.1-226), 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 2.3.1-219); again, consistent with the characteristics reported by Wang and Angell (Reference 2.3.1-218).

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 2.3.1-219). 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 2.3.1-218). 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 VCS Units 1 and 2, 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 2.3.1-220). 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 2.3.1-220).

Summaries of successive annual temperature and rainfall normals as well as the composite 70-year average are provided below for these climate divisions (Reference 2.3.1-220).

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 about 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 one inch) between the 1931–1960 and the 1951–1980 normal periods. Since then, it has trended upward in these divisions ranging from about 2.2 inches in Climate Division TX-07 to about 4.4 inches in Climate Division TX-08. Similar trends are observable for all of the other climate divisions in Texas (Reference 2.3.1-220).

The preceding values represent variations of “average” temperature and rainfall conditions over time. The occurrence of extreme temperature and precipitation (i.e., rainfall and snowfall) events does not necessarily follow the same trends. However, characteristics about the occurrence of such events over time are indicated by the summaries for observed extremes of temperature, and rainfall and snowfall totals recorded in the VCS site area (see Table 2.3.1-203).

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 2.3.1-203).

The occurrence of all tropical cyclones within a 100-nautical-mile radius of the VCS site has been somewhat cyclical over the available 157-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 2.3.1-203 and described in Subsection 2.3.1.3.3 are associated with these tropical cyclone events (Reference 2.3.1-214).

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

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 design-basis characteristics determined previously under Subsection 2.3.1.3 are developed consistent with the intent of that guidance and incorporate the readily available, historical data records for locations considered to be representative of the VCS site.

2.3.1.8 References

2.3.1-201 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).

2.3.1-202 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.

2.3.1-203 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.

2.3.1-204 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.

2.3.1-205 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.

2.3.1-206 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.

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Table 2.3.1-201
NWS and Cooperative Observing Stations Near the VCS Site

Station[a]	County	Approximate Distance (Miles)	Direction Relative to Site	Elevation (feet)
Palacios Municipal Airport	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 2.3.1-202
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
CLOUDNESS	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 2.3.1-203
Climatological Extremes at Selected NWS and Cooperative Observing Stations in the VCS Site Area

Station	Maximum Temperature (°F)	Minimum Temperature (°F)	Maximum 24 hr Rainfall (Inches)	Maximum Monthly Rainfall (Inches)	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)	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)	4.5[b,c] (12/25/2004)[d]	6.5[b,c] (01/1926)[d]
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)	34.44[c,e] (07/2006)	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)	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)	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)	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)	2.5[b,c] (12/21/1929)	2.5[b,c] (12/1929)
Edna Highway 59 Bridge	NA[g]	NA[g]	17.58[b,c] (10/18/1994)	20.97[b,c] (10/1994)	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)	6.0[b,c] (12/25/2004)	6.0[b,c] (12/2004)
Goliad	112[a,b,c] (06/14/1998)[h]	7[a,b,c] (01/12/1962)	9.16[a,b,c] (09/21/1967)	22.19[b,c] (09/1967)	12.0[b,c] (12/25/2004)	12.0[b,c,e] (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)	7.0[b,c] (12/25/2004)	7.0[b,c] (12/2004)
Aransas Wildlife Refuge	103[b,i] (08/30/1954)[j]	9[a,b,c] (12/23/1989)	14.25a[,b,c] (11/01/1974)	22.65[e] (07/2007)	5.5[b,c,e] (12/25/2004)	5.5[b,c,e] (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)	2.1[a,b,c] (01/12/1985)	2.1[a,b,c] (01/1985)
Refugio 2 NW	112[b,c] (09/05/2000)	8[b,c] (01/12/1962)[g]	13.38[b,c] (10/16/1960)[k]	26.30[b,c] (09/1971)[k]	9.5[b,c] (12/25/2004)	9.5[b,c] (12/2004)
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)	5.0[b,c] (12/25/2004)	5.0[b,c] (12/2004)[l]

a. NCDC Monthly Station Climate Summaries, Climatography of the United States No.20 1971–2000 (Reference 2.3.1-202)

b. NCDC Cooperative Summaries of the Day TD 3200 & DS 3200/3210 (References 2.3.1-205 and 2.3.1-206)

c. Utah State University Climate Center (Reference 2.3.1-204)
d. Occurs on multiple dates: 01/23/1926, 12/25/2004; (most recent date shown in table)
e. NCDC Cooperative Observer Records for Texas (Reference 2.3.1-233)
f. Occurs on multiple dates: 06/15/1998, 09/06/2000; (most recent date shown in table)
g. Not reported here. Less than 6 years of data available
h. Occurs on multiple dates: 07/09/1939, 08/13/1962, 06/14/1998; (most recent date shown in table)
i. Occurred at retired Aransas Wildlife Refuge Co-op observing station (#410437), period of record Jun 1, 1940–Dec 31, 1970
j. Occurs on multiple dates: 06/27/1953, 08/30/1954; (most recent date shown in table)
k. Occurred at retired Refugio Co-op observing station (#417529), period of record Jan 1, 1948–Nov 30, 1984
l. Occurs for multiple months: 12/2004, 01/1926; (most recent month shown in table)

Table 2.3.1-204 (Sheet 1 of 2)
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)

Table 2.3.1-204 (Sheet 2 of 2)
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
Winter	Mean	427	925	3.6	3.2	1617 (M)	2912 (F)
Spring	Mean	608	1201	3.9	3.5	2506 (F)	4127 (G)
Summer	Mean	403	1569	3.5	3.4	1486 (M)	5286 (G)
Autumn	Mean	376	1278	3.4	3.2	1377 (M)	4067 (G)
Annual	Mean	454	1245	3.6	3.3	1748 (M)	4104 (G)

Sources: References 2.3.1-219 and 2.3.1-226

a. Monthly minimum, maximum and mean values are based directly on summaries available from USDA - Forest Service Ventilation Climate Information System (VCIS) (Reference 2.3.1-219). 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);

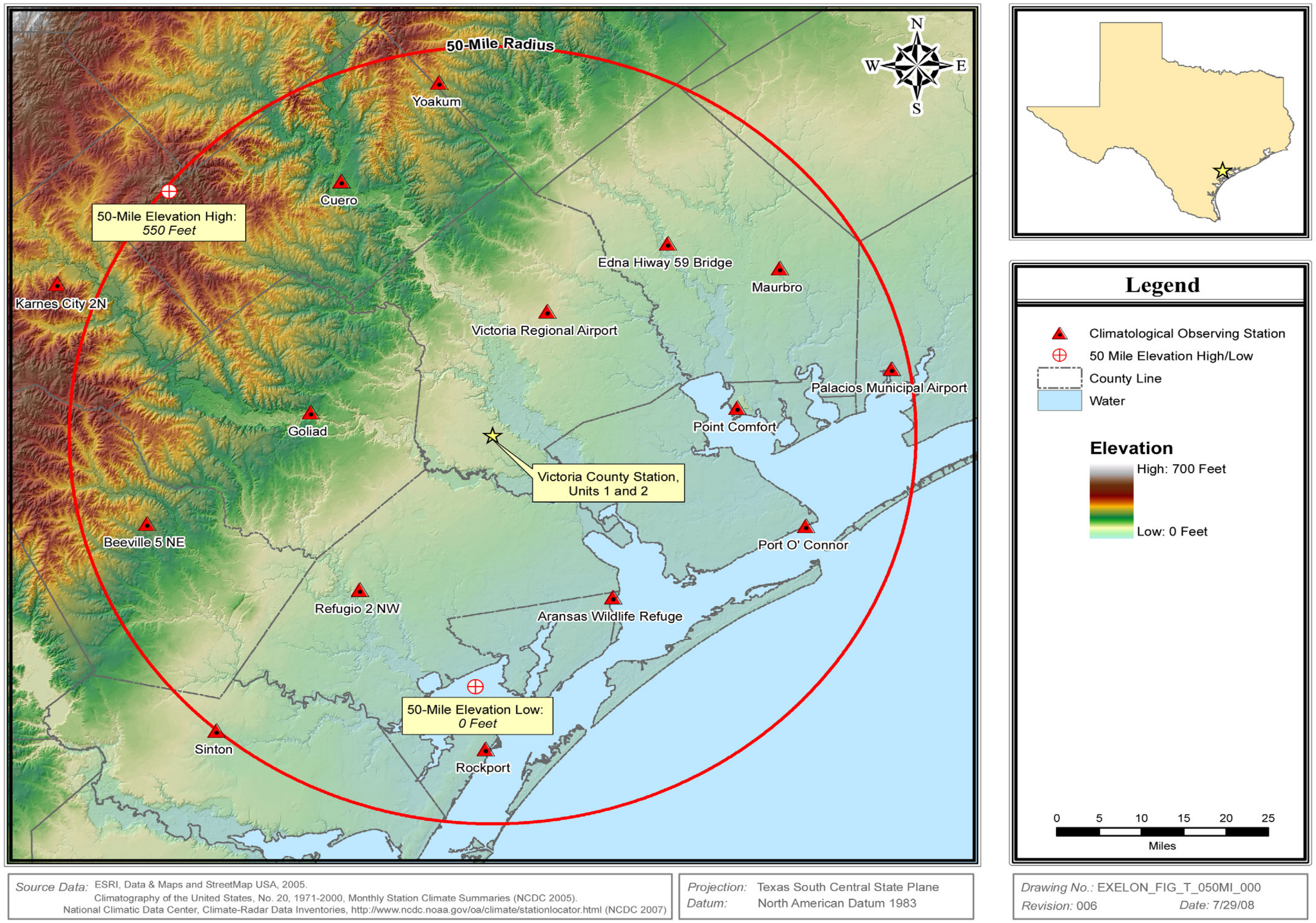


Figure 2.3.1-201 Climatological Observing Stations Near the Victoria County Station

VCS COL 2.0-8-A

2.3.2 Local Meteorology

This subsection addresses various meteorological and climatological characteristics of the site and vicinity around VCS Units 1 and 2. Subsection 2.3.2.1 identifies data resources used to develop the climatological descriptions and introduces information about the onsite meteorological monitoring program used to characterize site-specific atmospheric dispersion conditions.

The information presented in Subsection 2.3.2.2 focuses on the site-specific characteristics related to atmospheric transport and diffusion, based on measurements from the pre-application phase onsite meteorological monitoring program. This subsection also addresses climatological normals, means, and extremes for various weather elements based on long-term records from nearby observing stations, and evaluates those characteristics to substantiate that those observations are representative of conditions that might be expected to occur at the VCS site.

Subsection 2.3.2.3 illustrates topographic features at and in the vicinity of the site, as well as in the broader site area. Within the context of the meteorological and climatological conditions considered to be representative of the 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 the construction, presence, and operation of the plant and its related facilities.

Finally, Subsection 2.3.2.5 discusses current ambient air quality conditions in the site 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. None of the site parameters and values listed in DCD Tier 1, Table 5.1-1 and DCD Tier 2, Table 2.0-1 has counterparts under Subsection 2.3.2.

2.3.2.1 **Data Sources**

The primary sources of data used to characterize local meteorological and climatological conditions representative of the VCS site include long-term summaries for the first-order National Weather Service (NWS) station at Victoria, Texas, and 14 other nearby cooperative network observing stations. Table 2.3.1-201 identifies the offsite observing stations and provides the approximate distance and direction of each station relative to the VCS site; their locations are shown in Figure 2.3.1-201.

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. In addition, first-order NWS stations record measurements, typically on an hourly basis, of other weather elements, including winds, several indicators of atmospheric moisture content (i.e., relative humidity, dew point and wet bulb temperatures), and barometric pressure, as well as other observations when those conditions occur (e.g., fog, thunderstorms). This information was based on the following resources:

- *2007 Local Climatological Data, Annual Summary with Comparative Data for Victoria, Texas* (Reference 2.3.2-201)
- *Climatography of the United States, No. 20, 1971–2000, Monthly Station Climate Summaries* (Reference 2.3.2-202)
- *Climatography of the United States, No. 81, 1971–2000, U.S. Monthly Climate Normals* (Reference 2.3.2-203)
- Utah *Climate Center*, Utah State University, *Climate Data Base for Texas* (Reference 2.3.2-204)
- *Cooperative Summary of the Day, TD3200, Period of Record Through 2001, For the Central United States* (Reference 2.3.2-205)
- *U.S. Summary of Day Climate Data (DS 3200/3210), POR 2002–2005* (Reference 2.3.2-206)

Measurements from the tower-mounted meteorological monitoring system that currently supports the pre-application phase of VCS Units 1 and 2—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 1-year period of record from July 1, 2007 through June 30, 2008.

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, including:

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

2.3.2.2 Normal, Mean, and Extreme Values of Meteorological Parameters

Wind and atmospheric stability characteristics, based on meteorological data obtained from the pre-application phase monitoring program operated in support of VCS Units 1 and 2, are described in Subsections 2.3.2.2.1 through 2.3.2.2.3. These site-specific data also provide input to dispersion modeling analyses of impacts, at onsite and offsite receptor locations, due to accidental and routine radiological releases to the atmosphere (see Subsections 2.3.4 and 2.3.5).

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

2.3.2.2.1 Average Wind Direction and Wind Speed Conditions

The distribution of wind direction and wind speed is an important consideration when characterizing the dispersion climatology of a site. Long-term average wind motions at the macro- and synoptic scales (on the order of several thousand down to several hundred kilometers) are influenced by the general circulation patterns of the atmosphere at the macroscale and by large-scale topographic features (i.e., land-water interfaces such as coastal areas). These characteristics are addressed 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 (in general), by meso- or regional-scale (up to about 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 VCS Units 1 and 2 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 phase monitoring program. Wind direction and wind speed measurements were made at two levels on a 60-meter instrumented tower (the lower level at 10 meters and the upper level at 60 meters). The monitoring program began operation on June 28, 2007.

Figures 2.3.2-201 through 2.3.2-206 present annual and seasonal wind rose plots (i.e., graphical distributions of the direction from which the wind is blowing and wind speeds for each of 16 22.5° compass sectors centered on north, north-northeast, and northeast, etc.) for the 10-meter level based on measurements over the 1-year period of record from July 1, 2007 through June 30, 2008.

The wind direction distribution at the 10-meter level indicates a prevailing wind (the direction from which the wind blows most often) from the south-southeast on an annual basis; with about 50% of the winds blowing from the southeast quadrant (see Figure 2.3.2-201). Winds from the north and north-northeast sectors occur about 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 2.3.2-203 and 2.3.2-204). During the winter, winds from the north sector prevail (see Figure 2.3.2-202). Autumn represents a transitional season in that winds from the northeast and southeast quadrants occur with about the same frequency as north to northeasterly flow increases due to cold frontal passages (see Figure 2.3.2-205); winds from the north sector prevail during this season as well. Plots of individual monthly wind roses at the 10-meter measurement level are presented in Figure 2.3.2-206 (Sheets 1 to 12).

Wind rose plots based on measurements at the 60-meter level are shown in Figures 2.3.2-207 through 2.3.2-212. By comparison, wind direction distributions for the 60-meter level are fairly 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. However, autumn differs in terms of the predominant directional quadrant—that is, winds from the southeast quadrant clearly occur more often at the 60-meter level than at the 10-meter level where, as indicated above, the aggregate frequencies from the northeast and southeast quadrants appear to be similar. Plots of individual monthly wind roses at the 60-meter measurement level are presented in Figure 2.3.2-212 (Sheets 1 to 12).

Wind information summarized in the local climatological data (LCD) summary for the Victoria, Texas, NWS station (see Table 2.3.1-202) indicates a prevailing south-southeasterly wind direction on an annual basis, as well as seasonal variations (Reference 2.3.2-201), 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 many factors: topographic setting; sensor exposure; instrument threshold and accuracy, and length of record.

Table 2.3.2-201 summarizes seasonal and annual mean wind speeds based on measurements from the upper and lower levels of the onsite meteorological tower over the 1-year period from July 1, 2007, through June 30, 2008, and from wind instrumentation at the Victoria, Texas, NWS station based on a 24-year period of record (Reference 2.3.2-201). The elevation of the wind instruments 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 5.9 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 about 0.8 meters per second lower at the VCS site than at Victoria. Seasonal mean wind speeds for both locations follow the same pattern discussed in Subsection 2.3.1.6 in relation to the seasonal variation of relatively higher air stagnation and restrictive dispersion conditions in the site region.

There were only 13 occurrences of calm wind conditions recorded by the onsite meteorological monitoring system at the 10-meter measurement level, and only 2 occurrences at the 60-meter level, over the 1-year period from July 1, 2007, through June 30, 2008.

2.3.2.2.2 Wind Direction Persistence

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

Tables 2.3.2-202 and 2.3.2-203 present wind direction persistence/wind speed distributions based on measurements from the VCS pre-application phase monitoring program for the 1-year period of record from July 1, 2007 through June 30, 2008. The distributions account for discrete durations ranging between 1 and 48 hours for wind directions from 22.5° upwind sectors centered on each of the 16 standard compass radials (i.e., north, north-northeast, northeast, etc.) and for wind speed groups greater than or equal to 5, 10, 15, 20, 25, and 30 mph. Distributions are provided for wind measurements made at the lower (10-meter) and the upper (60-meter) tower levels, respectively, identified in the preceding subsection.

At the 10-meter level, the longest persistence period is at least 30 hours for winds from the north. This duration appears in the broadest wind speed group summarized (i.e., for speeds greater than or equal to 5 mph). For the north direction sector, the longest persistence period decreases to at least 18 hours for wind speeds greater than or equal to 10 mph. Maximum persistence periods of at least 18 hours duration occurred for speeds greater than or equal to 15 mph and south-southeast winds. For wind speeds greater than or equal to 25 mph, maximum persistence is limited to at least 4 hours and was recorded for south-southeast and northwest winds.

At the 60-meter level, the longest persistence period is at least 36 hours and occurred for winds from the south-southeast (see Table 2.3.2-203) for wind speeds greater than or equal to 15 mph. For this direction sector, the longest persistence period decreases to at least 18 hours for wind speeds greater than or equal to 20 mph. For wind speeds greater than or equal to 30 mph, maximum persistence is limited to at least 4 hours and was recorded for winds from the southeast, south-southeast, and northwest sectors.

2.3.2.2.3 Atmospheric Stability

Atmospheric stability is a relative indicator for the potential diffusion of pollutants released into the ambient air. Atmospheric stability, as addressed in this FSAR, was based on the delta-temperature (Δ**T**) method discussed in Section 2.2 of RG 1.23 (Reference 2.3.2-207).

The approach classifies stability based on the temperature change with height (i.e., the difference in °C per 100 meters, or Δ**T**). Stability classifications are assigned according to the following criteria from Table 1 of RG 1.23:

Extremely Unstable (Class A):	ΔT ≤–1.9°C
Moderately Unstable (Class B):	–1.9°C <Δ**T** ≤–1.7°C
Slightly Unstable (Class C):	–1.7°C <Δ**T** ≤–1.5°C
Neutral Stability (Class D):	–1.5°C <Δ**T** ≤–0.5°C
Slightly Stable (Class E):	0.5°C <Δ**T** ≤+1.5°C
Moderately Stable (Class F):	+1.5°C <Δ**T** ≤+4.0°C
Extremely Stable (Class G):	+4.0°C <Δ**T**

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

During the 1-year period from July 1, 2007 through June 30, 2008, Δ**T** was determined from the difference between temperature measurements made at the 60- and 10-meter tower levels. Seasonal and annual frequencies of atmospheric stability class and associated 10-meter level mean wind speeds for this period of record are presented in Table 2.3.2-204.

The data indicate a predominance of neutral stability (Class D) and slightly stable (Class E) conditions throughout most of the year. These stability classes combined were recorded about 52% of the time on an annual basis, ranging seasonally from about 42% during autumn to about 58% during both the winter and spring. Extremely unstable conditions (Class A) were recorded slightly more than 5% of the time on an annual basis, occurring more frequently during the summer (about 8% of the time), due to relatively greater solar insolation, and least often during the autumn (only about 2.5% of the time). Moderately and extremely stable conditions (Classes F and G, respectively) were recorded about 29% of the time on an annual basis, occurring most often during the autumn (about 42% of the time), owing in part to increased radiational cooling at night, and least often during the spring (about 20% 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 Table 2.3.2-205 and Table 2.3.2-206, respectively, based on the 1-year period of record from July 1, 2007 through June 30, 2008. The 10-meter level JFDs are used to evaluate short-term dispersion estimates for accidental atmospheric releases (see Subsection 2.3.4) and long-term diffusion estimates of routine releases to the atmosphere (see Subsection 2.3.5).

The pre-application phase onsite meteorological monitoring program will continue until two complete annual cycles of measurement data are available. A supplement to the COL Application, including the subsequently measured data and a reanalysis of the atmospheric dispersion estimates in Subsections 2.3.4 and 2.3.5, based on the complete 2-year data set, will be submitted. See Subsection 2.3.3.6.5 for additional details.

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 about 3°F, ranging from 68.2°F at the Yoakum station (about 46 miles north of the site for VCS Units 1 and 2) to 71.3°F at the Goliad station (about 22 miles to the west) (see Table 2.3.2-207).

Likewise, the diurnal (day-to-night) temperature ranges, as indicated by the differences between the daily mean maximum and minimum temperatures, are fairly comparable, ranging from 11.4°F at Port O'Connor (about 39 miles east-southeast of the VCS site) to 24.2°F at the Cuero station (about 37 miles to the north-northwest) (Reference 2.3.2-204). The breadth of 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 much 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 2.3.2-201).

Extreme maximum temperatures recorded in the vicinity of the site for VCS Units 1 and 2 have ranged from 103°F to 113°F, with the highest reading observed at the Cuero cooperative station on September 5, 2000. As Table 2.3.1-203 and the accompanying notes show, individual station extreme maximum temperature records were set at multiple locations on the same or adjacent dates (e.g., 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 2.3.2-202 and 2.3.2-204).

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 (about 46 miles to the north) on December 23, 1989. More noteworthy, though, Table 2.3.1-203 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 (Reference 2.3.2-202 and 2.3.2-204).

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 at the site for VCS Units 1 and 2.

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 2.3.1-202) 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 2.3.2-201).

The LCD summary shows a mean annual dew point temperature of 61.2°F, also 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 2.3.2-201).

The 30-year normal daily relative humidity averages 76% 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% during the months of June, July, August, and September (Reference 2.3.2-201).

2.3.2.2.6 **Precipitation**

As Table 2.3.2-207 indicates, normal annual rainfall totals for the 15 nearby observing stations listed in Table 2.3.1-201 (i.e., within approximately 50 miles of the VCS site) vary noticeably, ranging from 28.35 inches at the Karnes City 2N observing station (about 55 miles to the west-northwest of the site for VCS Units 1 and 2) to 45.40 inches at the Palacios Municipal Airport station (about 48 miles to the east) (Reference 2.3.2-203). This data, in conjunction with Figure 2.3.1-201, also indicates that total annual rainfall tends to decrease more from east to west more than as a function of distance inland from the Gulf of Mexico and adjacent bay waters.

However, when the four climatological observing stations closest to and surrounding 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 2.3.2-203). 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 about 63% 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 2.3.2-201).

Subsection 2.3.1.3.4 described historical precipitation extremes (rainfall and snowfall), as presented in Table 2.3.1-203 for the 15 nearby climatological observing stations listed in Table 2.3.1-201. Based on the maximum 24-hour and monthly precipitation totals recorded among these stations and, more importantly, the areal distribution of these stations around the site, the data suggests that these statistics are reasonably representative of the extremes of rainfall and snowfall that might be expected to be observed at the 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, about 17 miles to the north-northeast. The 2007 LCD summary for this station (Table 2.3.1-202) indicates an average of about 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 2.3.2-201).

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 one day per month (Reference 2.3.2-201).

The frequency of heavy fog conditions at the site for VCS Units 1 and 2 would be expected to be very similar to the observations made at the Victoria, Texas, NWS station due to their nearness to each other (about 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 2.3.2-208). The seasonal variation in "*The Climate Atlas*" is very similar to that in the 2007 LCD for the Victoria NWS station (References 2.3.2-208 and 2.3.2-201).

Enhancement of naturally occurring fog conditions due to the cooling basin and plant service water system cooling towers associated with VCS Units 1 and 2 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 for Units 1 and 2 covers about 41 acres.

Terrain features within 50 miles of the site for VCS Units 1 and 2, based on digital map elevations, are illustrated in Figure 2.3.1-201. Terrain elevation profiles along each of the 16 standard 22.5° compass radials out to a distance of 50 miles from the site are shown in Figure 2.3.2-214 (Sheets 1 through 6). Because Units 1 and 2 are located relatively close to one another and because of the distance covered by these profiles, the locus of these radial lines is the center point between the Units 1 and 2 reactor buildings.

The nominal plant grade elevation for Units 1 and 2 is around 95 feet above MSL. Located within the south-central Texas Coastal Plain, terrain within 50 miles of the site for VCS Units 1 and 2 is generally flat to gently rolling with elevations decreasing to the east-northeast clockwise through the south-southwest. Terrain elevations tend to increase to the west-southwest through the north-northeast with increasing distance from the site with relief of up to about 450 feet relative to nominal plant grade. Figure 2.3.1-201 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 2.3.2-214). 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 Figure 2.3.1-201 and 2.3.2-214).

More detailed topographic features within 5 miles of the site for VCS Units 1 and 2, also based on digital map elevations, are shown in Figure 2.3.2-213. 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 of the site for VCS Units 1 and 2 will include clearing, grubbing, excavation, leveling, and landscaping activities typical of large-scale projects (see Section 3.9 of the Environmental Report for a listing of activities and their estimated durations). The most prominent feature, however, in terms of land alteration associated with this facility, will be the excavation and construction of a 4938-acre cooling water basin and a 1295-acre Guadalupe-Blanco River Authority storage water reservoir adjacent to the CB. 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 2.3.2-213 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, those units.

The dimensions and operating characteristics of the facilities associated with VCS Units 1 and 2, 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. However, these effects will likely dissipate within ten structure heights downwind of the intervening structure(s). Similarly, while ambient temperatures immediately above any improved surfaces could increase, these temperature effects will be too limited in their vertical profile and horizontal extent to alter local-, area-, or regional-scale mean or extreme ambient temperature patterns. See Subsections 2.3.3.2.4 and 2.3.3.2.5 for additional details.

VCS Units 1 and 2 use a cooling basin and plant service water system cooling towers as a means of heat dissipation during normal operation (see Subsection 1.1.2). Potential meteorological effects due to the cooling basin and plant service water system 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 site for VCS Units 1 and 2 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 Part 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); about 355 miles west of the site.

2.3.2.5.2 **Projected Air Quality Conditions**

The Unit 1 and 2 nuclear steam supply systems and other related radiological systems are not sources of criteria pollutants or other air toxics emissions. Supporting equipment (e.g., diesel generators, auxiliary boilers, fire pump engines), and other nonradiological emission-generating sources (e.g., storage tanks and related equipment) or activities 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. Therefore, these emission sources will not be expected to impact ambient air quality levels in the vicinity of the VCS site, nor will they be anticipated to be a significant factor in the design and operating bases of VCS Units 1 and 2. Likewise, because of the relatively long distance of separation from the VCS site, visibility at any Class I Federal Areas will not be 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 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 of VCS Units 1 and 2, 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 and visibility associated with their operation are addressed under ER Subsection 5.8.1 and 5.3.3, respectively.

2.3.2.6 **References**

2.3.2-201 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).

2.3.2-202 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.

2.3.2-203 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.

2.3.2-204 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.

2.3.2-205 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.

2.3.2-206 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.

2.3.2-207 U.S. Nuclear Regulatory Commission, *Meteorological Monitoring Programs for Nuclear Power Plants,* Regulatory Guide 1.23, Revision 1, March 2007.

2.3.2-208 National Climatic Data Center, *The Climate Atlas of the United States*, Version 2.0 (CD-ROM), NCDC, Climate Services Division, NOAA, September 2002.

Table 2.3.2-201
Seasonal and Annual Mean Wind Speeds for the VCS Units 1 and 2 Pre-Application Phase Monitoring Program (July 1, 2007–June 30, 2008) and the Victoria, Texas, NWS Station

Primary Tower Elevation	Location	Winter	Spring	Summer	Autumn	Annual
Upper Level (60 m) (m/sec)	VCS 1 & 2 Site	6.4	6.9	5.3	5.1	5.9
Lower Level (10 m) (m/sec)	VCS 1 & 2 Site	4.4	4.9	3.5	3.1	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 2.3.2-201

Notes:

Winter = December, January, February

Spring = March, April, May

Summer = June, July, August

Autumn = September, October, November

Table 2.3.2-202 (Sheet 1 of 3)
Wind Direction Persistence/Wind Speed Distributions for the VCS Site — 10-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
10m Wind Speed (MPH) — 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 2.3.2-202 (Sheet 2 of 3)
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 2.3.2-202 (Sheet 3 of 3)
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 2.3.2-203 (Sheet 1 of 3)
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 2.3.2-203 (Sheet 2 of 3)
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 2.3.2-203 (Sheet 3 of 3)
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	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

	Direction															
Hours	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
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 2.3.2-204
Seasonal and Annual Vertical Stability Class and 10-Meter Level Wind Speed Distributions for the VCS Site (July 1, 2007–June 30, 2008)

Vertical Stability Categories[a]							
Period	**A**	**B**	**C**	**D**	**E**	**F**	**G**
Winter							
Frequency (%)	4.50	5.47	6.25	34.33	23.71	12.36	13.37
Wind Speed (m/sec)	6.9	6.0	5.3	5.3	4.0	2.6	2.3
Spring							
Frequency (%)	7.12	5.94	8.57	34.51	23.81	8.75	11.29
Wind Speed (m/sec)	7.2	6.3	6.0	6.0	4.1	2.6	2.3
Summer							
Frequency (%)	7.95	5.77	7.40	24.98	26.02	23.48	4.41
Wind Speed (m/sec)	7.1	5.6	4.6	4.0	2.8	1.9	1.8
Autumn							
Frequency (%)	2.58	4.28	9.21	22.65	19.01	18.78	23.48
Wind Speed (m/sec)	6.0	5.3	4.1	4.0	3.0	2.2	2.0
Annual							
Frequency (%)	5.55	5.37	7.86	29.13	23.15	15.84	13.10
Wind Speed (m/sec)	6.9	5.8	5.0	4.9	3.5	2.2	2.1

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

Table 2.3.2-205 (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, 2008)

Site: Exelon Victoria County
Period: Months Jul-Jun for years 2007 - 2008
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	15	58	99	164	120	106	116	131	21	8	838
NNE	0	12	47	95	195	128	83	90	42	8	0	700
NE	0	19	53	80	197	79	40	22	16	2	0	508
ENE	0	22	37	71	127	60	33	16	5	0	0	371
E	0	16	55	82	186	96	55	30	28	0	0	548
ESE	0	21	49	66	183	114	90	53	39	8	0	623
SE	0	11	48	107	320	223	216	193	307	88	5	1518
SSE	0	22	36	97	329	209	182	244	303	157	51	1630
S	0	19	30	59	132	82	100	87	86	70	17	682
SSW	0	7	25	25	47	35	24	23	10	1	0	197
SW	0	11	19	16	29	15	13	5	2	0	0	110
WSW	0	9	24	24	23	9	6	2	3	0	0	100
W	0	9	25	26	19	6	10	8	2	4	0	109
WNW	0	16	22	34	28	10	7	10	14	0	3	144
NW	1	8	26	43	58	33	14	17	26	14	17	257
NNW	0	9	56	77	88	47	25	37	36	34	11	420
Tot	1	226	610	1001	2125	1266	1004	953	1050	407	112	8755

Hours of Calm	13
Hours of Variable Direction	5
Hours of Valid Data	8773
Hours of Missing Data	11
Hours in Period	8784

Table 2.3.2-205 (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, 2008)

Site: Exelon Victoria County
Period: Months Jul-Jun for years 2007 - 2008
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	0	3	8	14	26	4	3	58
NNE	0	0	0	0	2	4	5	13	13	4	0	41
NE	0	0	0	0	1	3	2	2	1	1	0	10
ENE	0	0	0	0	0	0	2	2	1	0	0	5
E	0	0	0	0	0	0	1	3	2	0	0	6
ESE	0	0	0	0	0	0	2	2	5	0	0	9
SE	0	0	0	0	1	2	5	13	48	24	0	93
SSE	0	0	0	0	1	3	2	29	76	33	17	161
S	0	0	0	0	1	0	3	7	11	9	5	36
SSW	0	0	0	0	1	0	1	3	2	0	0	7
SW	0	0	0	0	0	0	0	2	2	0	0	4
WSW	0	0	0	0	0	0	0	0	1	0	0	1
W	0	0	0	0	0	0	2	1	0	0	0	3
WNW	0	0	0	0	0	0	1	1	2	0	2	6
NW	0	0	0	0	0	0	0	4	9	1	7	21
NNW	0	0	0	0	0	1	3	4	5	9	3	25
Tot	0	0	0	0	7	16	37	100	204	85	37	486

Hours of Calm	0
Hours of Variable Direction	0
Hours of Valid Data	486
Hours of Missing Data	11
Hours in Period	8784

Table 2.3.2-205 (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, 2008)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
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	0	2	9	7	8	8	2	0	36
NNE	0	0	0	0	0	4	4	4	8	1	0	21
NE	0	0	0	1	4	3	4	1	2	0	0	15
ENE	0	0	0	1	0	6	7	3	0	0	0	17
E	0	0	0	0	5	5	3	3	6	0	0	22
ESE	0	0	0	0	3	9	8	6	5	2	0	33
SE	0	0	0	1	7	3	11	20	39	8	0	89
SSE	0	0	0	0	1	7	12	36	32	17	8	113
S	0	0	0	1	0	1	19	13	13	9	0	56
SSW	0	0	0	0	0	4	6	3	1	1	0	15
SW	0	0	0	0	0	1	1	1	0	0	0	3
WSW	0	0	0	0	1	0	0	1	0	0	0	2
W	0	0	0	0	0	0	2	1	1	0	0	4
WNW	0	0	0	0	0	0	0	1	4	0	1	6
NW	0	0	0	0	1	3	4	1	4	2	3	18
NNW	0	0	0	0	1	4	1	2	4	6	2	20
Tot	0	0	0	4	25	59	89	104	127	48	14	470

Hours of Calm	0
Hours of Variable Direction	0
Hours of Valid Data	470
Hours of Missing Data	11
Hours in Period	8784

Table 2.3.2-205 (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, 2008)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
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	14	19	9	8	6	2	2	61
NNE	0	0	2	5	10	7	6	12	3	0	0	45
NE	0	0	1	3	11	17	7	3	1	0	0	43
ENE	0	0	0	5	5	8	8	1	1	0	0	28
E	0	0	0	2	14	18	9	4	4	0	0	51
ESE	0	0	0	3	10	12	12	9	5	0	0	51
SE	0	0	0	2	7	10	22	19	45	6	0	111
SSE	0	0	1	0	14	10	11	41	35	21	8	141
S	0	0	0	1	1	11	14	12	9	13	9	70
SSW	0	0	2	1	4	5	4	5	1	0	0	22
SW	0	0	0	0	3	3	6	0	0	0	0	12
WSW	0	0	0	2	1	0	1	1	0	0	0	5
W	0	0	1	2	1	0	3	0	1	0	0	8
WNW	0	0	0	1	1	1	2	1	1	0	0	7
NW	0	0	0	1	3	3	2	1	1	1	2	14
NNW	0	0	1	1	3	5	1	1	2	4	1	19
Tot	0	0	8	30	102	129	117	118	115	47	22	688

Hours of Calm	0
Hours of Variable Direction	0
Hours of Valid Data	688
Hours of Missing Data	11
Hours in Period	8784

Table 2.3.2-205 (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, 2008)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
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	8	15	32	28	51	59	49	9	3	255
NNE	0	4	4	17	52	50	44	48	15	1	0	235
NE	0	2	6	13	43	26	11	9	11	0	0	121
ENE	0	1	5	9	32	16	9	8	2	0	0	82
E	0	2	7	11	33	31	29	18	15	0	0	146
ESE	0	1	4	0	29	39	45	34	21	6	0	179
SE	0	1	3	6	26	54	89	97	157	48	5	486
SSE	0	1	2	10	34	40	67	103	132	83	18	490
S	0	5	2	3	25	25	38	47	47	39	3	234
SSW	0	0	3	6	14	17	9	9	5	0	0	63
SW	0	0	2	6	12	4	4	2	0	0	0	30
WSW	0	0	3	6	8	1	3	0	1	0	0	22
W	0	1	3	6	2	3	2	2	0	4	0	23
WNW	0	0	3	6	5	2	3	3	5	0	0	27
NW	0	1	3	8	22	9	7	5	5	7	2	69
NNW	0	1	8	7	12	9	9	15	13	9	5	88
Tot	0	21	66	129	381	354	420	459	478	206	36	2550

Hours of Calm	2
Hours of Variable Direction	0
Hours of Valid Data	2552
Hours of Missing Data	11
Hours in Period	8784

Table 2.3.2-205 (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, 2008)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
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	4	11	19	33	34	28	27	42	4	0	202
NNE	0	2	14	24	37	28	21	13	3	2	0	144
NE	0	5	16	26	52	19	10	7	1	1	0	137
ENE	0	8	9	19	41	18	4	2	1	0	0	102
E	0	7	12	20	64	31	12	2	1	0	0	149
ESE	0	3	7	10	50	38	23	2	2	0	0	135
SE	0	1	13	21	74	118	87	44	18	2	0	378
SSE	0	6	3	16	99	113	86	35	28	3	0	389
S	0	3	8	13	44	32	25	8	6	0	0	139
SSW	0	1	2	2	7	6	3	3	1	0	0	25
SW	0	2	5	4	4	4	2	0	0	0	0	21
WSW	0	0	5	2	3	2	1	0	1	0	0	14
W	0	3	4	4	3	3	1	4	0	0	0	22
WNW	0	1	5	7	5	1	0	4	2	0	0	25
NW	0	2	7	4	4	8	0	5	7	3	3	43
NNW	0	1	14	11	19	14	10	15	12	6	0	102
Tot	0	49	135	202	539	469	313	171	125	21	3	2027

Hours of Calm	1
Hours of Variable Direction	1
Hours of Valid Data	2029
Hours of Missing Data	11
Hours in Period	8784

Table 2.3.2-205 (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, 2008)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
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	5	13	30	40	22	3	0	0	0	0	113
NNE	0	3	14	27	40	28	3	0	0	0	0	115
NE	0	7	17	17	43	7	5	0	0	0	0	96
ENE	0	6	15	25	35	8	3	0	0	0	0	92
E	0	3	26	36	38	7	1	0	0	0	0	111
ESE	0	9	21	34	55	10	0	0	0	0	0	129
SE	0	6	23	60	130	24	1	0	0	0	0	244
SSE	0	8	21	50	127	17	4	0	0	0	0	227
S	0	3	12	21	32	10	1	0	0	0	0	79
SSW	0	2	9	8	10	0	1	0	0	0	0	30
SW	0	6	2	1	2	2	0	0	0	0	0	13
WSW	0	4	3	2	2	5	1	0	0	0	0	17
W	0	1	6	3	1	0	0	0	0	0	0	11
WNW	0	2	6	5	4	2	1	0	0	0	0	20
NW	0	3	8	13	9	6	1	1	0	0	0	41
NNW	0	1	9	17	16	5	1	0	0	0	0	49
Tot	0	69	205	349	584	153	26	1	0	0	0	1387

Hours of Calm	1
Hours of Variable Direction	1
Hours of Valid Data	1389
Hours of Missing Data	11
Hours in Period	8784

Table 2.3.2-205 (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, 2008)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
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	5	26	34	43	5	0	0	0	0	0	113
NNE	0	3	13	22	54	7	0	0	0	0	0	99
NE	0	5	13	20	43	4	1	0	0	0	0	86
ENE	0	7	8	12	14	4	0	0	0	0	0	45
E	0	4	10	13	32	4	0	0	0	0	0	63
ESE	0	8	17	19	36	6	0	0	1	0	0	87
SE	0	3	9	17	75	12	1	0	0	0	0	117
SSE	0	7	9	21	53	19	0	0	0	0	0	109
S	0	8	8	20	29	3	0	0	0	0	0	68
SSW	0	4	9	8	11	3	0	0	0	0	0	35
SW	0	3	10	5	8	1	0	0	0	0	0	27
WSW	0	5	13	12	8	1	0	0	0	0	0	39
W	0	4	11	11	12	0	0	0	0	0	0	38
WNW	0	13	8	15	13	4	0	0	0	0	0	53
NW	1	2	8	17	19	4	0	0	0	0	0	51
NNW	0	6	24	41	37	9	0	0	0	0	0	117
Tot	1	87	196	287	487	86	2	0	1	0	0	1147

Hours of Calm	9
Hours of Variable Direction	3
Hours of Valid Data	1159
Hours of Missing Data	11
Hours in Period	8784

Table 2.3.2-206 (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, 2008)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
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	3	11	20	48	63	70	86	222	108	71	702
NNE	0	3	11	17	60	66	75	93	207	60	12	604
NE	0	4	9	16	81	96	93	77	98	26	2	502
ENE	0	1	9	19	53	75	87	84	64	9	0	401
E	0	5	9	14	63	88	102	102	89	15	2	489
ESE	0	2	13	17	59	89	140	153	177	19	7	676
SE	0	1	5	11	46	88	134	262	505	203	77	1332
SSE	0	2	3	10	54	78	174	304	774	315	220	1934
S	0	4	9	9	42	75	141	206	279	98	122	985
SSW	0	2	8	8	31	40	53	49	51	25	4	271
SW	0	1	7	7	28	31	18	22	28	4	0	146
WSW	0	1	7	13	18	9	4	11	23	2	1	89
W	0	1	5	9	13	13	9	14	14	4	1	83
WNW	0	0	1	6	9	15	7	5	17	12	4	76
NW	0	5	10	12	27	24	16	16	34	21	26	191
NNW	0	2	12	13	33	39	37	33	58	37	24	288
Tot	0	37	129	201	665	889	1160	1517	2640	958	573	8769

Hours of Calm	2
Hours of Variable Direction	1
Hours of Valid Data	8772
Hours of Missing Data	12
Hours in Period	8784

Table 2.3.2-206 (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, 2008)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
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	0	4	6	23	17	7	57
NNE	0	0	0	0	0	3	3	7	13	10	4	40
NE	0	0	0	0	0	4	0	1	5	1	0	11
ENE	0	0	0	0	0	0	0	3	2	1	0	6
E	0	0	0	0	0	0	0	2	3	0	0	5
ESE	0	0	0	0	0	0	0	2	3	0	0	5
SE	0	0	0	0	0	1	3	3	30	34	7	78
SSE	0	0	0	0	0	1	4	9	56	59	37	166
S	0	0	0	0	1	0	0	5	12	12	18	48
SSW	0	0	0	0	1	0	0	1	4	2	2	10
SW	0	0	0	0	0	0	0	1	2	0	0	3
WSW	0	0	0	0	0	0	0	0	2	0	0	2
W	0	0	0	0	0	0	0	2	1	0	0	3
WNW	0	0	0	0	0	0	0	1	3	0	1	5
NW	0	0	0	0	0	0	0	0	9	1	9	19
NNW	0	0	0	0	0	0	4	3	6	12	3	28
Tot	0	0	0	0	2	9	18	46	174	149	88	486

Hours of Calm	0
Hours of Variable Direction	0
Hours of Valid Data	486
Hours of Missing Data	12
Hours in Period	8784

Table 2.3.2-206 (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, 2008)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
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	0	2	5	5	6	7	6	3	34
NNE	0	0	0	0	0	2	3	2	7	5	2	21
NE	0	0	0	1	3	3	3	3	1	1	0	15
ENE	0	0	0	0	1	3	5	6	3	0	0	18
E	0	0	0	0	3	2	3	5	5	1	0	19
ESE	0	0	0	0	3	2	11	4	7	3	0	30
SE	0	0	0	0	2	3	6	14	29	18	8	80
SSE	0	0	0	0	3	1	11	9	44	20	24	112
S	0	0	0	0	1	1	5	19	26	11	9	72
SSW	0	0	0	0	0	0	6	5	5	0	1	17
SW	0	0	0	0	0	0	1	1	1	0	0	3
WSW	0	0	0	0	0	0	0	0	1	0	0	1
W	0	0	0	0	0	0	0	2	2	0	0	4
WNW	0	0	0	0	0	1	0	0	2	1	1	5
NW	0	0	0	0	1	1	3	3	5	3	2	18
NNW	0	0	0	0	0	2	4	0	5	5	5	21
Tot	0	0	0	1	19	26	66	79	150	74	55	470

Hours of Calm	0
Hours of Variable Direction	0
Hours of Valid Data	470
Hours of Missing Data	12
Hours in Period	8784

Table 2.3.2-206 (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, 2008)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
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	11	11	11	6	11	5	2	59
NNE	0	0	1	1	12	3	5	6	14	2	0	44
NE	0	0	1	3	6	12	12	6	1	1	0	42
ENE	0	0	0	1	10	3	7	5	3	0	0	29
E	0	0	0	1	7	16	10	8	6	0	1	49
ESE	0	0	0	2	7	10	8	8	11	1	0	47
SE	0	0	1	2	7	7	9	22	43	18	3	112
SSE	0	0	0	0	7	8	8	10	54	18	25	130
S	0	0	1	0	3	4	12	11	20	8	26	85
SSW	0	0	1	0	1	5	6	5	8	0	0	26
SW	0	0	0	0	1	3	3	4	0	0	0	11
WSW	0	0	1	1	2	0	0	1	1	0	0	6
W	0	0	0	0	3	0	1	2	1	0	0	7
WNW	0	0	0	1	0	0	3	0	1	1	0	6
NW	0	0	0	1	4	3	1	1	1	1	0	12
NNW	0	0	1	1	4	4	2	0	3	3	5	23
Tot	0	0	8	15	85	89	98	95	178	58	62	688

Hours of Calm	0
Hours of Variable Direction	0
Hours of Valid Data	688
Hours of Missing Data	12
Hours in Period	8784

Table 2.3.2-206 (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, 2008)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
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	3	10	19	20	22	23	73	41	29	240
NNE	0	2	4	9	28	31	33	30	73	15	2	227
NE	0	3	3	5	40	27	18	10	21	12	1	140
ENE	0	1	3	8	19	17	14	8	10	2	0	82
E	0	2	7	6	22	23	14	20	27	9	1	131
ESE	0	0	2	3	14	23	26	33	52	12	6	171
SE	0	0	2	4	16	26	36	56	142	103	51	436
SSE	0	1	1	4	7	21	32	52	149	125	125	517
S	0	2	3	3	18	23	22	30	69	39	67	276
SSW	0	1	3	1	12	12	13	13	12	11	1	79
SW	0	0	3	2	10	9	4	4	4	0	0	36
WSW	0	1	1	6	6	2	1	3	0	1	0	21
W	0	0	3	3	6	3	2	1	1	1	1	21
WNW	0	0	0	2	4	3	1	1	6	3	2	22
NW	0	1	5	8	11	11	3	4	9	3	8	63
NNW	0	0	8	4	12	15	5	9	18	9	10	90
Tot	0	14	51	78	244	266	246	297	666	386	304	2552

Hours of Calm	0
Hours of Variable Direction	0
Hours of Valid Data	2552
Hours of Missing Data	12
Hours in Period	8784

Table 2.3.2-206 (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, 2008)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
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	4	3	9	13	15	21	47	37	30	180
NNE	0	0	3	2	11	18	15	22	33	20	4	128
NE	0	0	2	5	14	26	24	15	31	4	1	122
ENE	0	0	3	5	11	31	30	23	12	0	0	115
E	0	1	1	0	10	25	34	28	25	4	0	128
ESE	0	0	6	7	8	18	31	51	34	1	1	157
SE	0	0	0	3	6	23	31	74	147	21	8	313
SSE	0	0	1	4	10	18	41	84	235	50	9	452
S	0	1	3	5	6	18	37	50	66	17	2	205
SSW	0	1	3	5	5	7	5	8	2	8	0	44
SW	0	1	1	1	5	9	5	3	5	1	0	31
WSW	0	0	0	3	2	2	1	2	1	0	1	12
W	0	0	0	2	1	3	2	2	3	2	0	15
WNW	0	0	0	1	0	5	1	2	0	5	0	14
NW	0	0	2	2	5	4	3	4	3	8	7	38
NNW	0	1	2	6	9	7	10	8	22	8	1	74
Tot	0	6	31	54	112	227	285	397	666	186	64	2028

Hours of Calm	0
Hours of Variable Direction	1
Hours of Valid Data	2029
Hours of Missing Data	12
Hours in Period	8784

Table 2.3.2-206 (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, 2008)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
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	1	0	3	6	10	10	16	34	1	0	81
NNE	0	1	2	4	6	5	8	13	37	7	0	83
NE	0	0	1	0	9	11	22	24	21	4	0	92
ENE	0	0	0	1	8	13	12	19	11	3	0	67
E	0	2	0	4	8	13	29	16	9	1	0	82
ESE	0	0	0	2	12	24	43	39	34	1	0	155
SE	0	1	1	1	8	18	27	49	50	3	0	158
SSE	0	0	0	1	14	18	62	119	132	5	0	351
S	0	1	1	0	6	14	40	67	51	2	0	182
SSW	0	0	1	1	3	5	13	9	6	0	0	38
SW	0	0	2	3	5	9	1	2	3	2	0	27
WSW	0	0	1	0	4	2	1	2	1	0	0	11
W	0	1	1	2	0	3	0	4	3	0	0	14
WNW	0	0	0	0	4	3	0	0	2	1	0	10
NW	0	0	1	0	3	4	1	2	4	3	0	18
NNW	0	0	0	0	3	5	4	6	0	0	0	18
Tot	0	7	11	22	99	157	273	387	398	33	0	1387

Hours of Calm	1
Hours of Variable Direction	0
Hours of Valid Data	1388
Hours of Missing Data	12
Hours in Period	8784

Table 2.3.2-206 (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, 2008)

Site: Exelon Victoria County
Period: Months Jul - Jun for years 2007 - 2008
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	3	3	1	4	3	8	27	1	0	51
NNE	0	0	1	1	3	4	8	13	30	1	0	61
NE	0	1	2	2	9	13	14	18	18	3	0	80
ENE	0	0	3	4	4	8	19	20	23	3	0	84
E	0	0	1	3	13	9	12	23	14	0	0	75
ESE	0	2	5	3	15	12	21	16	36	1	0	111
SE	0	0	1	1	7	10	22	44	64	6	0	155
SSE	0	1	1	1	13	11	16	21	104	38	0	206
S	0	0	1	1	7	15	25	24	35	9	0	117
SSW	0	0	0	1	9	11	10	8	14	4	0	57
SW	0	0	1	1	7	1	4	7	13	1	0	35
WSW	0	0	4	3	4	3	1	3	17	1	0	36
W	0	0	1	2	3	4	4	1	3	1	0	19
WNW	0	0	1	2	1	3	2	1	3	1	0	14
NW	0	4	2	1	3	1	5	2	3	2	0	23
NNW	0	1	1	2	5	6	8	7	4	0	0	34
Tot	0	10	28	31	104	115	174	216	408	72	0	1158

Hours of Calm	1
Hours of Variable Direction	0
Hours of Valid Data	1159
Hours of Missing Data	12
Hours in Period	8784

Table 2.3.2-207
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	NA[d]	NA[d]	NA[d]	NA[d]	42.17	NA[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	NA[d]
Karnes City 2N	80.4	57.8	22.6	69.1	28.35	NA[d]

a. NCDC Climatography No. 81 1971-2000 (Reference 2.3.2-203)
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 2.3.2-202)
d. NA = Measurements not made at this station

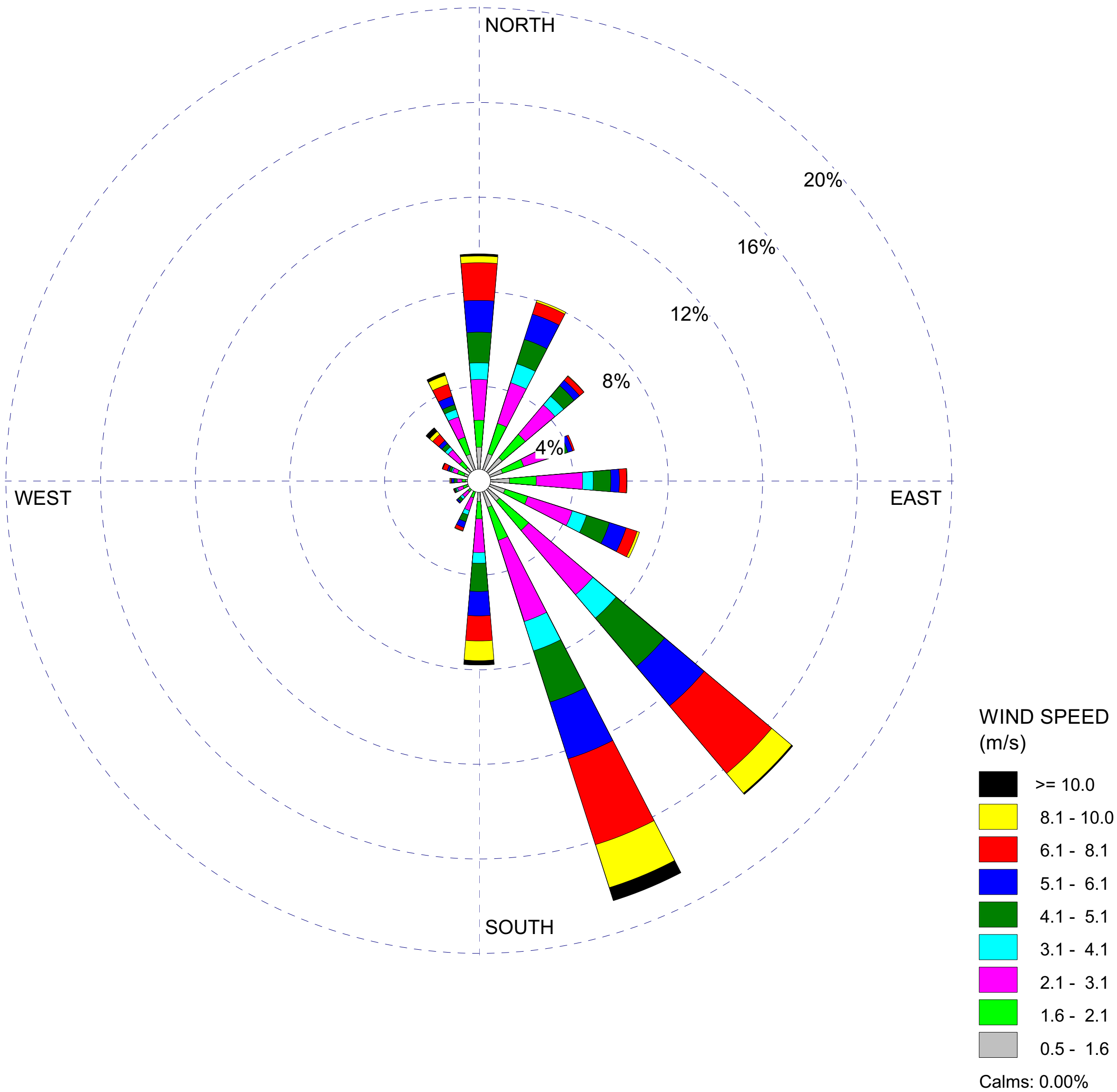


Figure 2.3.2-201 10-Meter Level Wind Rose — Annual VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)

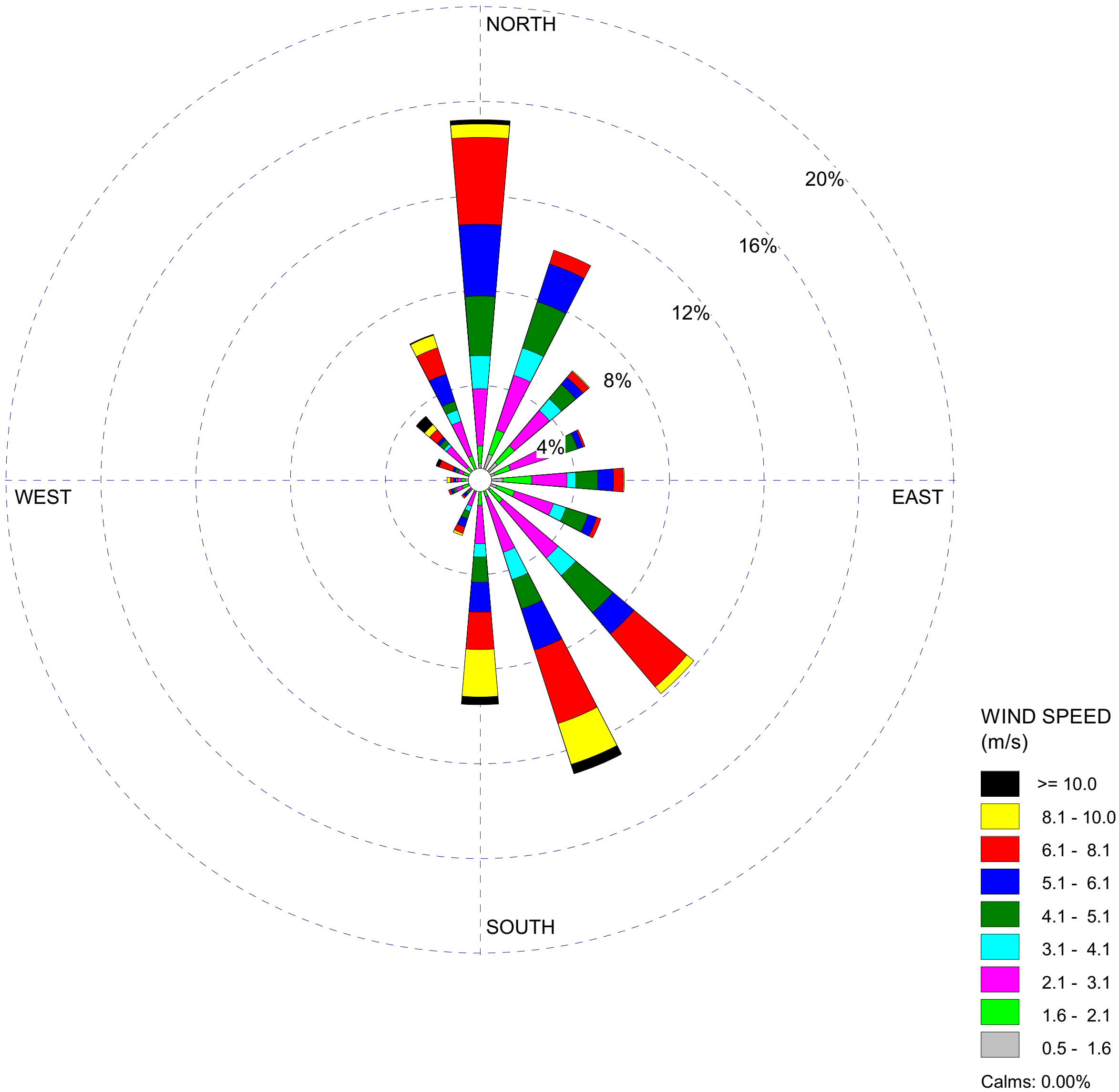


Figure 2.3.2-202 10-Meter Level Wind Rose — Winter VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)

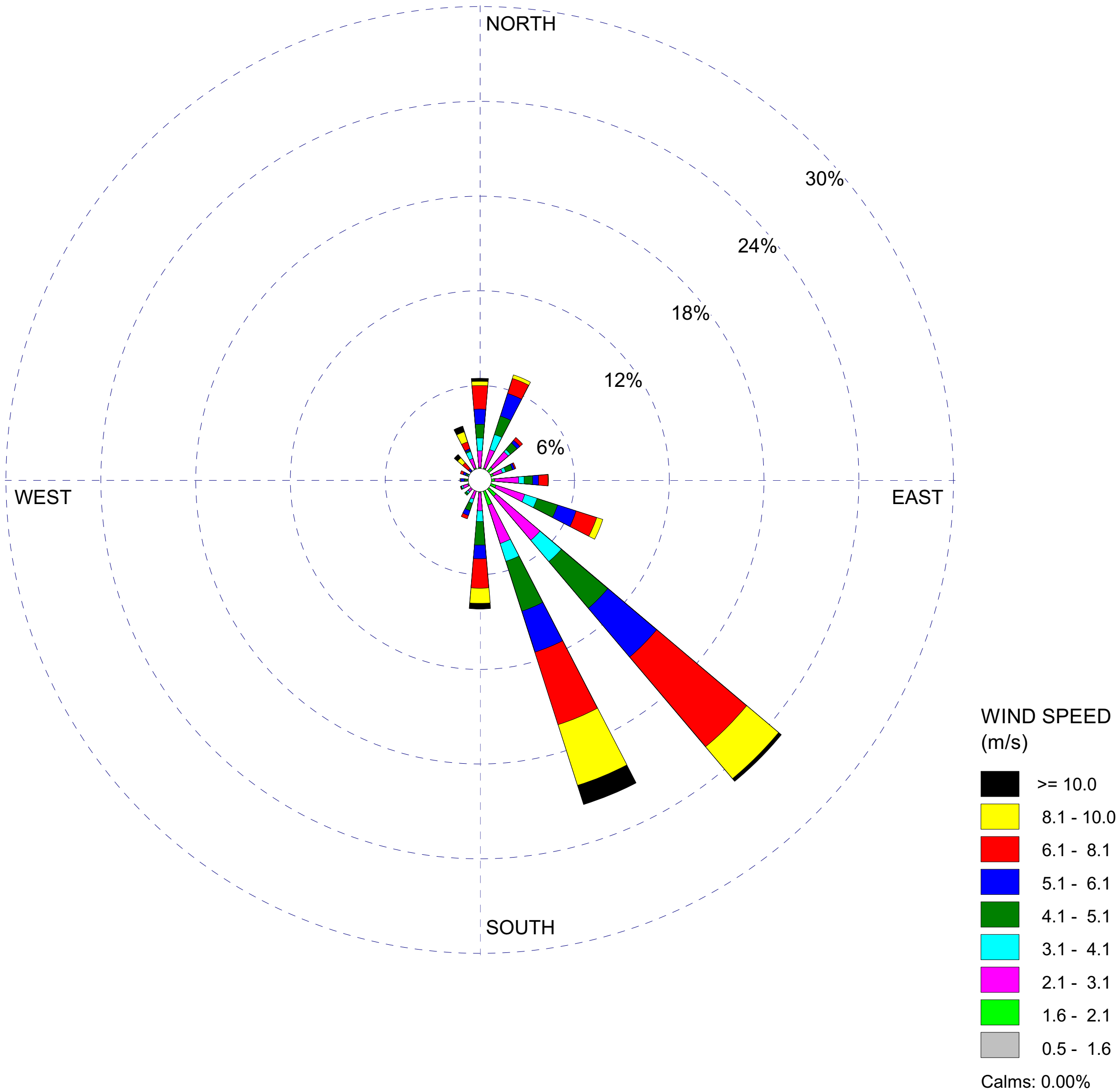


Figure 2.3.2-203 10-Meter Level Wind Rose — Spring
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)

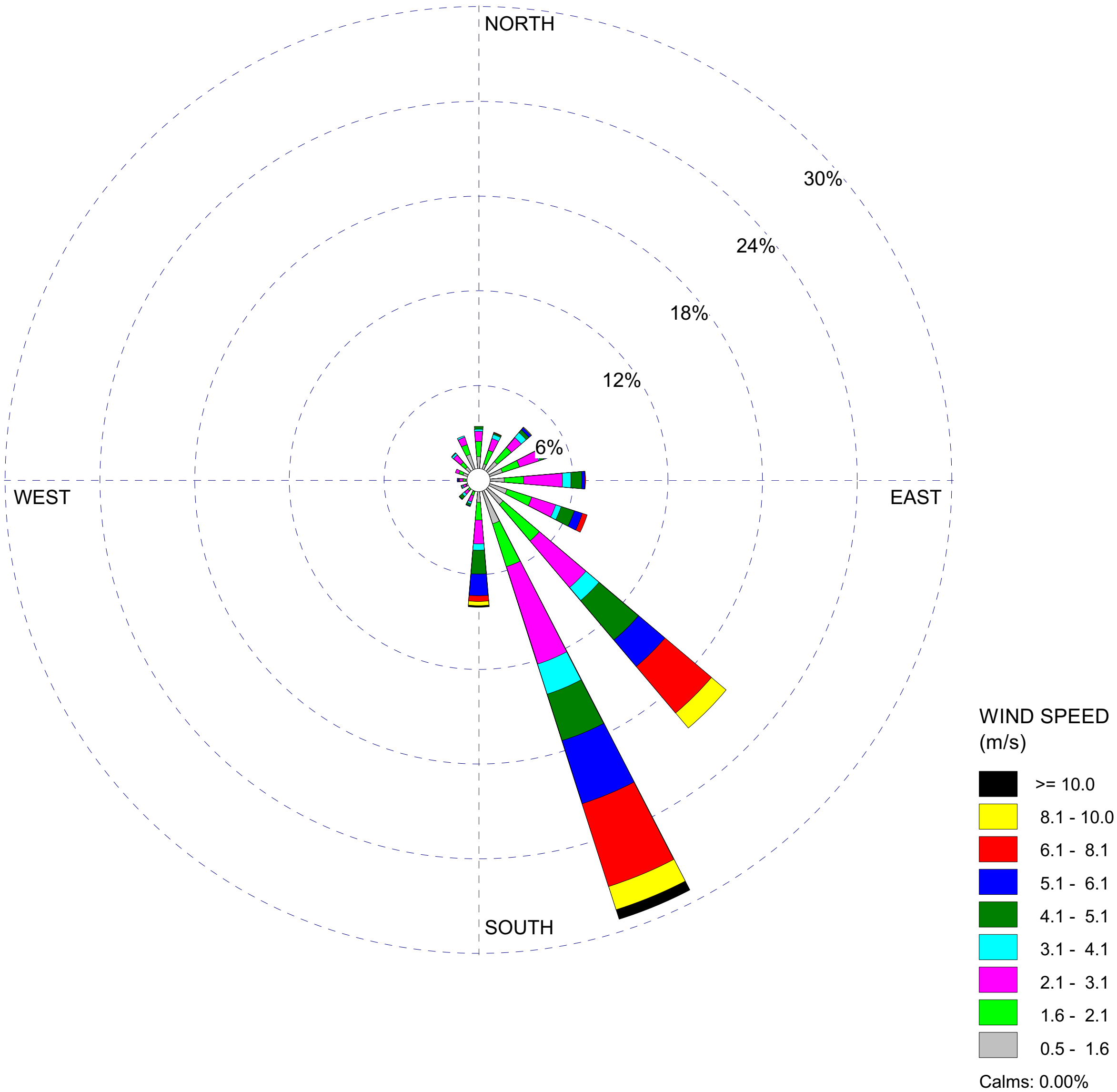


Figure 2.3.2-204 10-Meter Level Wind Rose — Summer
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)

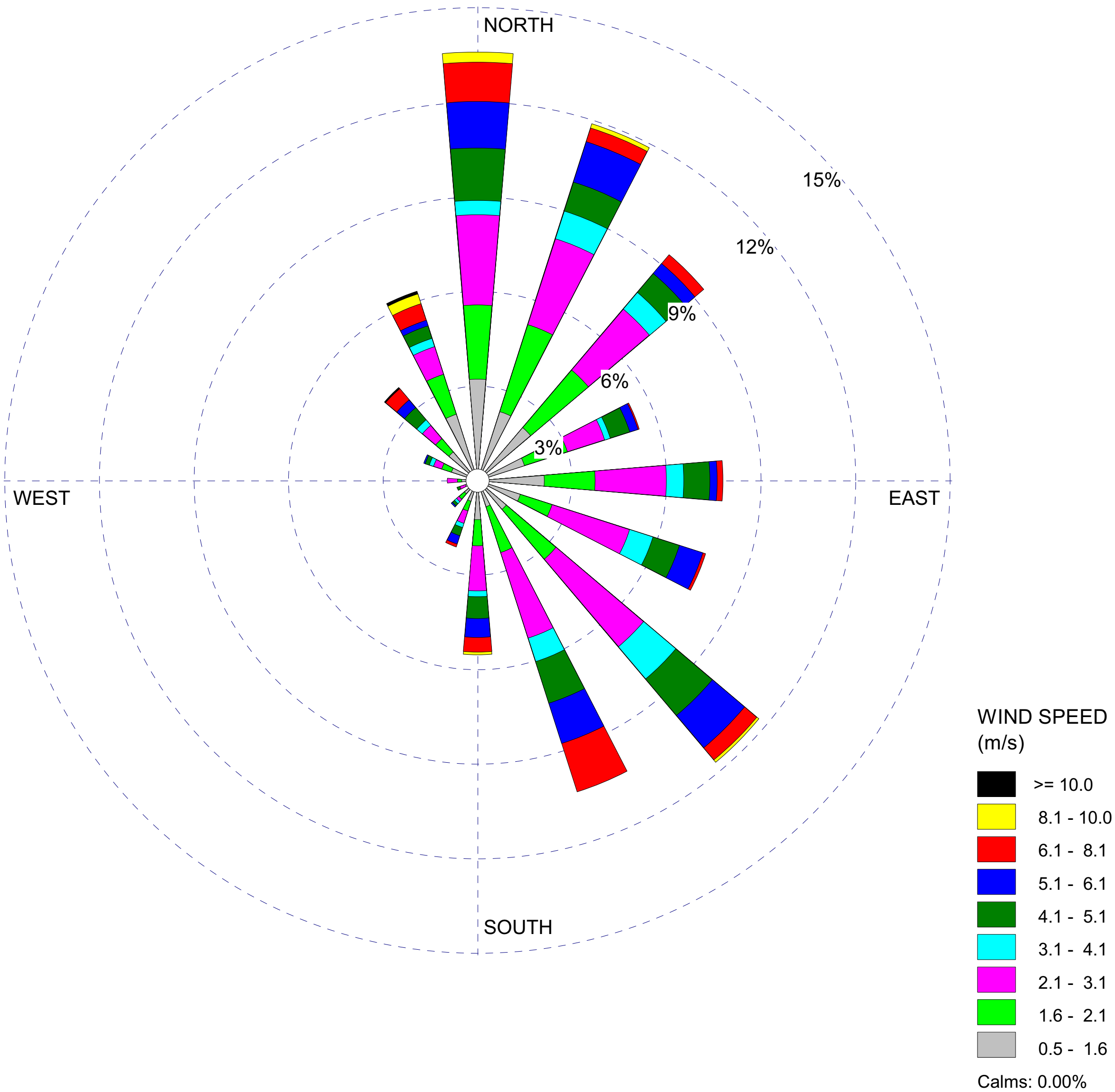


Figure 2.3.2-205 10-Meter Level Wind Rose — Autumn
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)

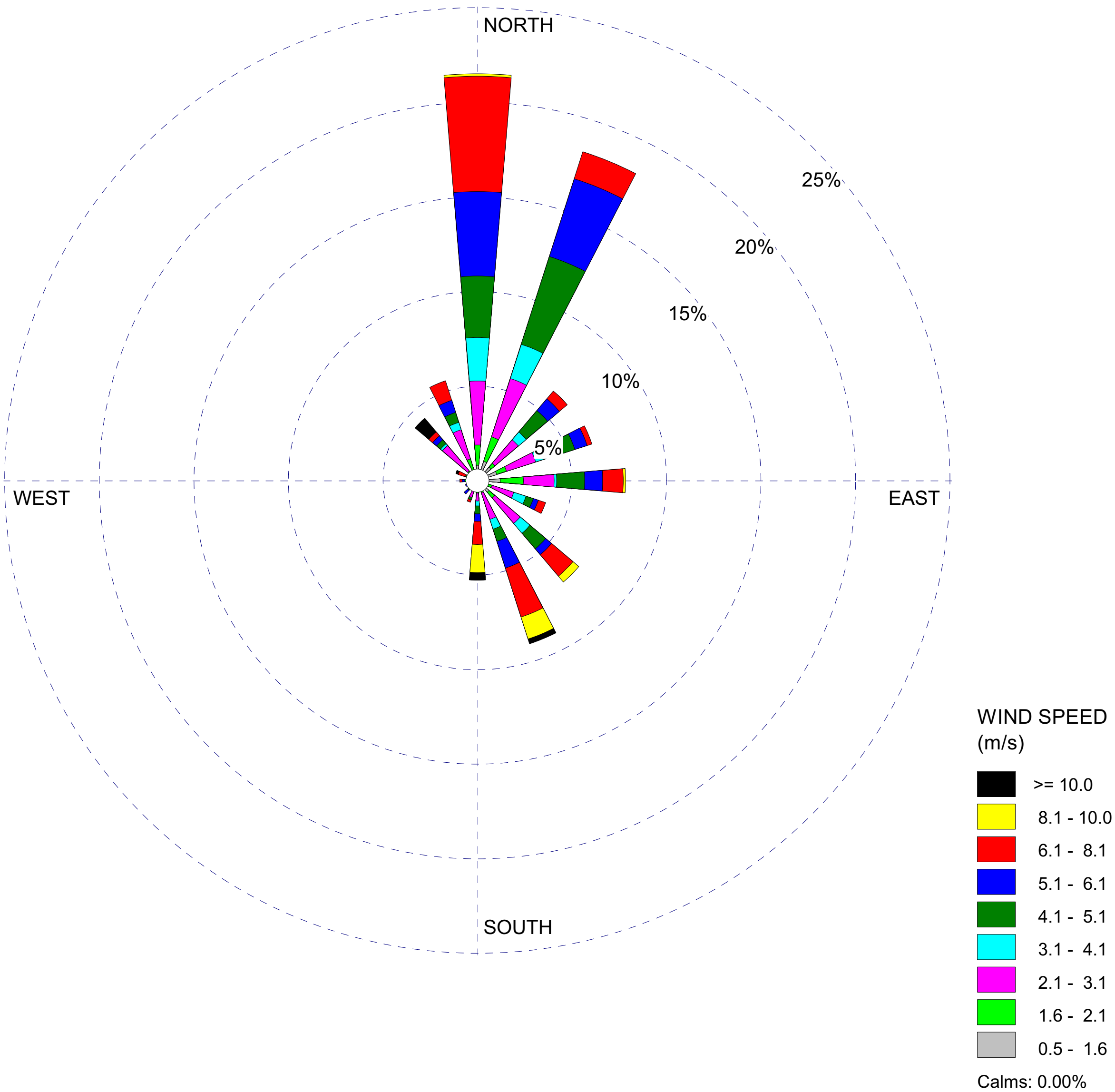


**Figure 2.3.2-206 10-Meter Level Wind Rose — January (Sheet 1 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)**

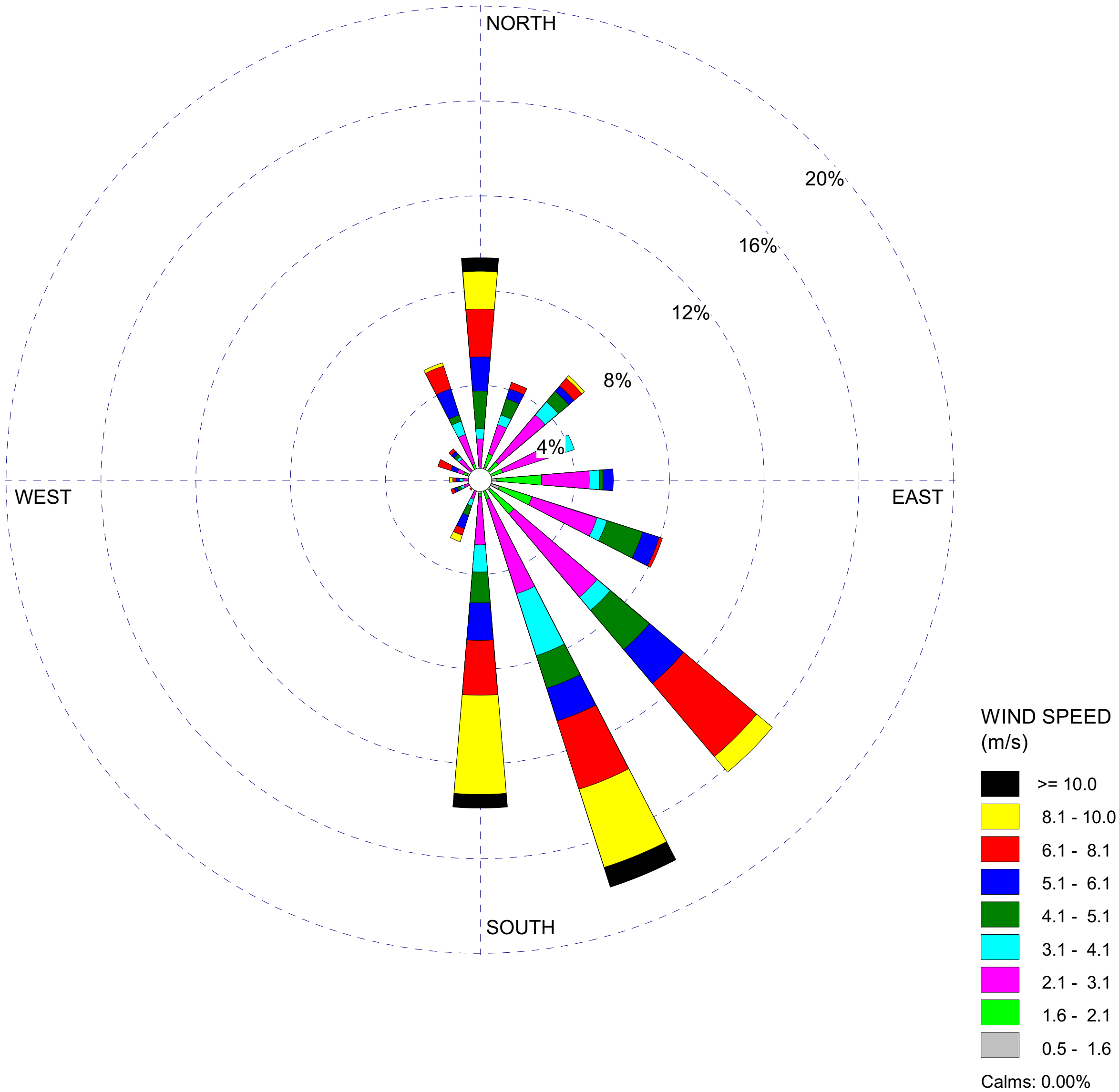


Figure 2.3.2-206 10-Meter Level Wind Rose — February (Sheet 2 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)

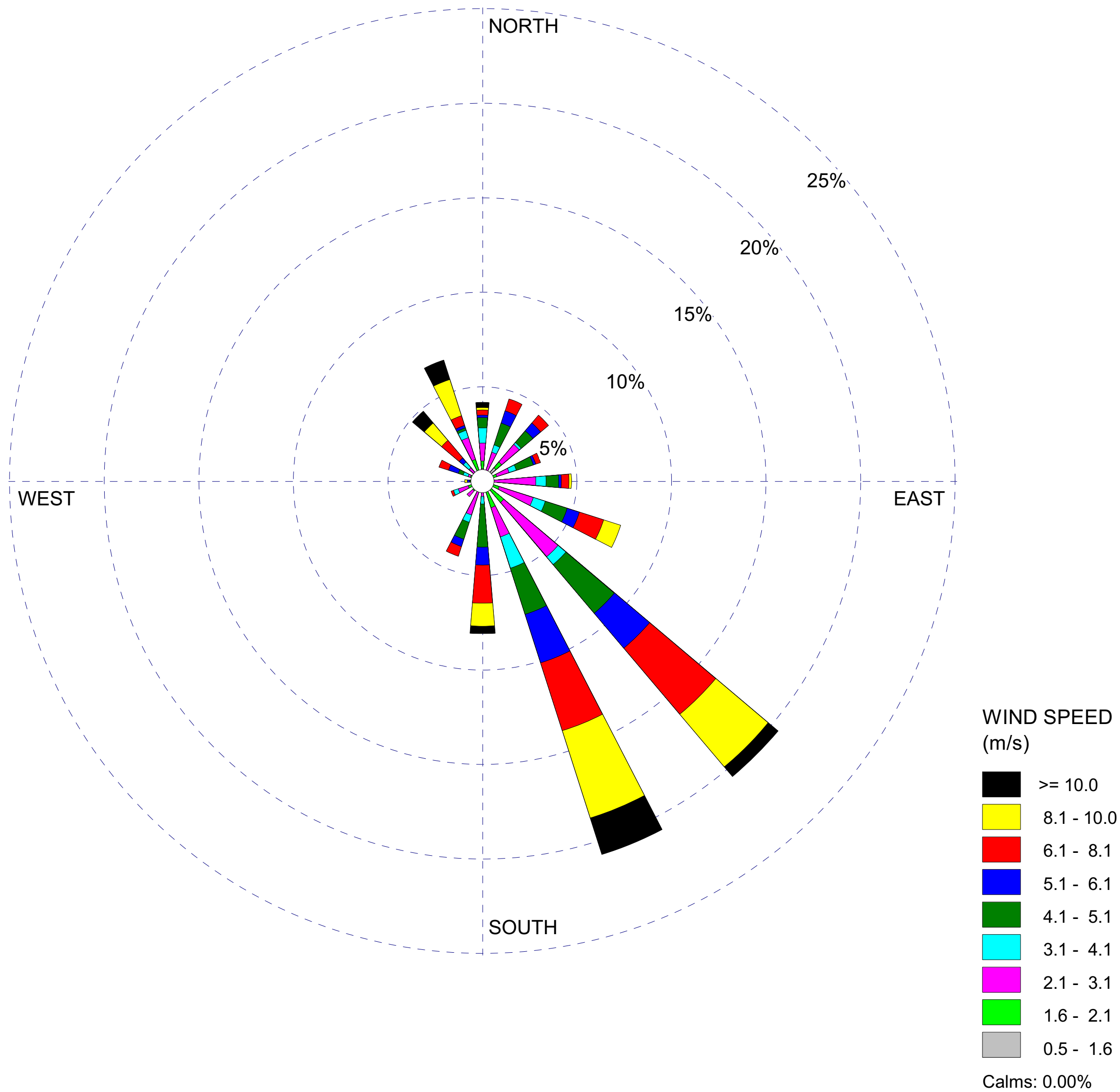


Figure 2.3.2-206 10-Meter Level Wind Rose — March (Sheet 3 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)

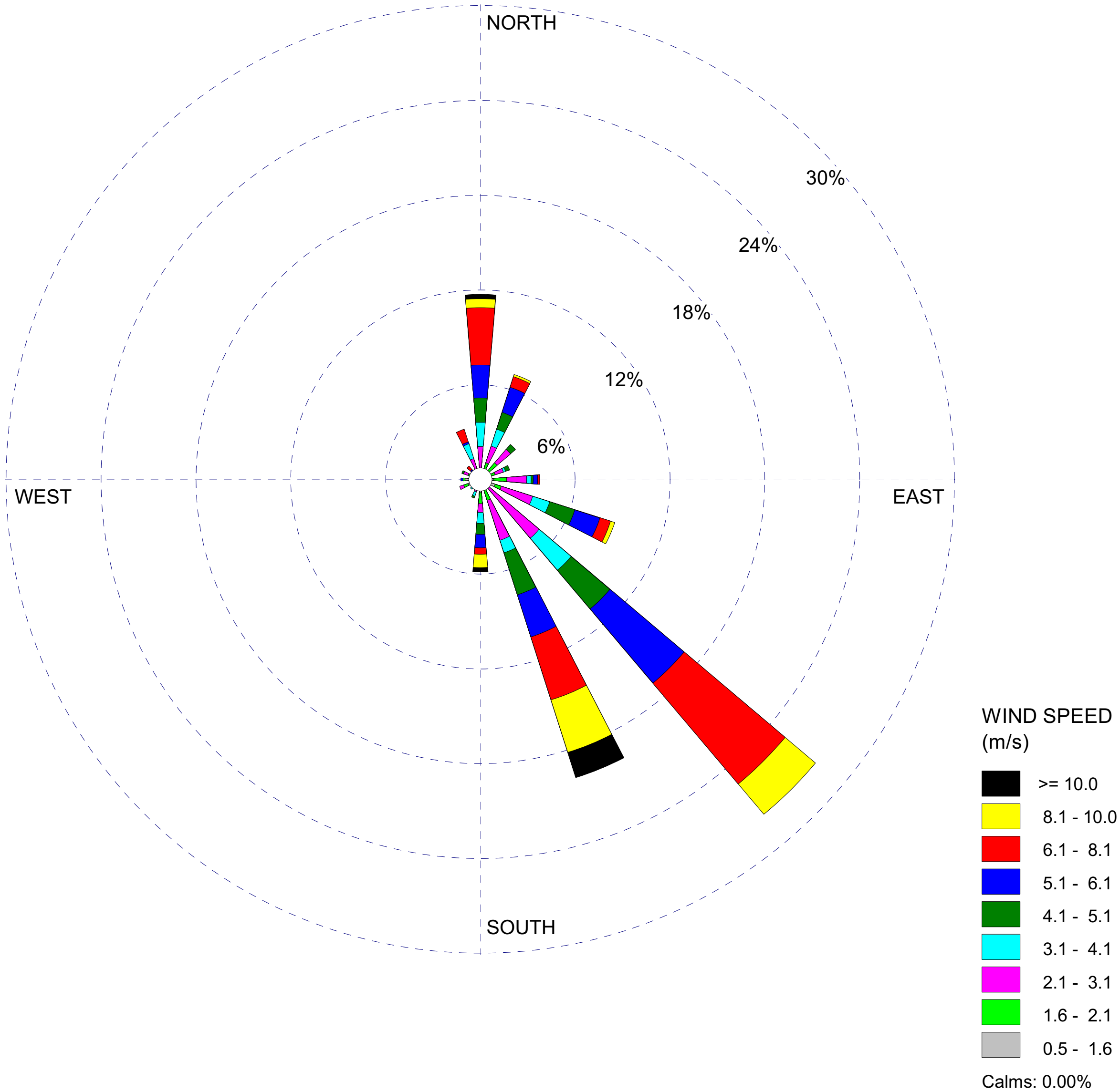


**Figure 2.3.2-206 10-Meter Level Wind Rose — April (Sheet 4 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)**

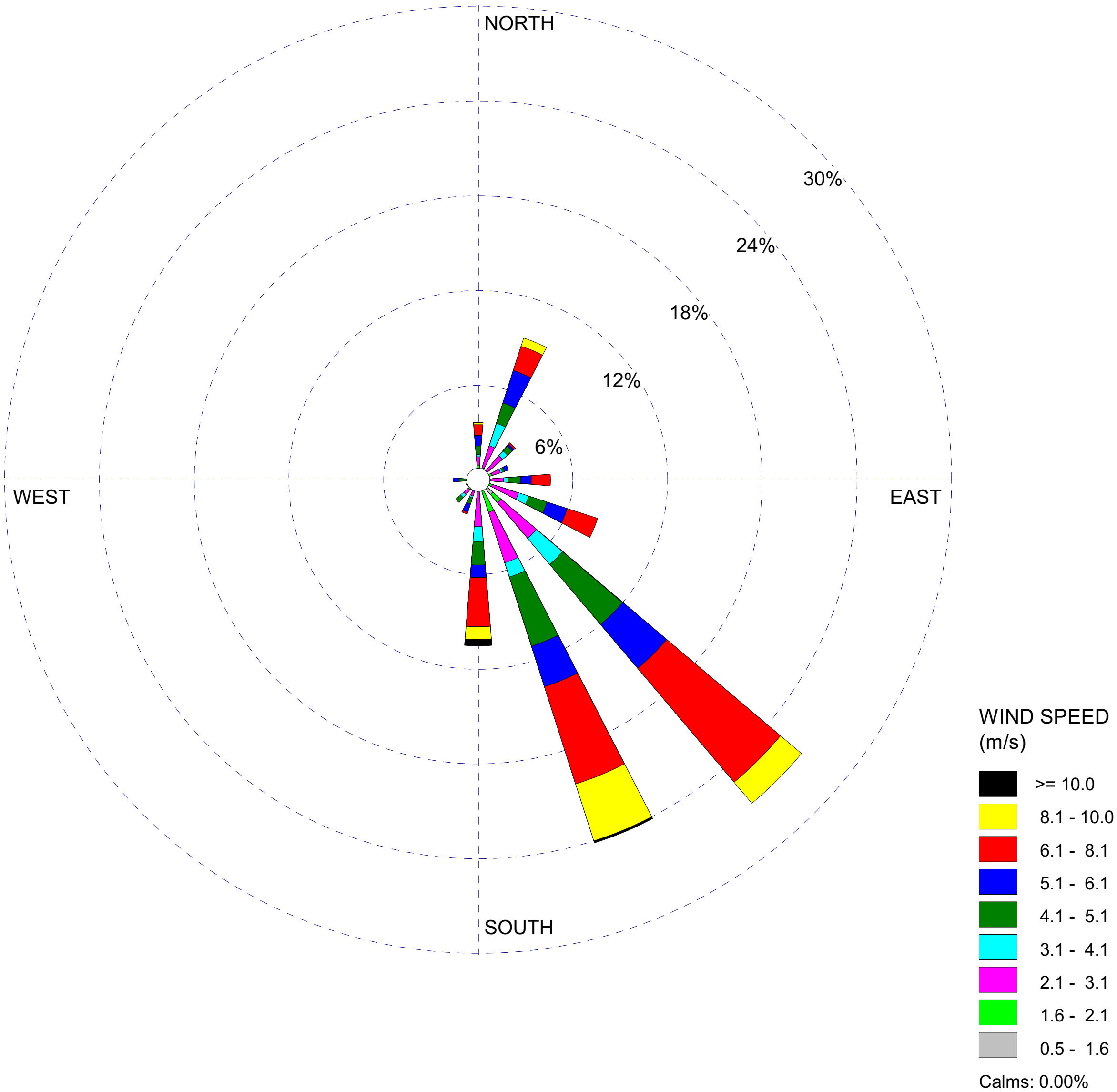


Figure 2.3.2-206 10-Meter Level Wind Rose — May (Sheet 5 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)

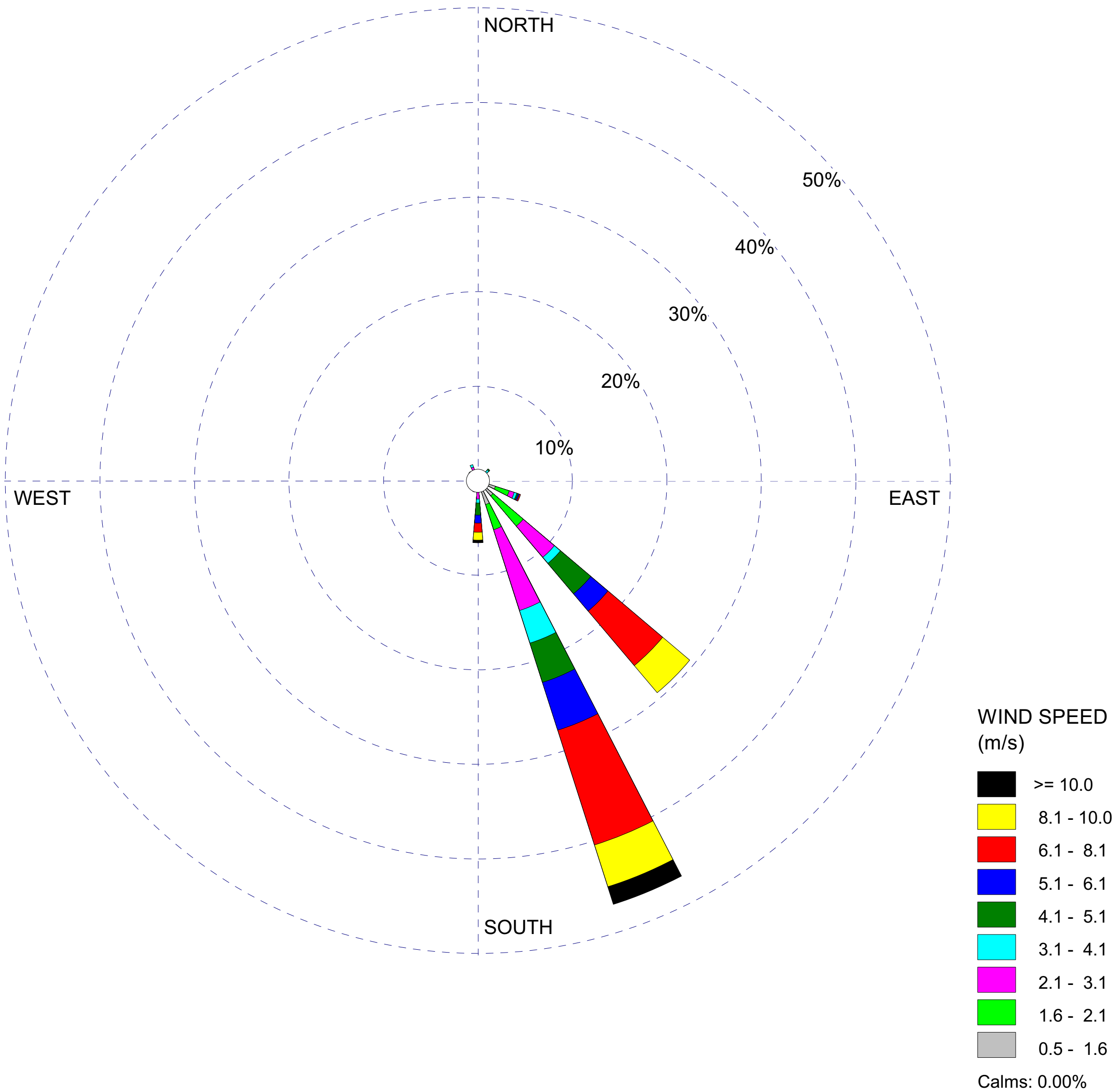


Figure 2.3.2-206 10-Meter Level Wind Rose — June (Sheet 6 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)

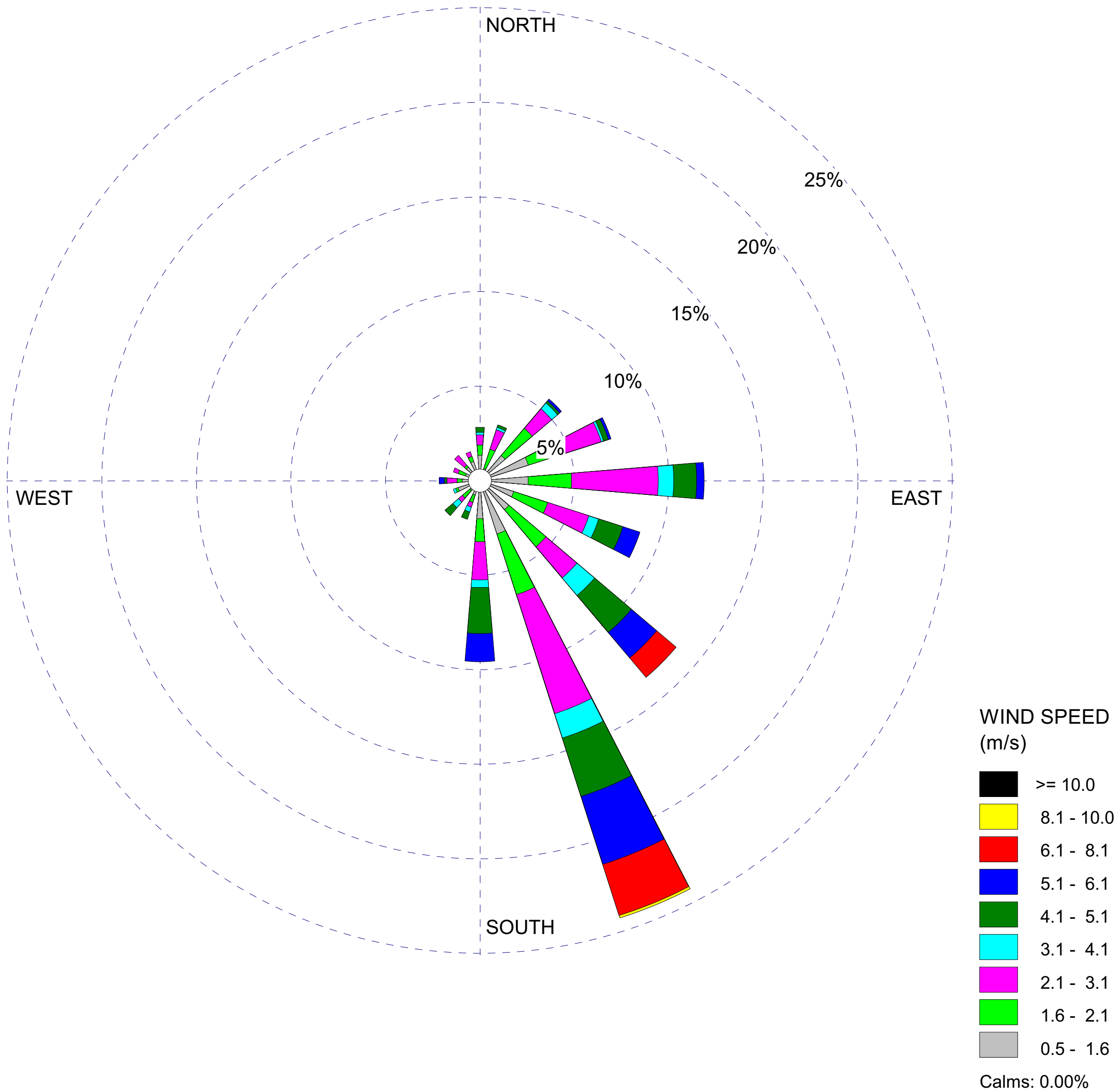


Figure 2.3.2-206 10-Meter Level Wind Rose — July (Sheet 7 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)

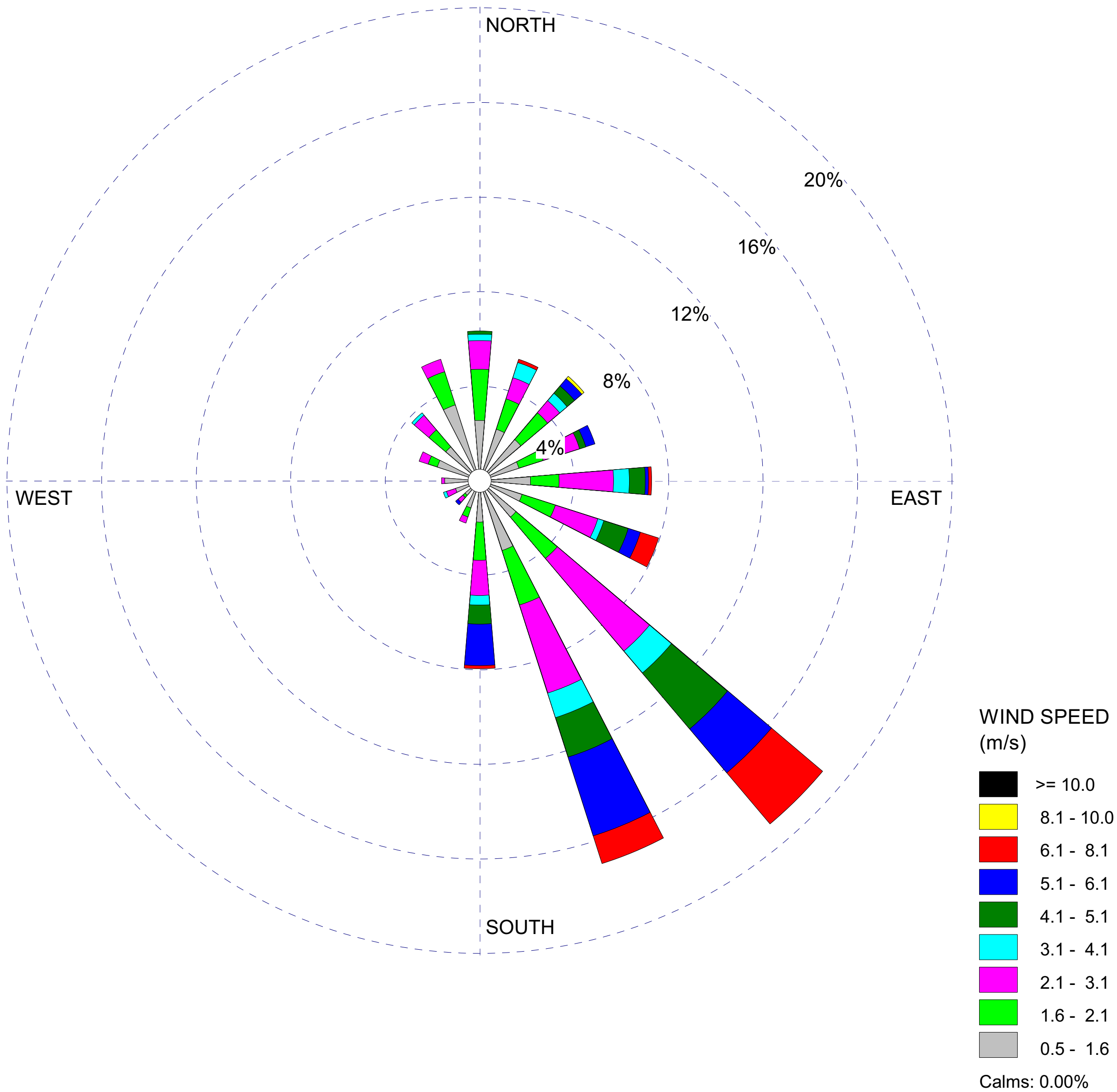


**Figure 2.3.2-206 10-Meter Level Wind Rose — August (Sheet 8 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)**

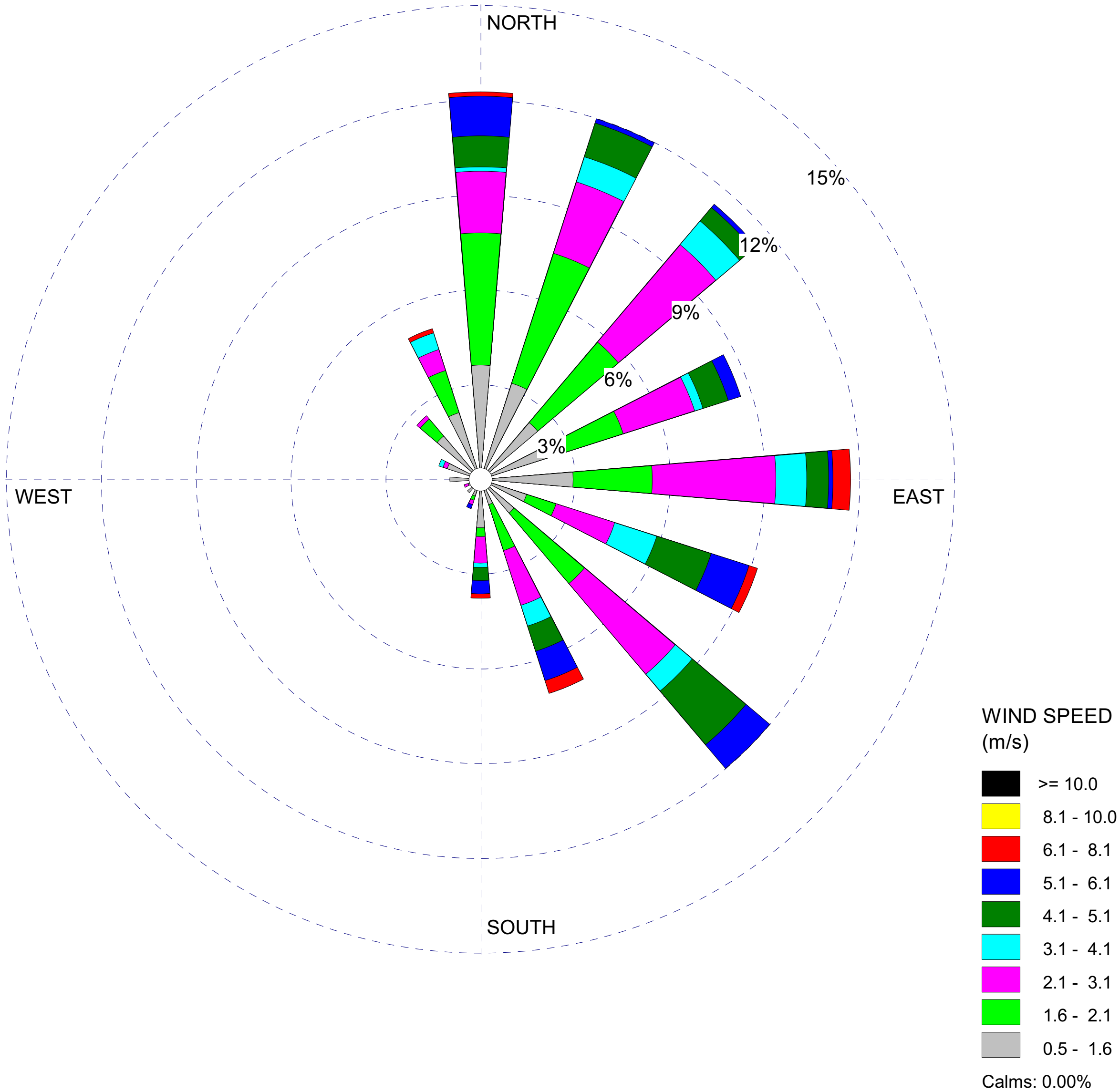


**Figure 2.3.2-206 10-Meter Level Wind Rose — September (Sheet 9 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)**

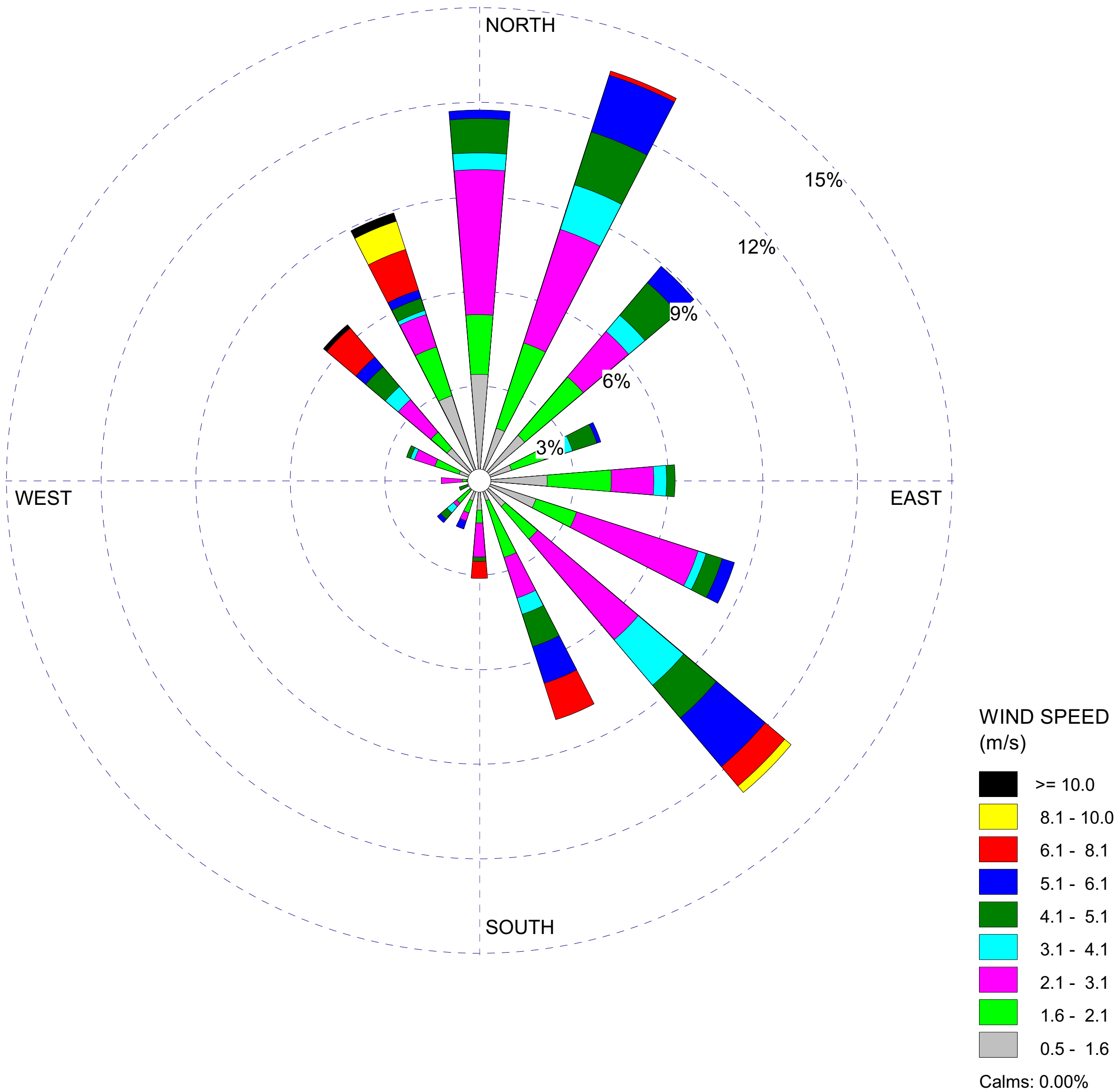


Figure 2.3.2-206 10-Meter Level Wind Rose — October (Sheet 10 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)

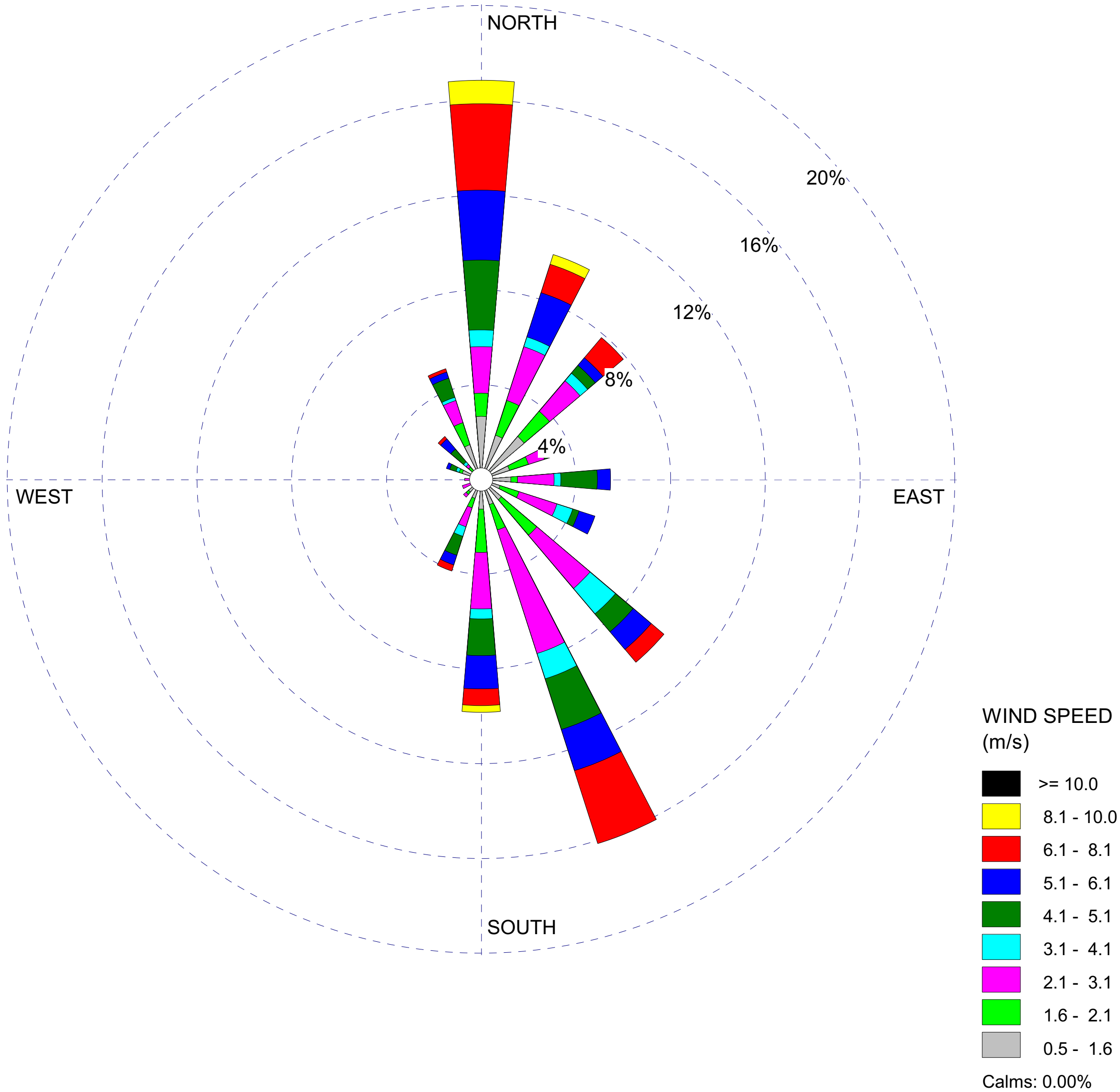


Figure 2.3.2-206 10-Meter Level Wind Rose — November (Sheet 11 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)

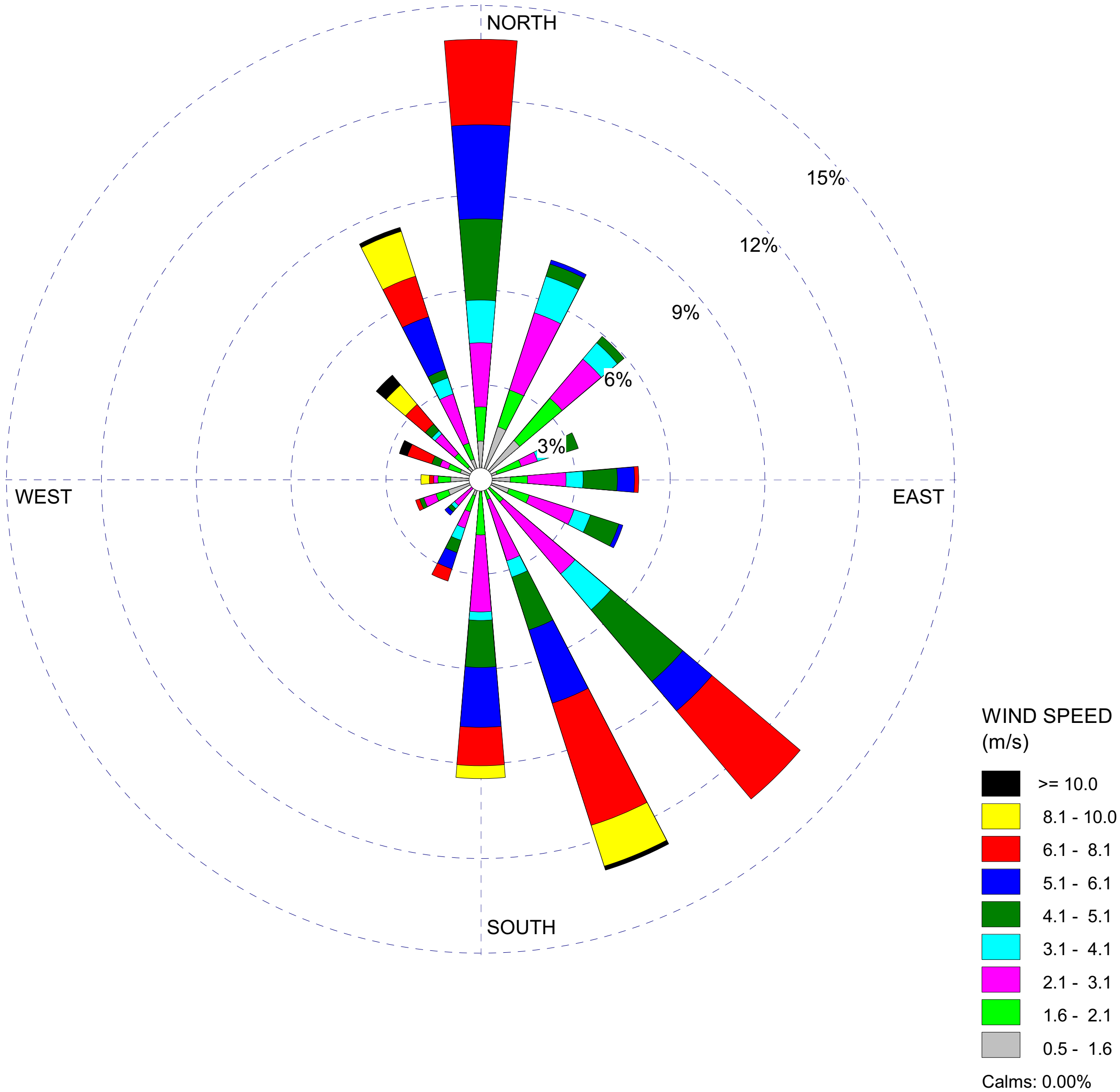


**Figure 2.3.2-206 10-Meter Level Wind Rose — December (Sheet 12 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)**

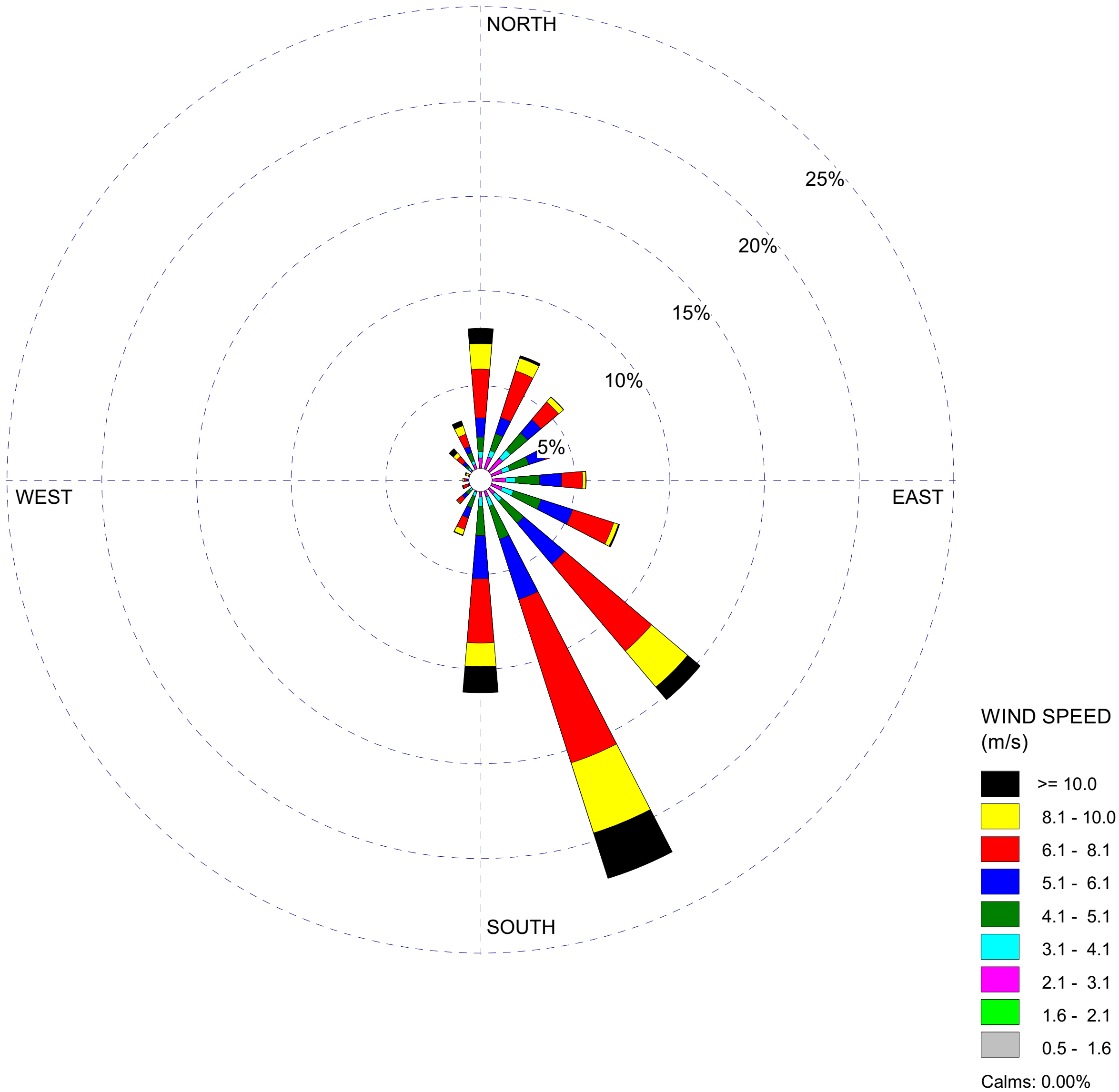


Figure 2.3.2-207 60-Meter Level Wind Rose — Annual VCS Pre-Application Monitoring Program (July 1, 2007 –June 30, 2008)

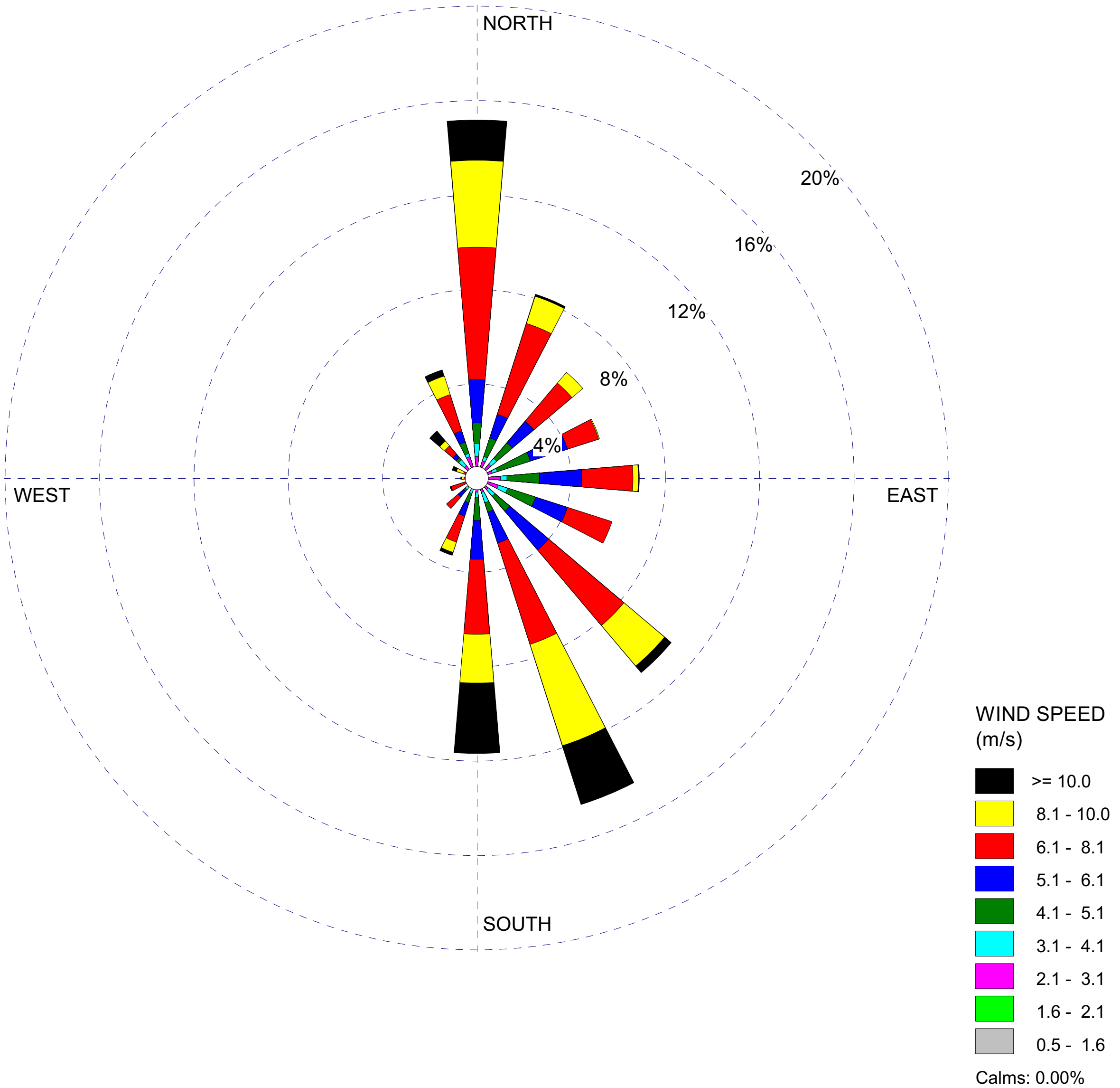


Figure 2.3.2-208 60-Meter Level Wind Rose — Winter
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)

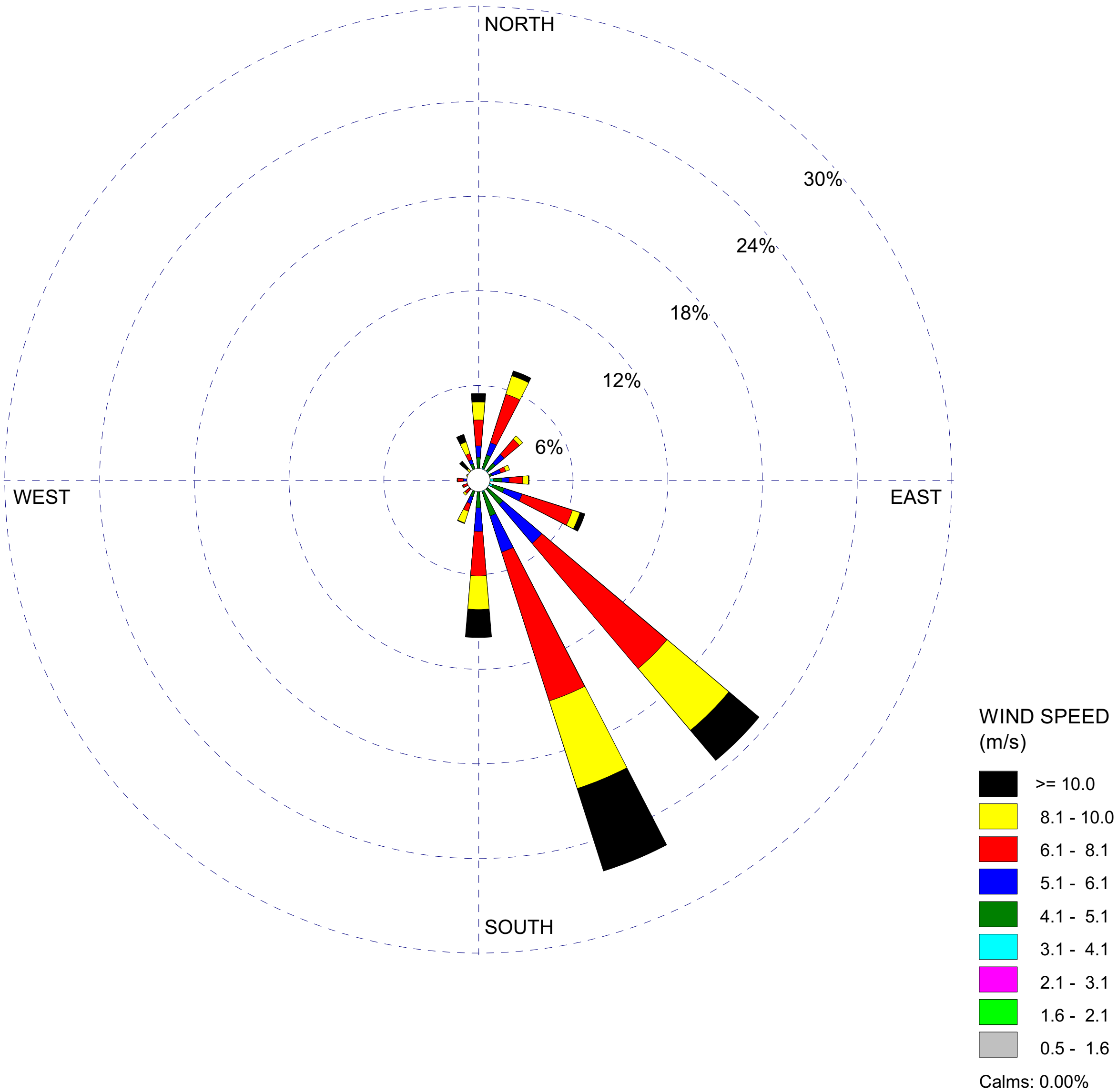


Figure 2.3.2-209 60-Meter Level Wind Rose — Spring
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)

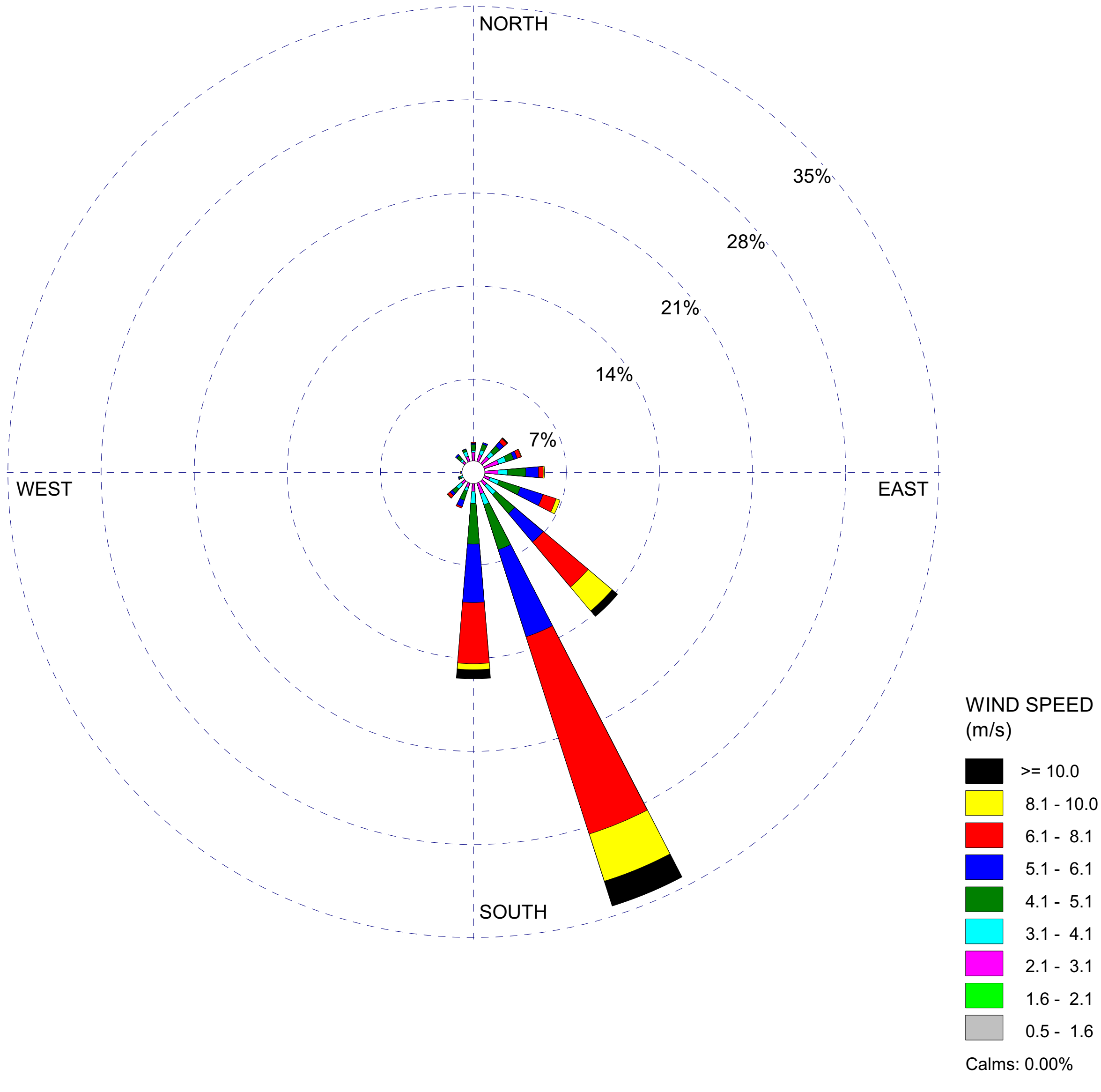


Figure 2.3.2-210 60-Meter Level Wind Rose — Summer
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)

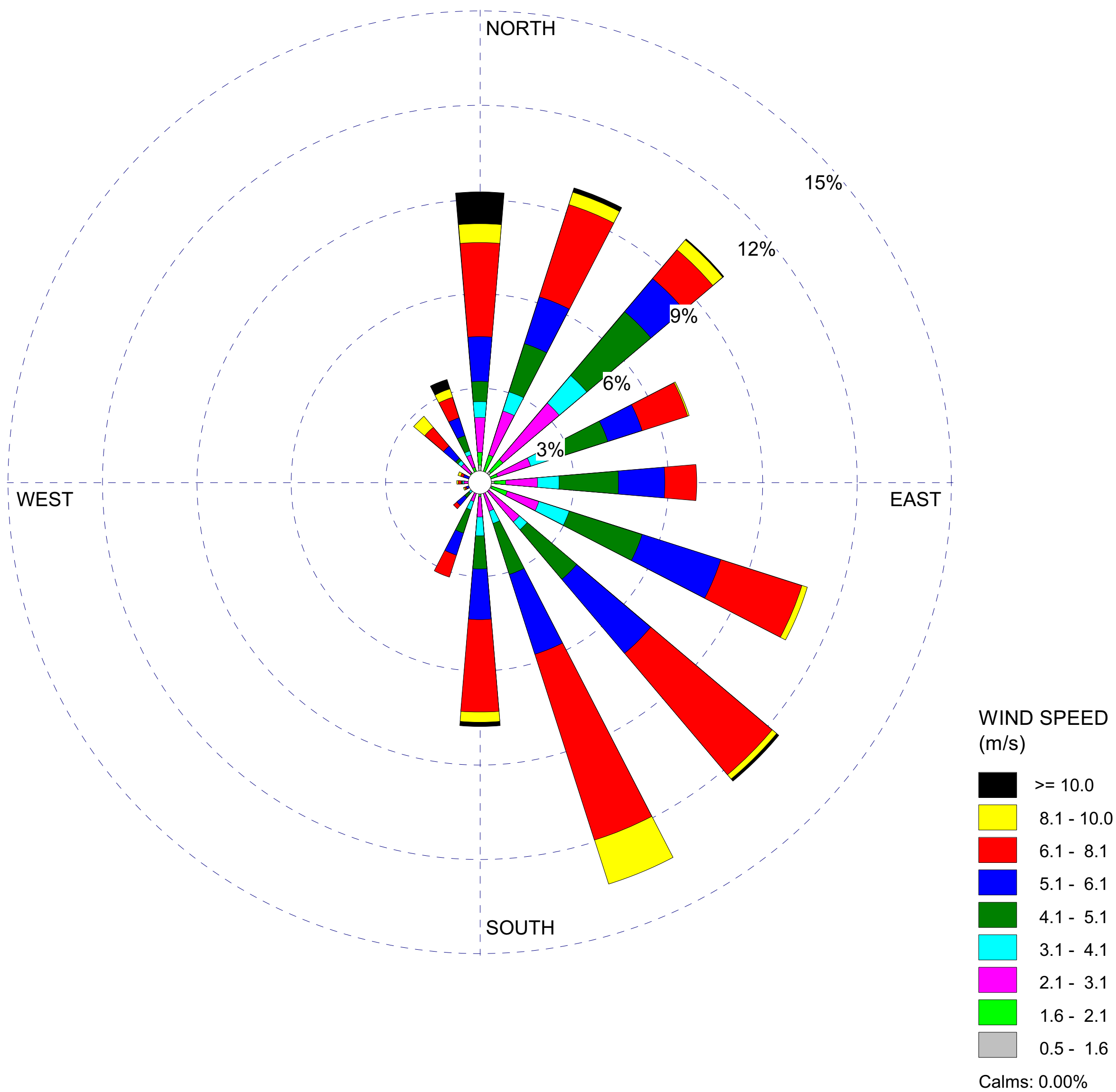


**Figure 2.3.2-211 60-Meter Level Wind Rose — Autumn
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)**

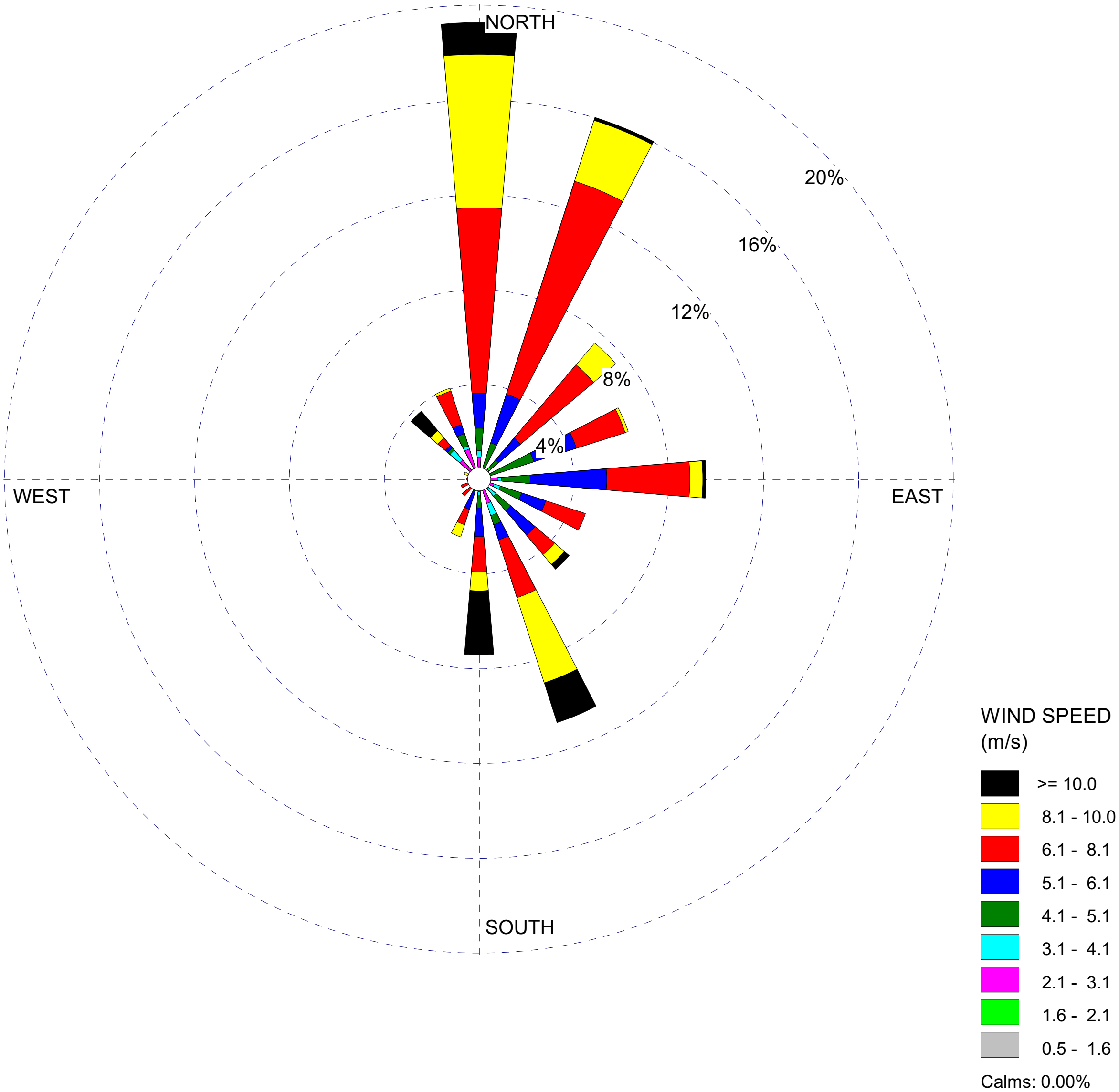


Figure 2.3.2-212 60-Meter Level Wind Rose — January (Sheet 1 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)

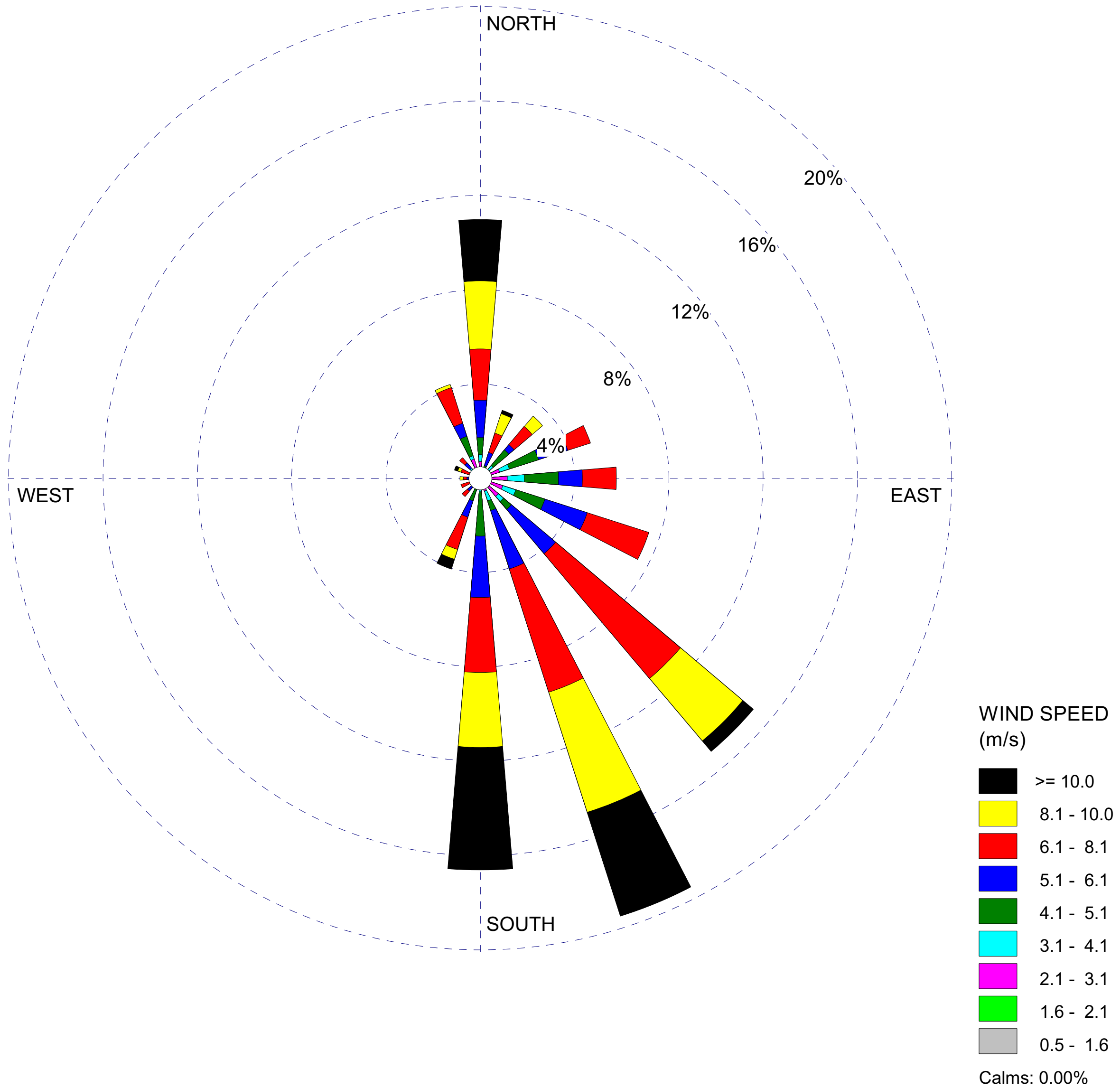


Figure 2.3.2-212 60-Meter Level Wind Rose — February (Sheet 2 of 12) VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)

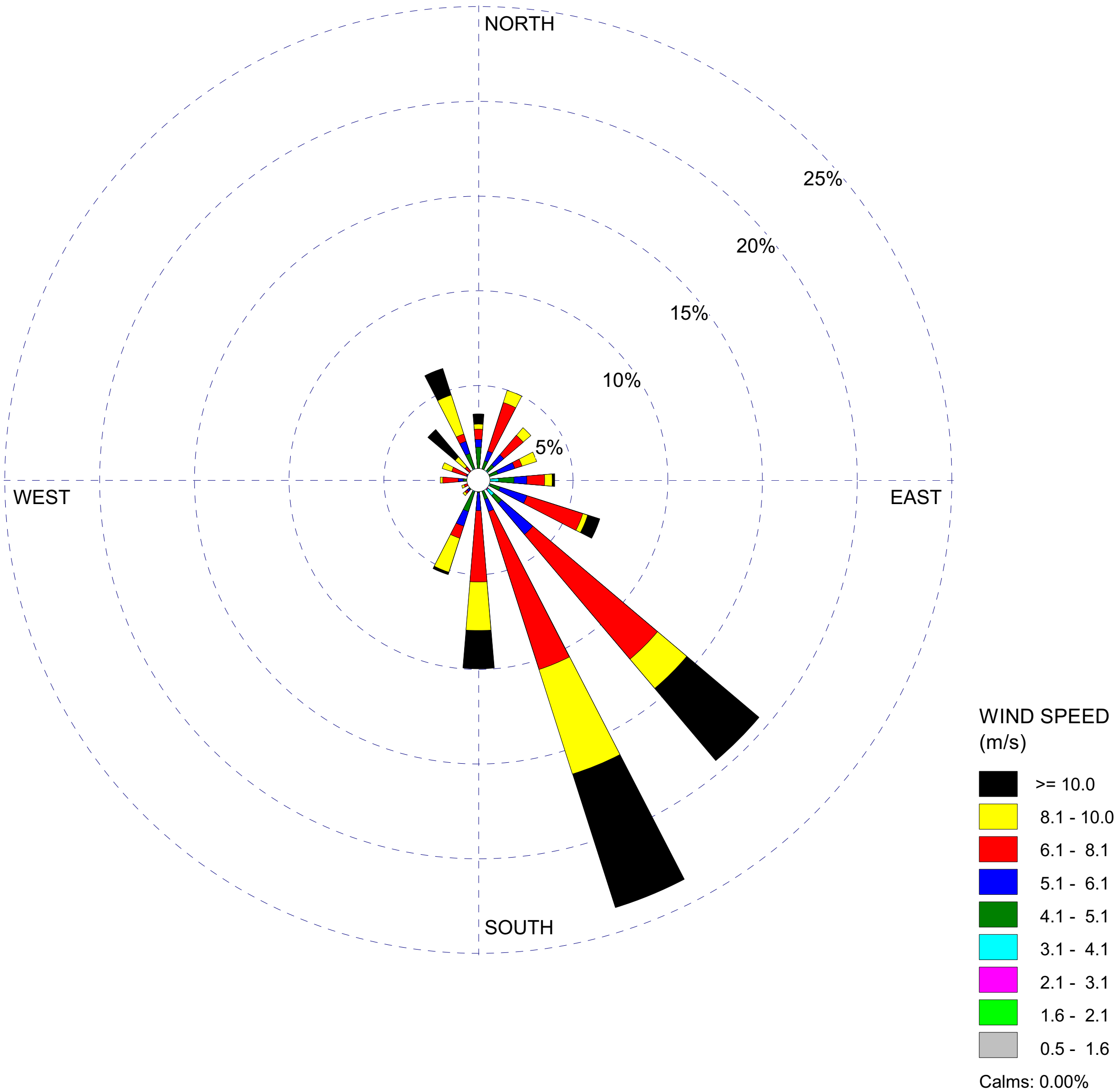


**Figure 2.3.2-212 60-Meter Level Wind Rose — March (Sheet 3 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)**

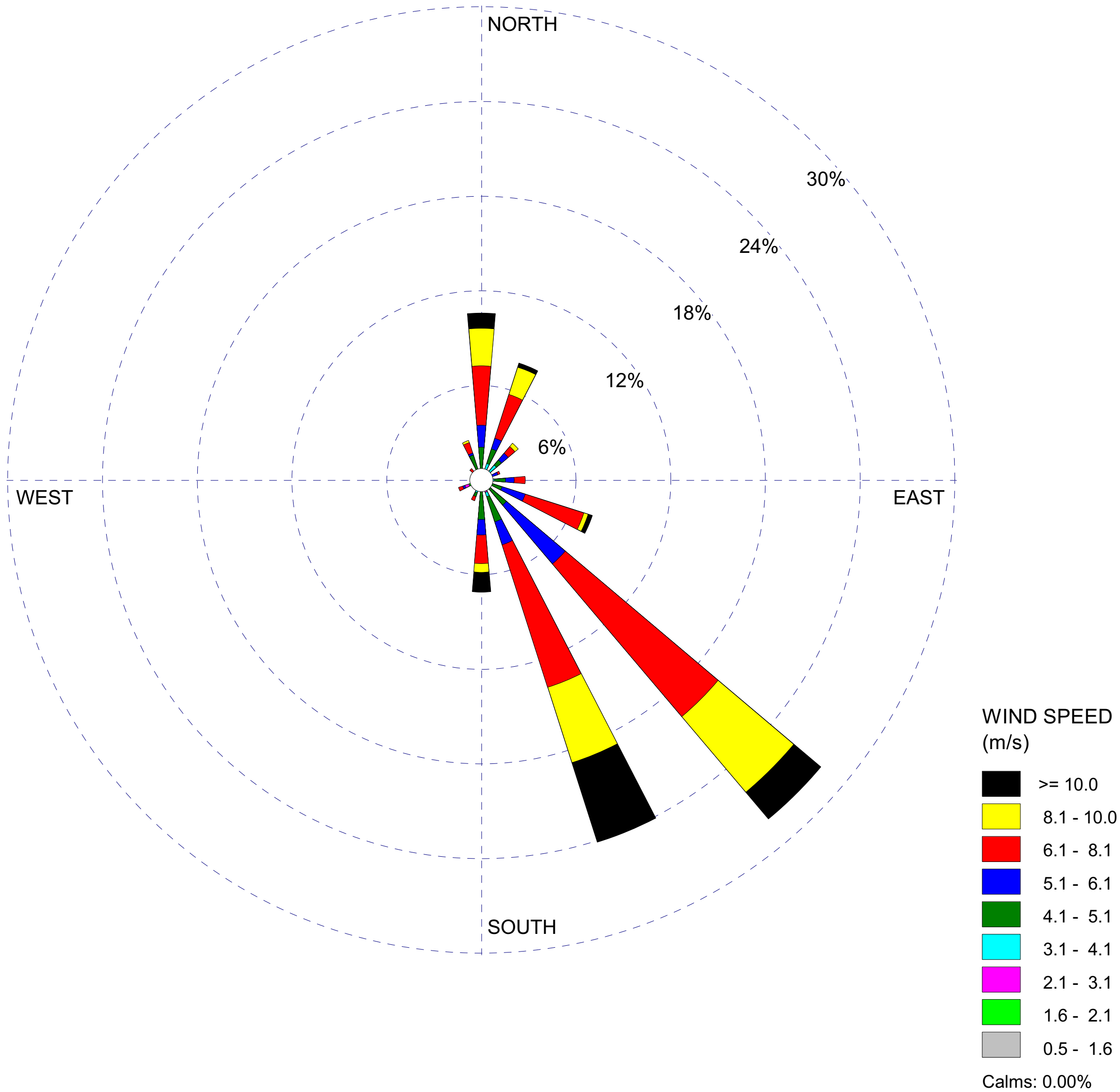


Figure 2.3.2-212 60-Meter Level Wind Rose — April (Sheet 4 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)

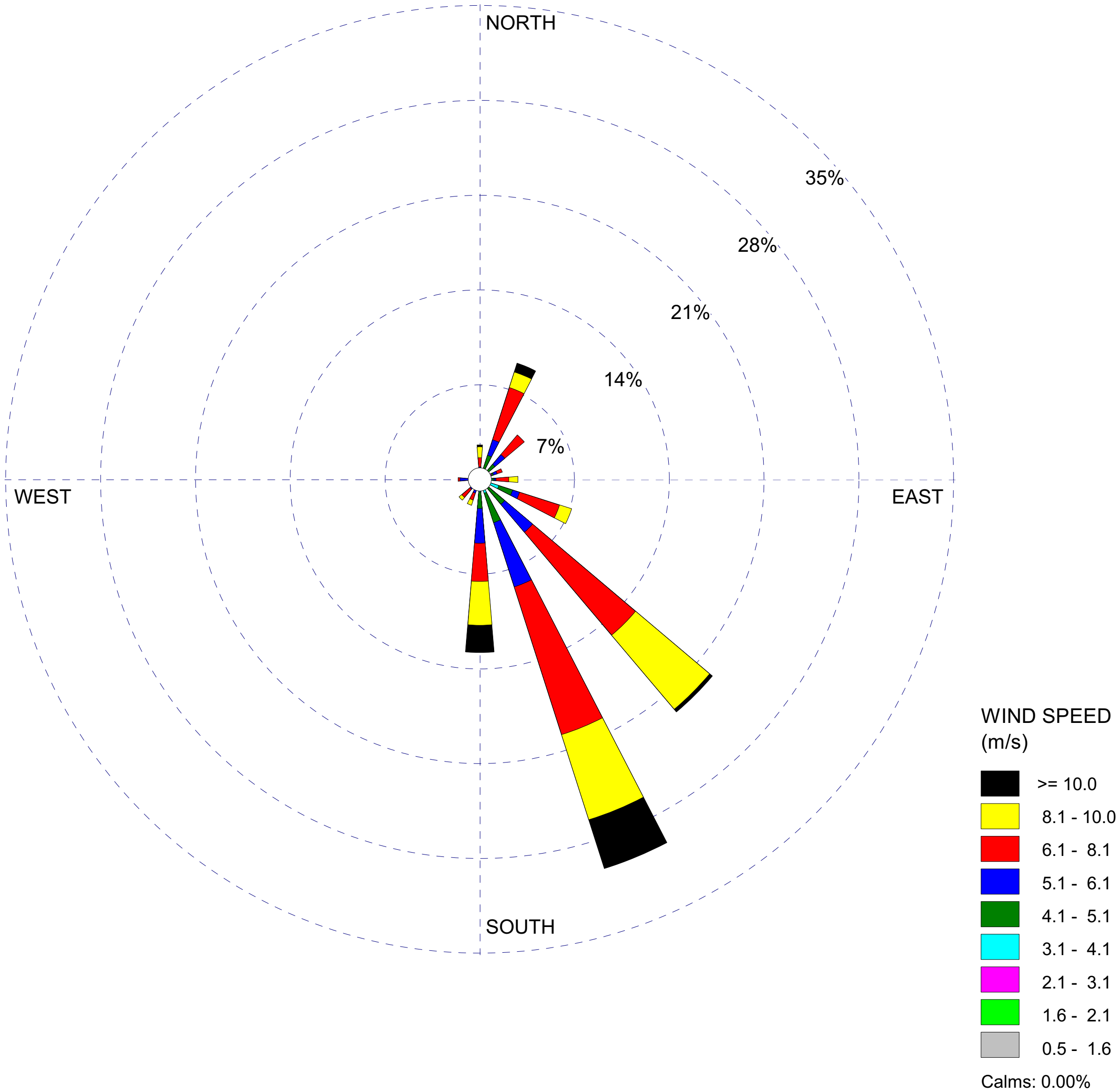


Figure 2.3.2-212 60-Meter Level Wind Rose — May (Sheet 5 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)

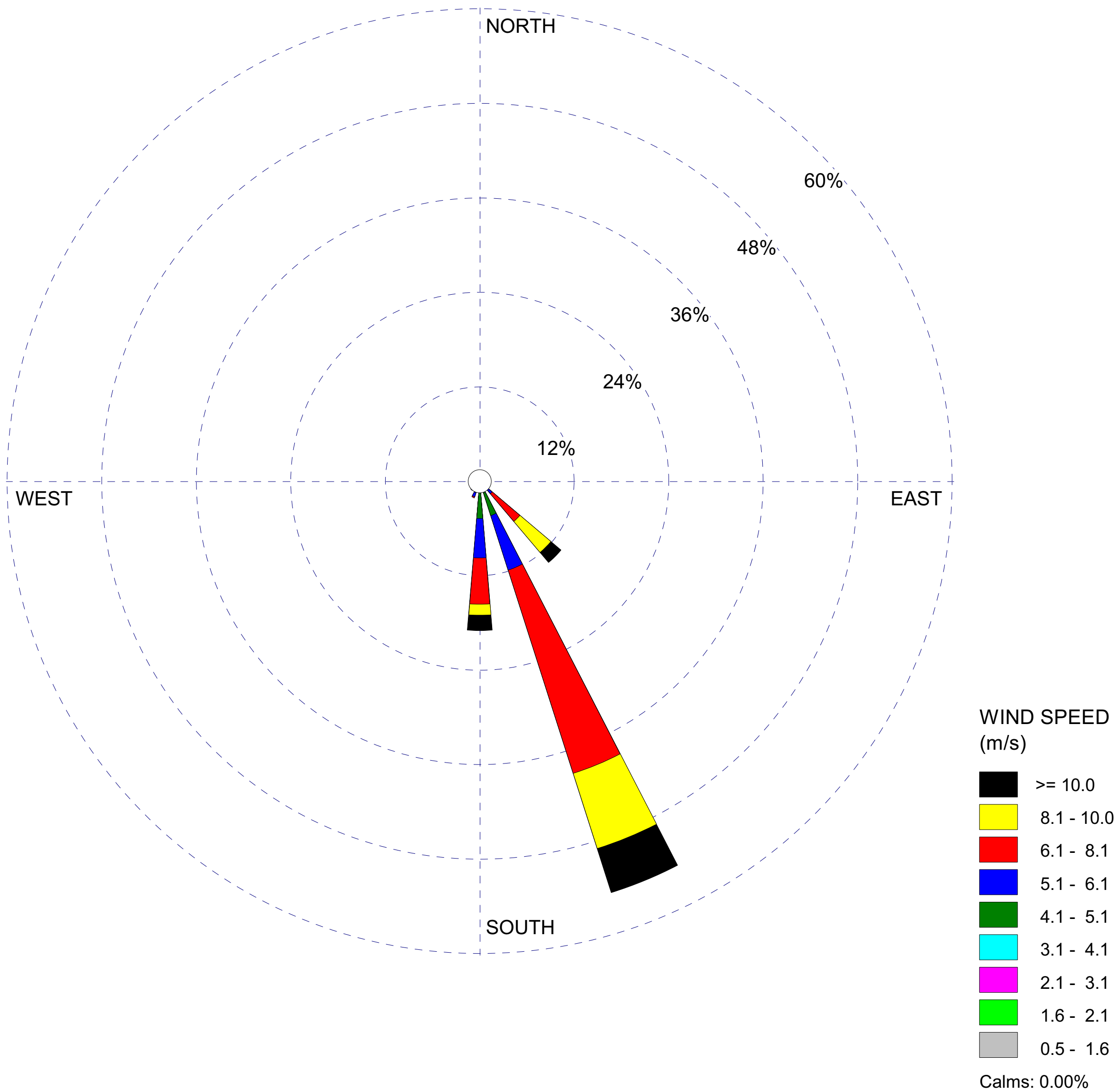


Figure 2.3.2-212 60-Meter Level Wind Rose — June (Sheet 6 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)

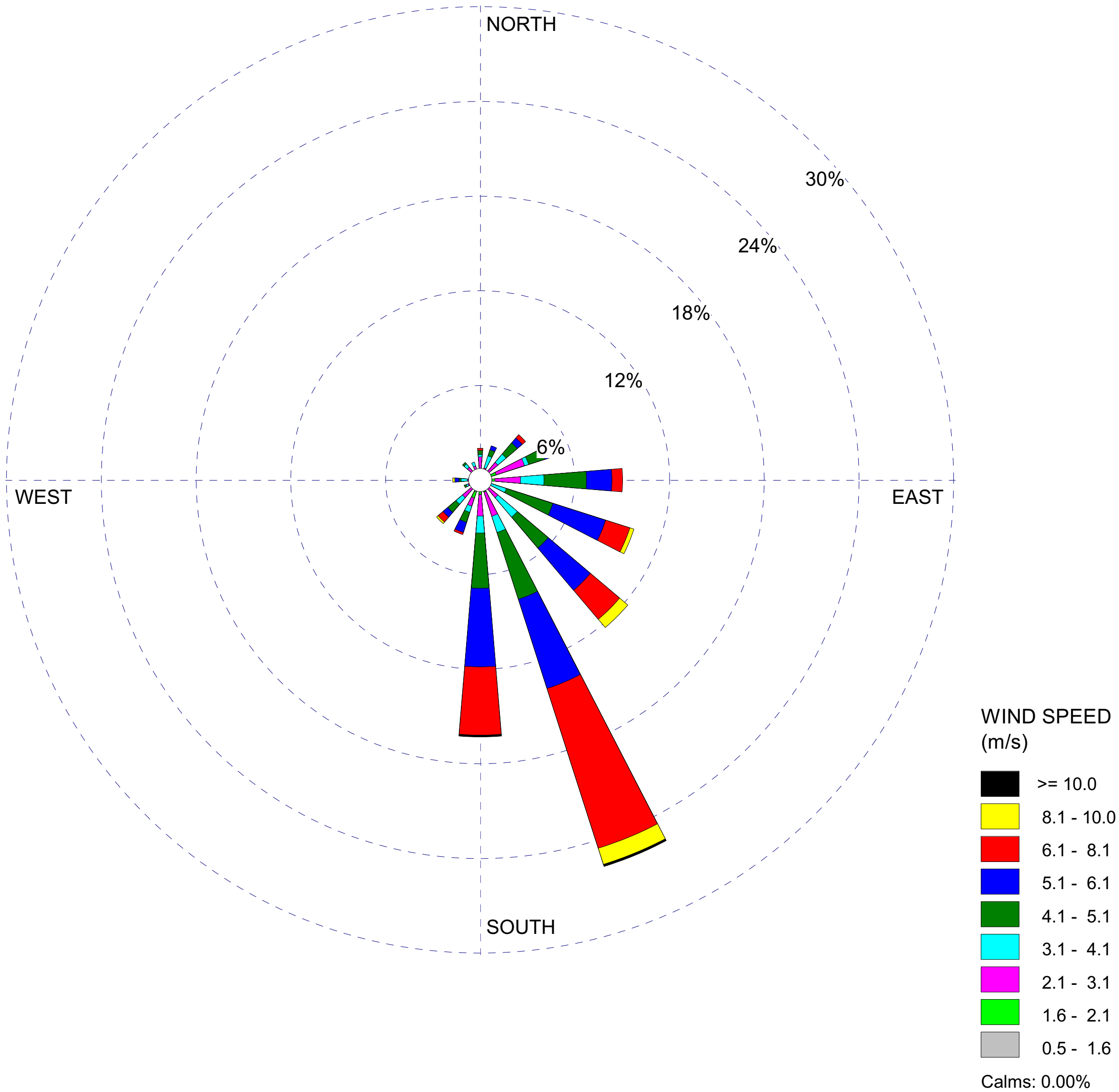


Figure 2.3.2-212 60-Meter Level Wind Rose — July (Sheet 7 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)

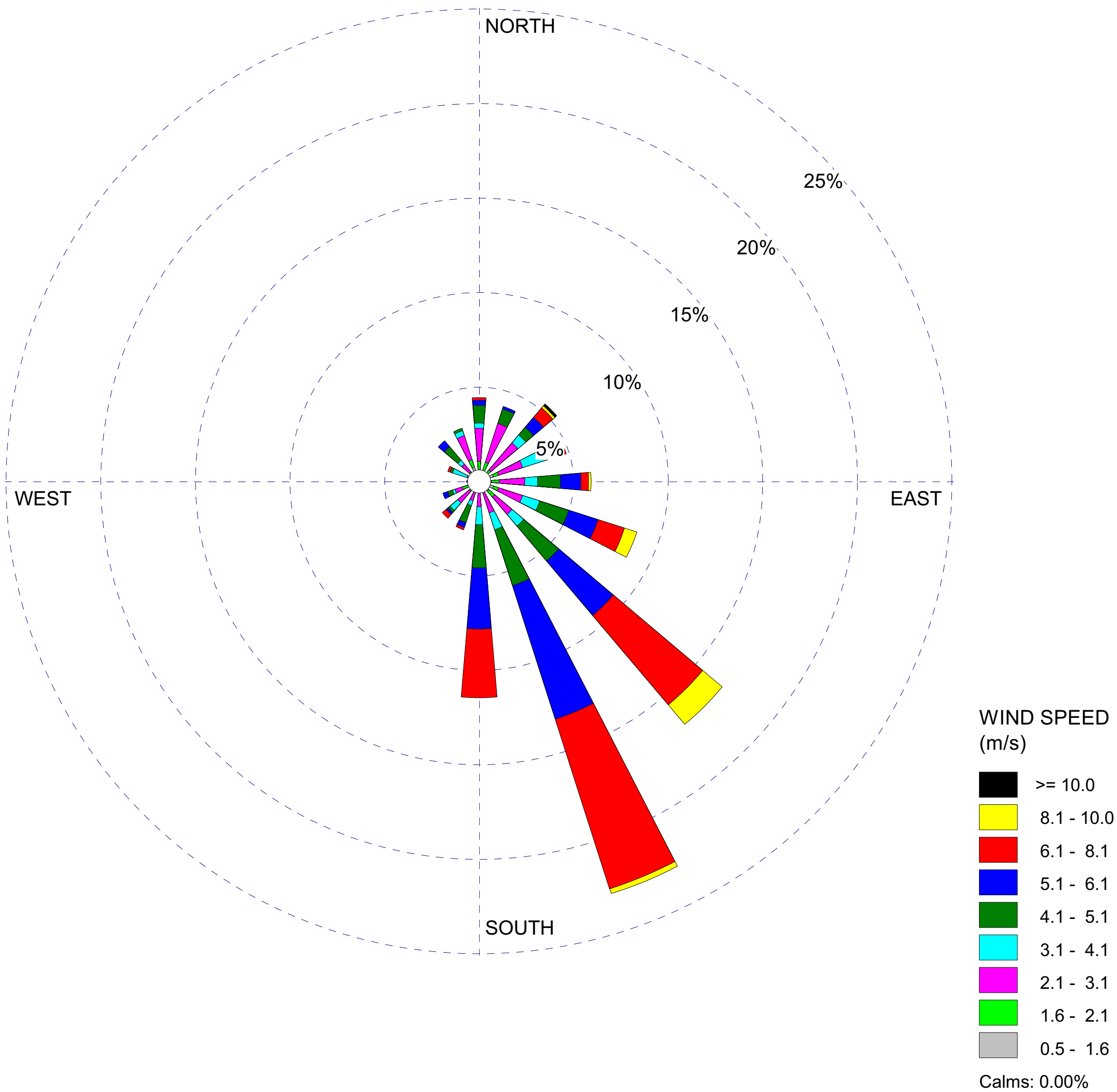


**Figure 2.3.2-212 60-Meter Level Wind Rose — August (Sheet 8 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)**

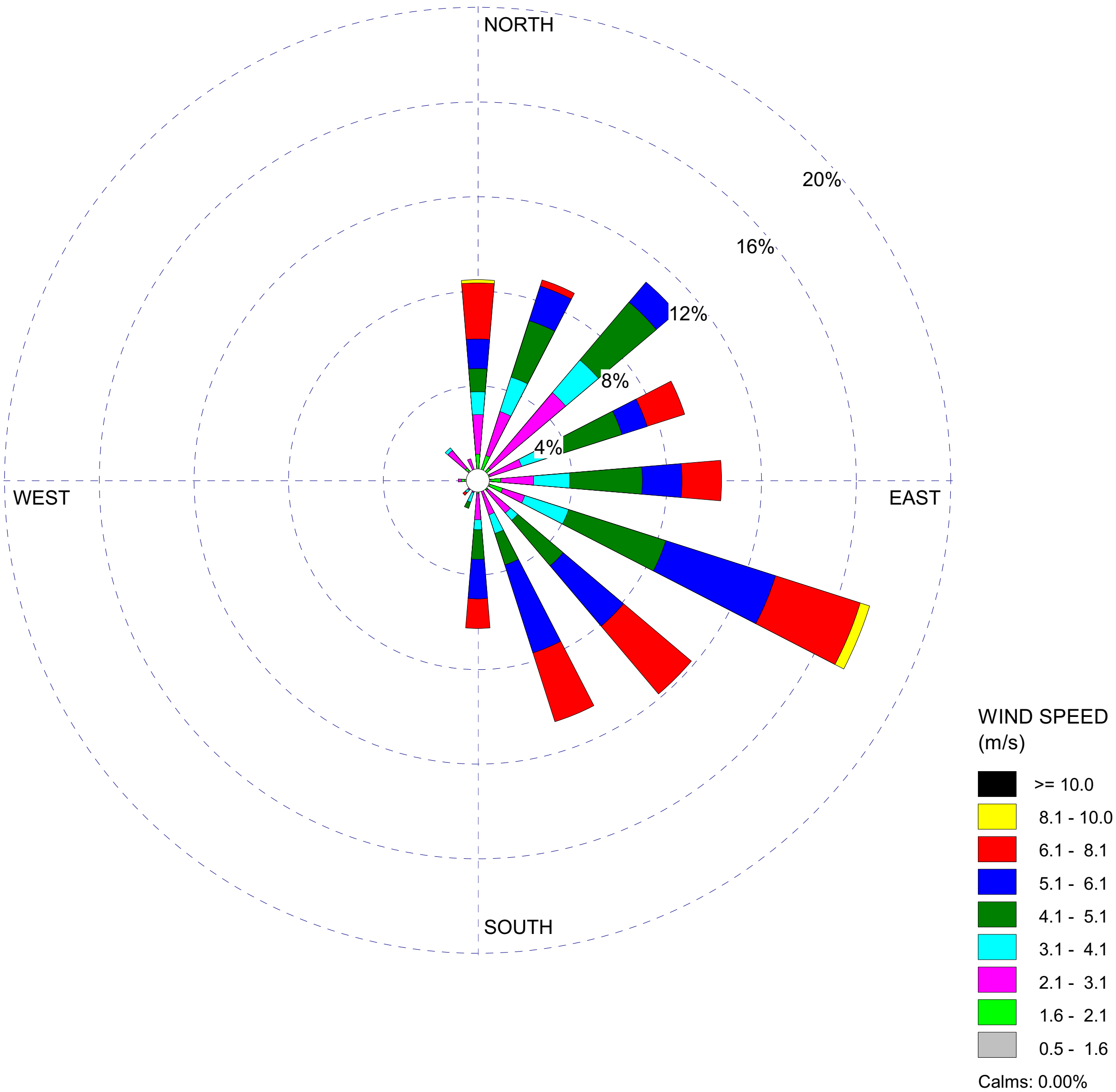


Figure 2.3.2-212 60-Meter Level Wind Rose — September (Sheet 9 of 12) VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)

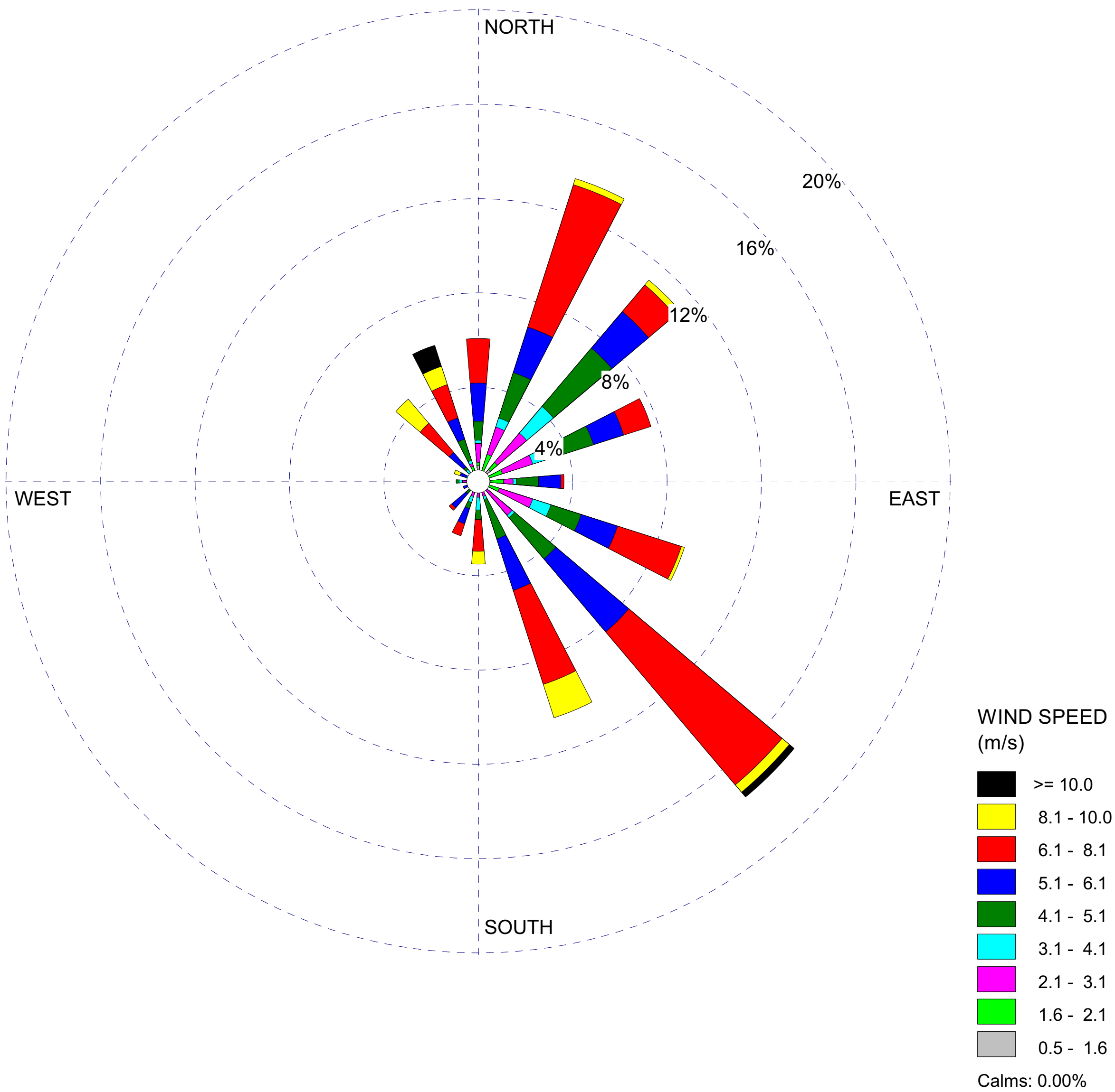


Figure 2.3.2-212 60-Meter Level Wind Rose — October (Sheet 10 of 12) VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)

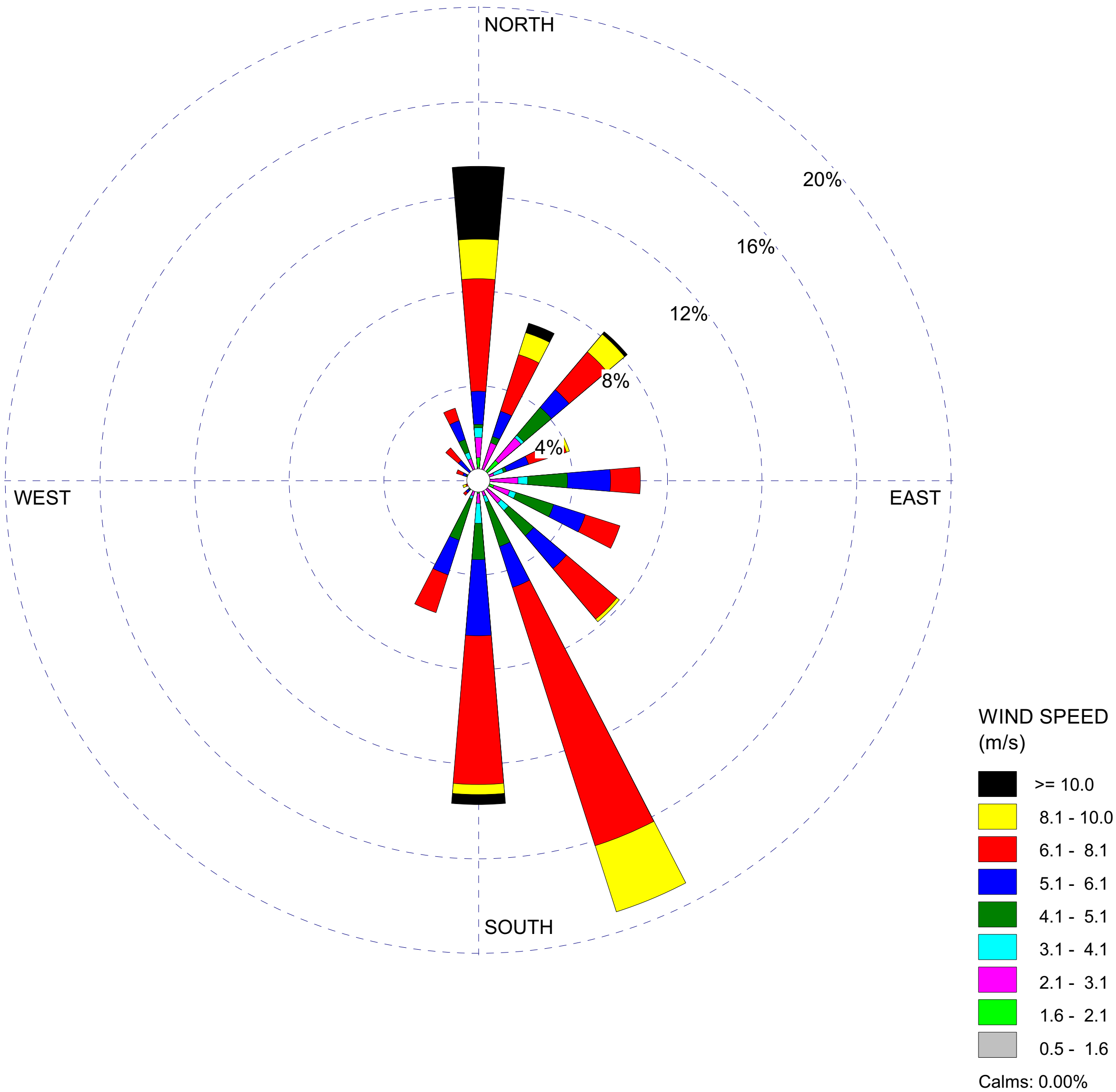


**Figure 2.3.2-212 60-Meter Level Wind Rose — November (Sheet 11 of 12)
VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)**

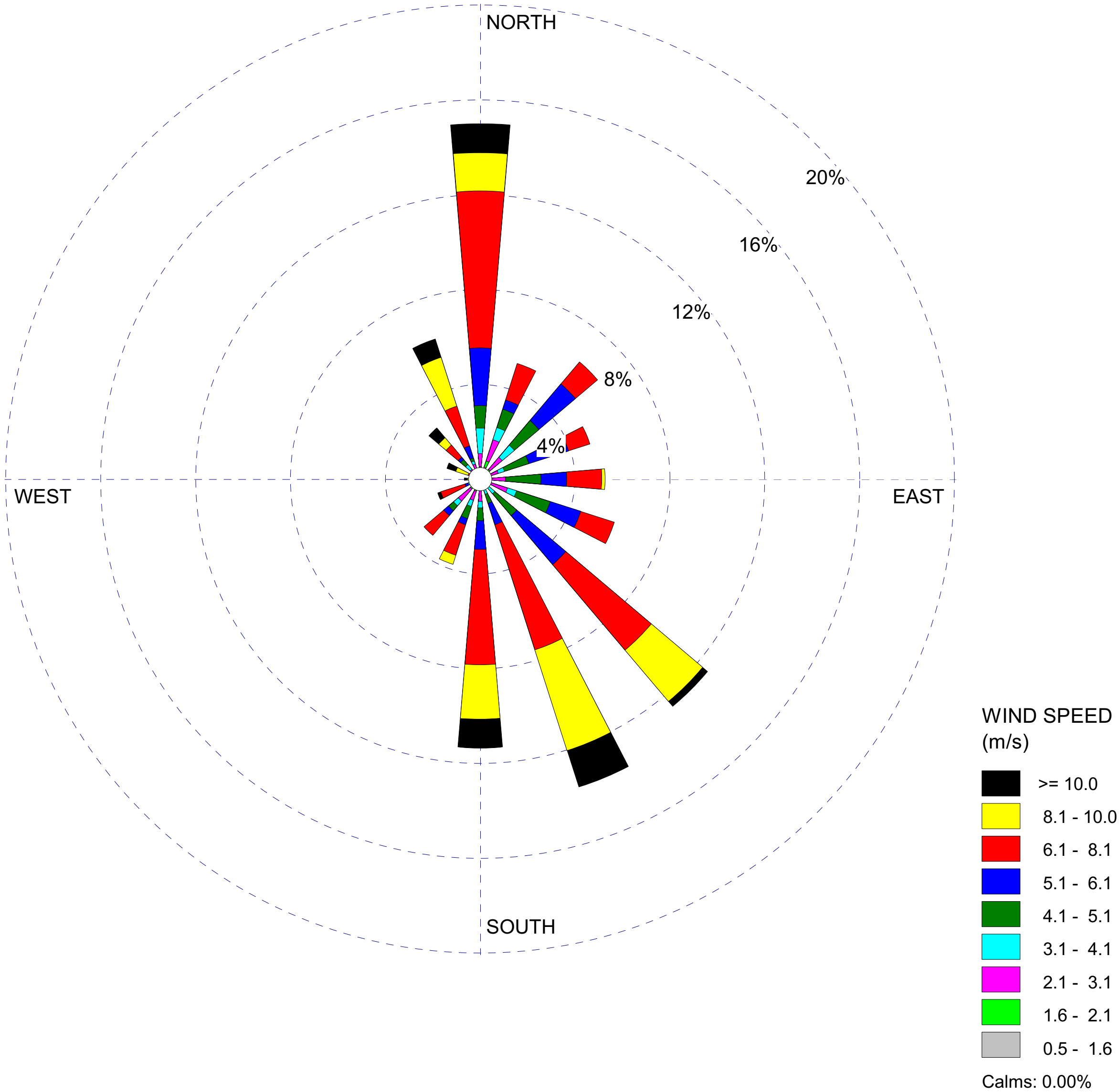
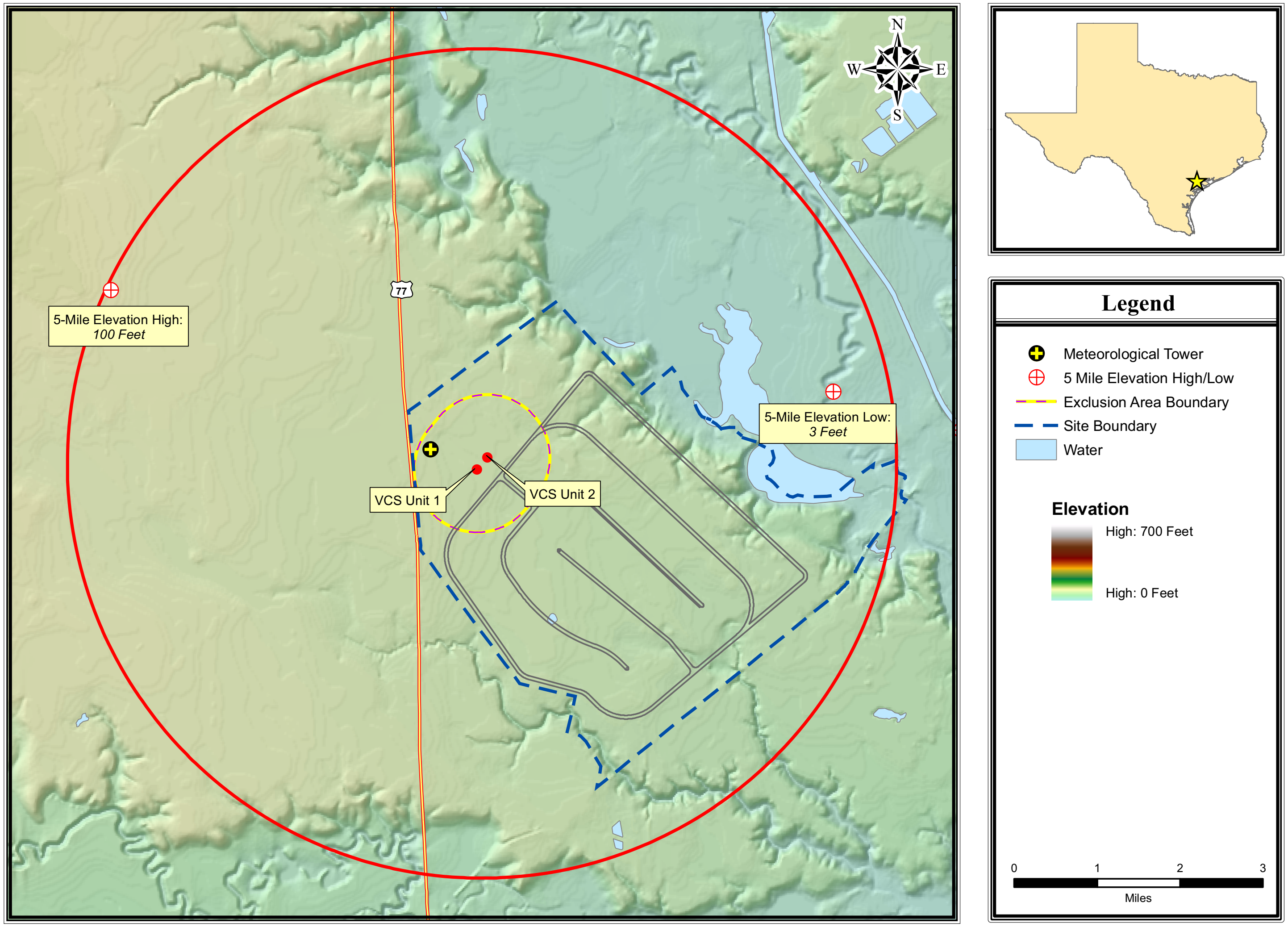


Figure 2.3.2-212 60-Meter Level Wind Rose — December (Sheet 12 of 12) VCS Pre-Application Monitoring Program (July 1, 2007–June 30, 2008)



Source Data: ESRI, Data & Maps and StreetMap USA, 2006.
25352-000-P1-0010-00002 Rev. 0
USGS, seamless data distribution, NED shaded relief.

Projection: Texas South Central State Plane
Datum: North American Datum 1983

Drawing No.: EXELON_FIG_T_005MI_001
Revision: 003 *Date:* 07/29/08

Figure 2.3.2-213 Site and Vicinity Map (5-Mile Radius)

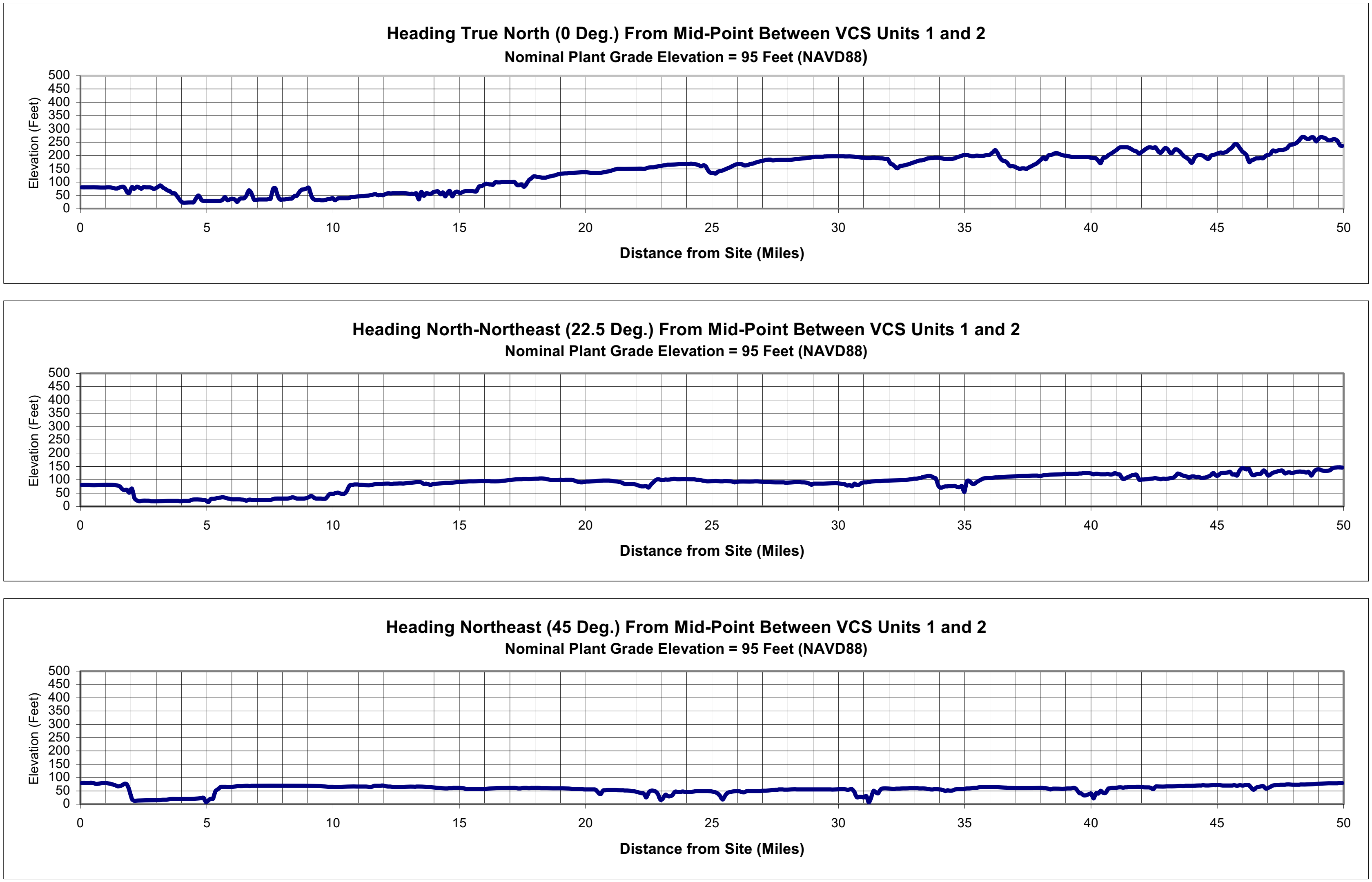
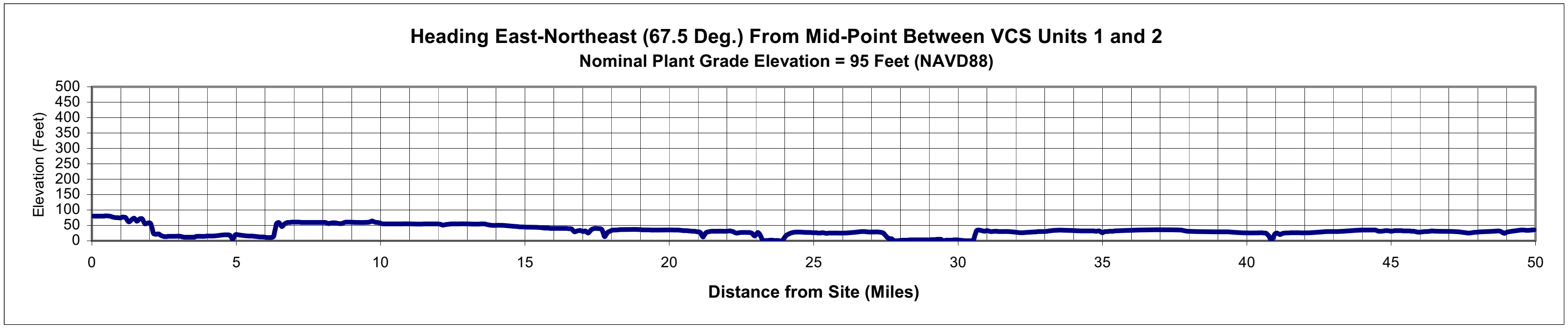
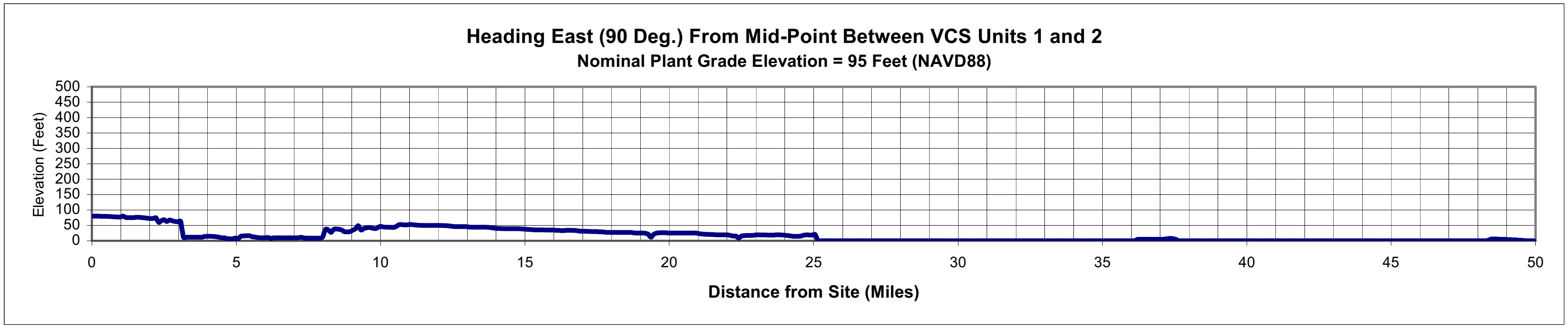


Figure 2.3.2-214 Terrain Elevation Profiles within 50 miles of the VCS Site (Sheet 1 of 6)





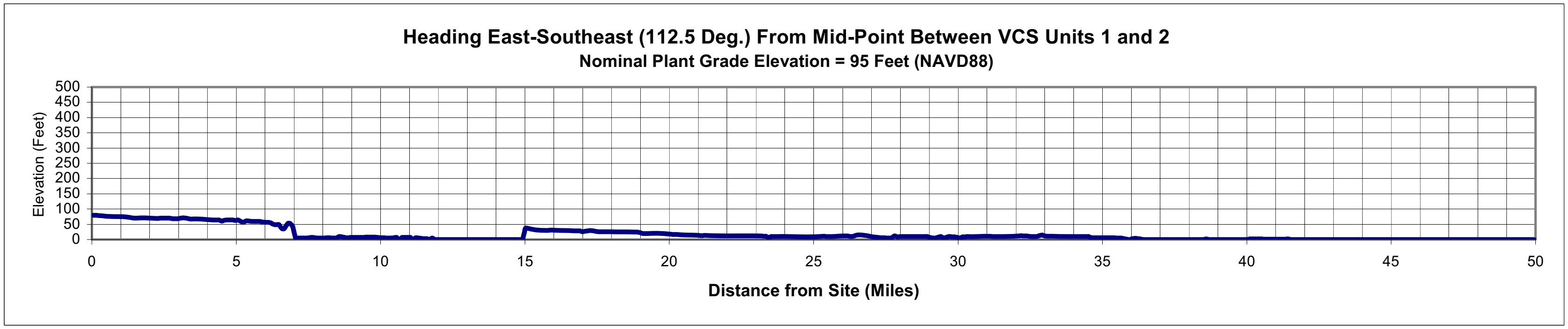
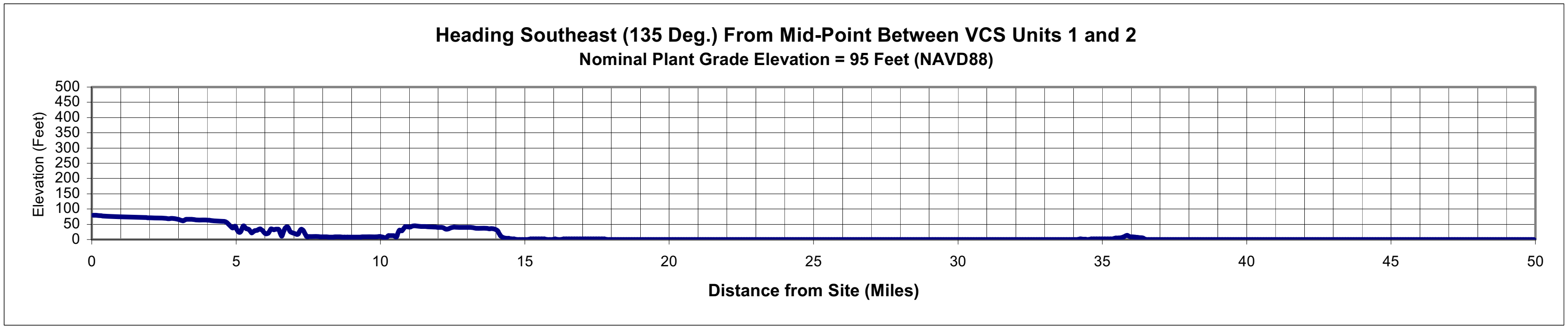
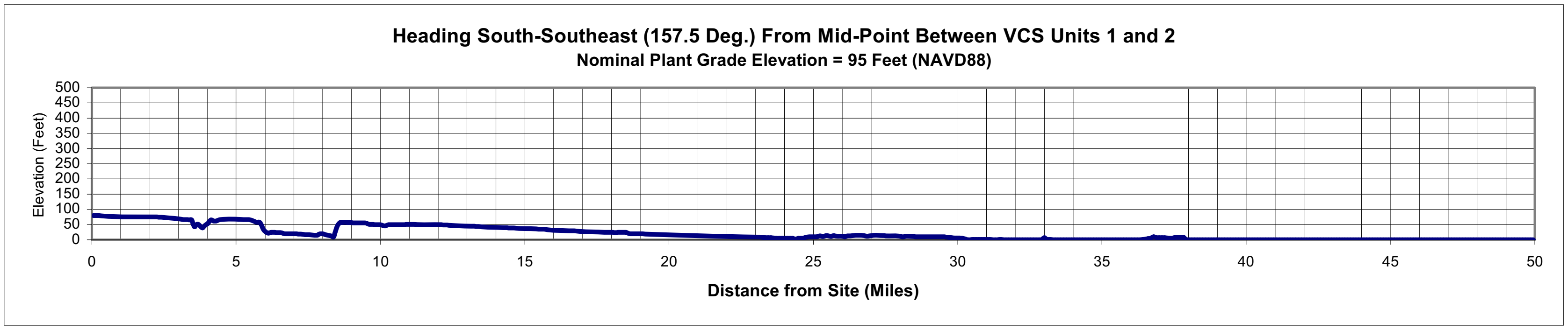


Figure 2.3.2-214 Terrain Elevation Profiles within 50 miles of the VCS Site (Sheet 2 of 6)





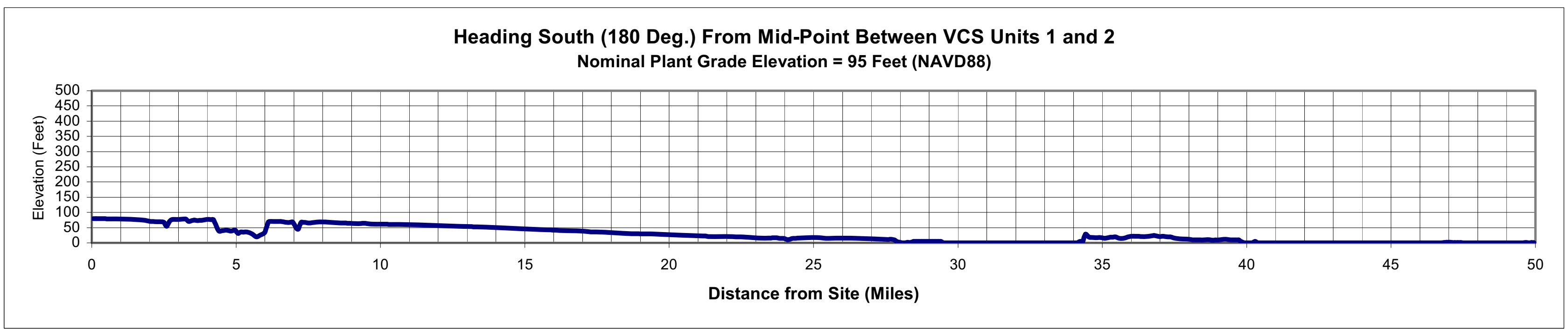
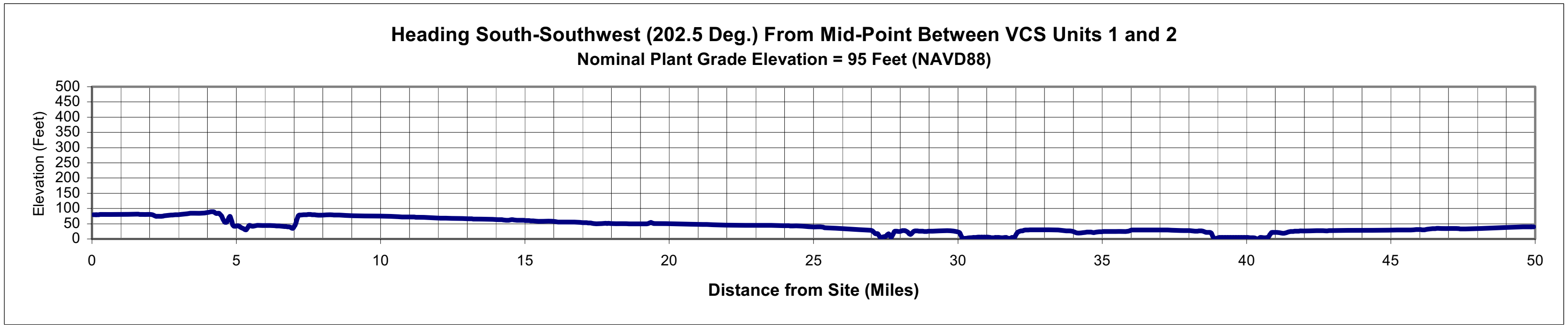
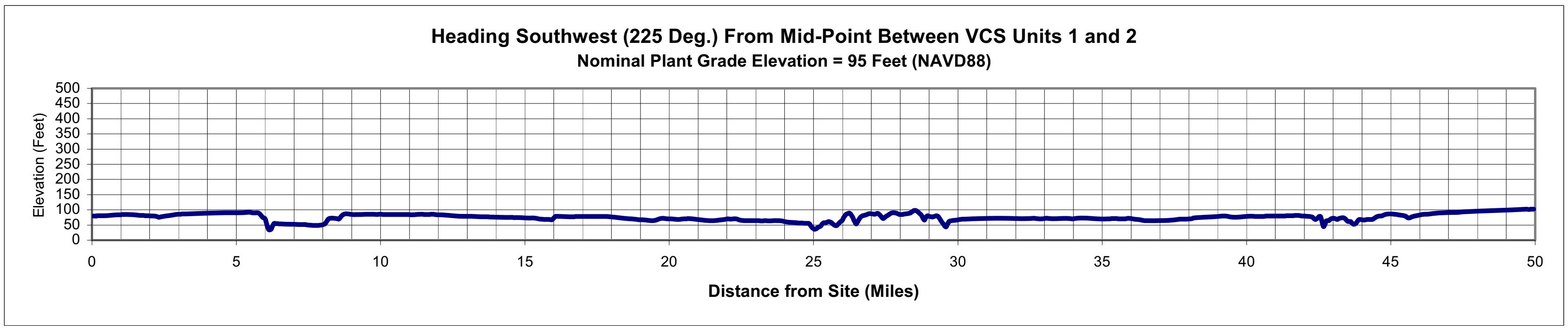


Figure 2.3.2-214 Terrain Elevation Profiles within 50 miles of the VCS Site (Sheet 3 of 6)





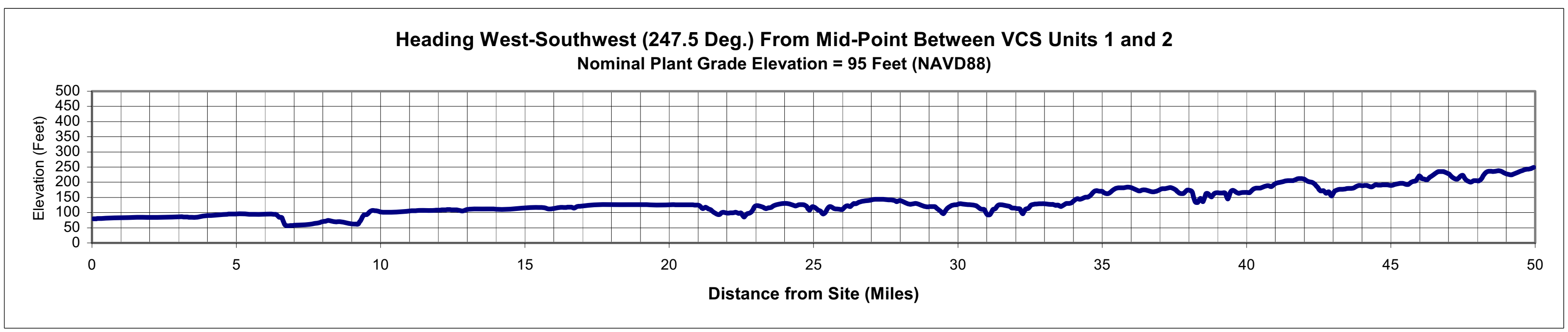
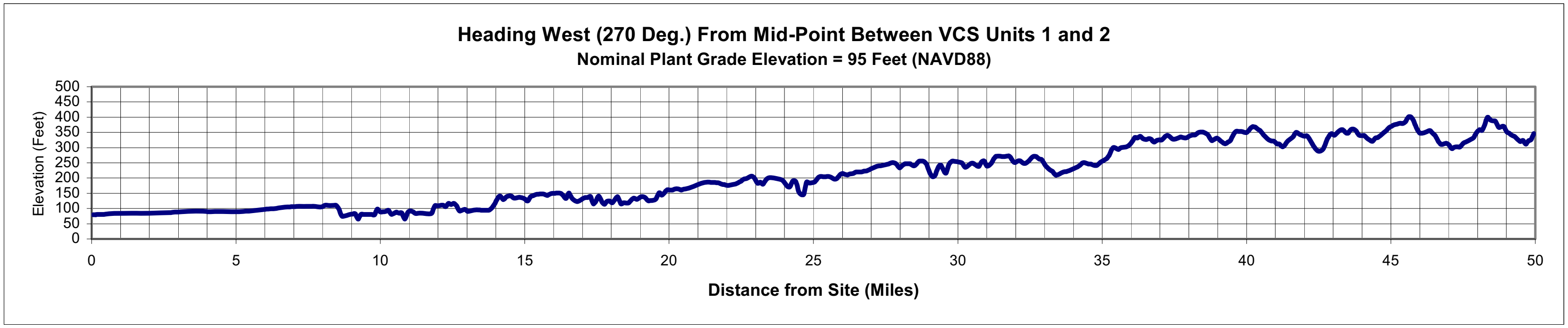
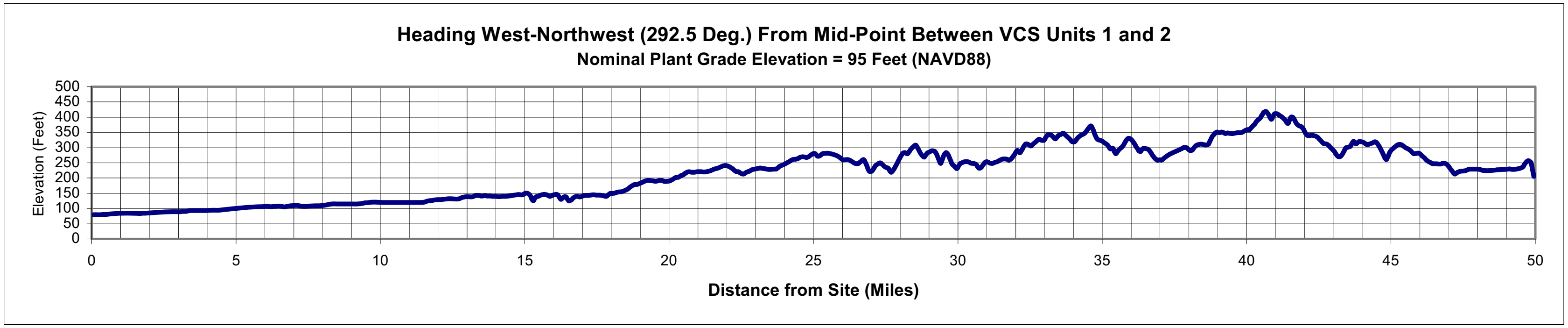


Figure 2.3.2-214 Terrain Elevation Profiles within 50 miles of the VCS Site (Sheet 4 of 6)





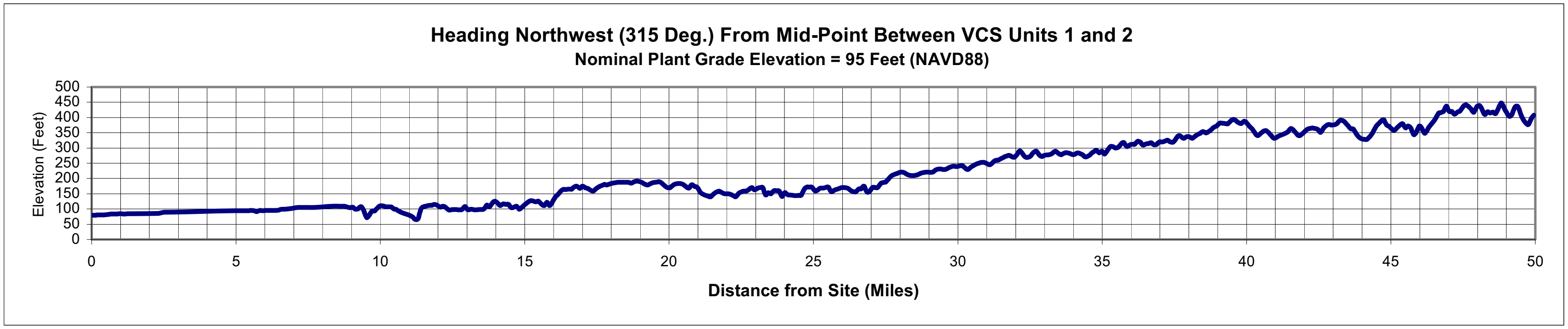


Figure 2.3.2-214 Terrain Elevation Profiles within 50 miles of the VCS Site (Sheet 5 of 6)

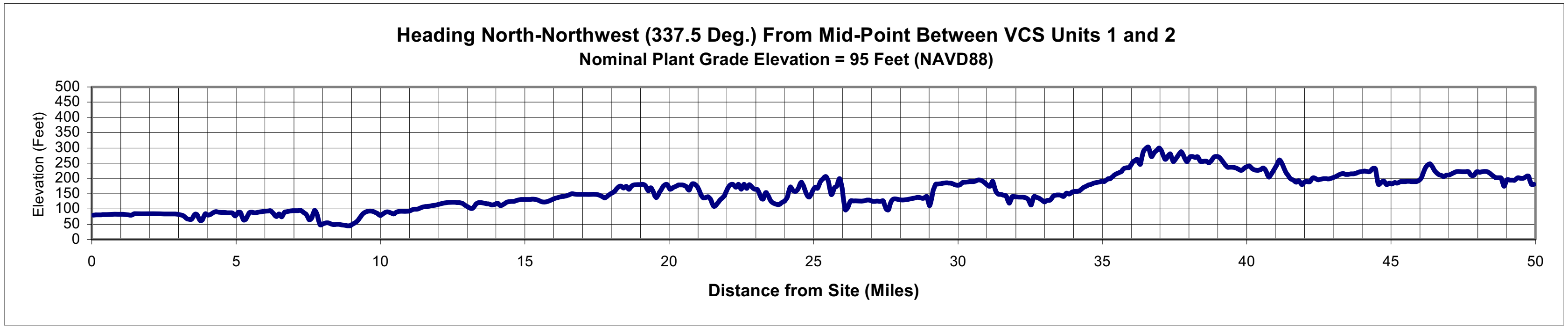


Figure 2.3.2-214 Terrain Elevation Profiles within 50 miles of the VCS Site (Sheet 6 of 6)

2.3.3 Meteorological Monitoring

VCS COL 2.0-9-A

The section describes the meteorological monitoring program at VCS Units 1 and 2, and its adequacy for: (1) characterizing atmospheric transport and diffusion conditions representative of the site and surrounding area; (2) providing a meteorological database for evaluation of the effects of plant construction and operation; and (3) accessing ongoing meteorological conditions used to support impact assessments and emergency preparedness.

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 meteorological monitoring program for the site meets the relevant requirements of 10 CFR 50, Appendix I and 10 CFR 51.45(c), 51.50, and 100.20(c)(2) and the guidance in Section C of RG 1.23, Revision 1; Section C.4 of RG 1.111, Revision 1; and RG 1.21, Revision 1.

2.3.3.1 General Monitoring Program Description

The onsite meteorological monitoring program consists of three phases:

1. Pre-Application Monitoring Phase — 2 years of the meteorological data currently collected on site is used to support the COL 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 expected 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, 1 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 in Chapter 4 of the Environmental Report 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 2.3.3-210). Instrument surveillance (i.e., operation, maintenance, and calibration), and data processing and validation in accordance with the applicable regulatory and relevant industry guidance have been 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%. No backup onsite meteorological data collection system is used because the monthly data recovery rate from the 60-meter tower has been 99.9% or better since program operation began.

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 existing and planned plant structures and other features of the plant site. In the evaluation, the location of the meteorological tower, surrounding terrain and vegetation, 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 2.3.3-201 and 2.3.3-202, 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 is located between Linn Lake and the Victoria Barge Canal, which is approximately 4 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 80 feet (NAVD 88). To the east of the site, elevation decreases from approximately 80 feet (NAVD 88) to approximately 3 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, 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 midpoint between Units 1 and 2, 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 2.3.3-201, 2.3.3-202, and 2.3.3-203, respectively. See Figure 2.3.2-214 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 reactor units and other plant features is shown in Figure 2.3.3-204. The base of the meteorological tower, located in an open field, is 82.4 feet above MSL. Finished plant grade at the new units will be 95 feet NAVD 88.

As shown in Figure 2.3.3-201, the area within a 5-mile radius of Victoria County Station 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 2.3.3-210). 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 overall 197 foot (60-meter) tower height and the lower wind sensor height (i.e., 33 feet or 10 meters).

There are no structures currently located near the meteorological tower except an equipment shelter at the base of the tower. The size of this environmentally controlled shelter, which houses 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).

Once constructed, the tallest plant structures will be the two identical turbine buildings (approximately 166 feet above grade, including the parapet).The Unit 1 turbine building is closest to the tower and is located 2770 feet from the tower. The tower site is 3140 feet from the center of the closest reactor building, which is 162 feet above grade as shown in Figure 2.3.3-204. Therefore, both of the turbine and reactor buildings are more than 10 times their building heights away from the meteorological tower. Other potential obstructions within 5000 feet of the meteorological tower have also been evaluated against the "10 times the obstruction height" guideline (Reference 2.3.3-210) 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.

<u>Present Environment</u>

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. Presently, 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 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.

As-Built Environment

Based on Figure 2.3.3-204, the minimum distances from the meteorological tower to the gravel switchyard and the power block are approximately 1300 feet and 2000 feet, respectively. The closest planned large concrete or asphalt parking lot or ventilation source will be located more than 2770 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.

There is one service water cooling tower serving each unit and the nearest cooling tower is approximately 2400 feet southeast of the meteorological tower. Visible cooling tower plume height at 2400 feet downwind exceeds the height of the relative humidity and temperature sensors installed at the 10-meter level of the meteorological tower. Therefore, operation of the service water cooling towers onsite would not affect the relative humidity and temperature measurements made on the tower.

The plant cooling system includes a 4938-acre cooling water basin, which will be located approximately 4480 feet from the meteorological tower at its closest point. Immediately adjacent to the cooling basin is a 1300-acre reservoir that will be constructed, owned, and operated by the Guadalupe-Blanco River Authority to serve its designated customers.

During plant operation, moisture content and temperature in the air immediately above the 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 2.3.3-204, winds from the east-northeast through south-southeast directions could potentially carry the moist air parcels over the basin toward the meteorological tower location. However, given the 4480-foot separation between the meteorological tower and the cooling basin and the adjacent reservoir, 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 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 speeds increase as air moves from land over a low-friction water surface that would enhance local dispersion. However, the low-level 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 low-level turbulence and on wind speeds 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 the cooling basin could alter the frictional coefficients of its neighboring 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 the climate for all receptors downwind of the reactor. When the basin water is warmer than the adjacent air, the increases of lower level ambient temperature increases would create thermal instability. Subsequently, more unstable atmospheric stability (i.e., favorable diffusion environment) is expected. In most cases, this basin warming effect should only last for several hundred yards from the basin due to rapid mixing with ambient air.

Given the 4660-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 can affect downwind measurements, the wind sensors are mounted on an 8-foot retractable boom, which is oriented to the southeast and extends 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 are free from the influence of the tower itself to airflow that would adversely affect their representativeness.

Temperature and humidity sensors are 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.

2.3.3.3 Pre-Application Monitoring Phase`

Two years of onsite meteorological data is currently being collected during the pre-application monitoring phase. In preparing the COL application for VCS Units 1 and 2, the adequacy and accuracy of the current onsite meteorological data collection system were evaluated, based on the guidance provided in RG 1.23 (Reference 2.3.3-210). The areas specifically examined include: tower siting and sensor location for determination of the representativeness of the data being 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 is being 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 are 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 2.3.3-203. A meteorological monitoring system block diagram for the current configuration is provided in Figure 2.3.3-205. The monitoring system is equipped with lightning protection.

Wind speed and wind direction are measured at 33 feet (10 meters) and 197 feet (60 meters) above ground level. The routine and potential accidental atmospheric release points for the ESBWR reactor include the plant stack (197 feet, 60 meters above ground level) and several other elevations below this height. The meteorological parameters measured for evaluation of the radiological impacts of these releases are consistent with Regulatory Position 2.1 of RG 1.23 (Reference 2.3.3-210).

Ambient temperature is monitored at the 10- and 60-meter levels. Vertical differential temperature (i.e., delta-T) is based on the difference between the temperatures measured at the 60- and 10-meter levels. Relative humidity is 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 the plant service water system (PSWS). The dew point temperature is calculated based on the coincident ambient temperature and relative humidity measurements. The atmospheric moisture content near the ground surface is approximated by the calculated dew point temperature for the 10-meter level and is used in the cooling basin fogging potential evaluation. Since the physical height of the selected plant service water cooling towers is 56 feet (17.1 meters), the atmospheric moisture content at the height of the water vapor release from the two plant service water cooling towers can be adequately represented by the dew point temperatures calculated for the 10-meter measurement level. Although RH is measured at the 60-meter level, the data collected is not used in evaluation of the environmental impacts resulting from operation of any plant heat dissipation systems on site.

Precipitation is measured using an 8-inch diameter, tipping bucket precipitation gage mounted at ground level but away from the tower shelter to prevent any interference in precipitation capture. The precipitation gage is equipped with a heating device in case of frozen precipitation. Windshields are provided to prevent wind-caused under-recording of precipitation. The rain gage wind shield is 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 Gauges.

Solar radiation is measured at 4.6 meters above ground, but the data collected is not used in preparing the COL Application.

2.3.3.3.2 **Meteorological Sensors Used**

A description of the meteorological sensors, including sensor type, manufacturer, model number, sensor specifications (including sensor starting threshold, range, and measurement resolution, as applicable), and sensor accuracy for the data collection system at the site during the pre-application monitoring phase, is provided in Table 2.3.3-204.

The meteorological sensors installed on the tower are designed to operate under the 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%.
- 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 have been observed during the pre-application monitoring phase.

2.3.3.3.3 **Data Recording and Storage**

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

The Campbell Scientific data logger samples sensor output once per second. For most parameters, hourly averaged values are based on 3600 data points per hour. Data averaging is arithmetic with the exception of that for wind direction, which is a vector average. Precipitation data is recorded as a cumulative hourly total. Values are archived as hourly averages in accordance with Regulatory Position 6 in Section C of RG 1.23 (Reference 2.3.3-210).

The Johnson-Yokogawa Darwin digital recorder samples sensor output once every 10 seconds. The Darwin recorder has the capability to convert the digitally recorded information into analog format and then output the information back in digital format. The data traces produced by the recorder software are to facilitate review and documentation of data collection.

Once each week, the data that has been stored on the local data collection computer is transferred to a computer dedicated for housing the site database. Once each week, the site database is also backed up to a server and a portable backup drive that is 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 has been 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 is located offsite at the environmental consultant's office, calls the Campbell Scientific CR1000 data logger at the site. Data acquired since the last data collection (nominally 24 hours prior) is downloaded to a personal computer.

In the screening process, each parameter is 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 are flagged on the data printout.
- When the lower wind speed exceeds the upper wind speed or the upper wind speed exceeds the lower wind speed by 15 mph, the wind speeds are flagged on the data printout.
- Wind directions are flagged on the printout if invariant for consecutive hours, or the (automatically calculated) sigma-theta value equals or exceeds 50.
- Wind directions are flagged on the printout if direction shear greater than 60 degrees exists between the lower and upper level directions.
- Ambient temperature values are flagged on the printout if they are lower than a specified seasonally determined temperature, higher than a specified seasonally determined temperature, or more than a 6ºF change in an hour occurs.
- Vertical delta-T values are flagged on the printout if they are above 10ºF or below -10ºF.

- Dew point values, which are calculated using concurrent humidity and ambient temperature data, are flagged on the printout if they are below 0ºF, greater than 80ºF, or greater than a 6ºF change in a given hour.
- Precipitation values are flagged on the printout if they are greater than 0.25 inches per hour.

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

In addition, the daily data is 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 is not expected to match; however, the meteorologist will look for consistency in the temperatures, atmospheric moisture, cloud cover, precipitation (timing and, to a lesser extent, the amount), wind speed and wind direction. Information from maintenance logs and calibration results are taken into consideration as well in determining data validity.

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

If problems are discovered in the data screening or validation process, they are communicated to field services and management staff in a timely manner for corrective action. Routine site visitation logs, calibration logs, and equipment maintenance logs are generated in accordance with the Project Procedures Manual (Reference 2.3.3-202) 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 reviews the data and edits the data as appropriate. Erroneous data is invalidated, questionable data is reviewed further, and a determination made as to whether the data will be invalidated or replaced. While the goal is to achieve full data recovery, a minimum of 90% valid data recovery is 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 are followed, if required, for data substitution:

- Where data for a given parameter is missing for brief periods (e.g., 1 to 5 hours), interpolation may be used to fill data gaps.
- If wind direction data is missing or is invalid from one level, data from the other level can be used as a substitute. As historical data (e.g., more than 1 year of data) becomes available, the average difference in directions can also be used as an offset to the available direction level.
- If wind speed data is missing or is invalid from one level, data from the other level is 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. As historical data becomes available, a site-specific wind profile can be developed.
- Delta-T is used to determine and classify atmospheric stability in accordance with Table 1 of RG 1.23. When interpolation is 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 are 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. Relative instability is also more common during the warmer months and extends over a greater period of time during the day. As more than 1 year of data becomes available, data gaps can be filled based on site-specific characteristics (based on time of day, season, etc.).
- Missing precipitation data can be estimated using data collected at either Victoria Regional Airport or other nearby local observation stations.

Based on 1 year (i.e., July 1, 2007 through June 30, 2008) of data collected on site, there were only 11 hours of data measured at the lower measurement level missing and 12 hours of data from the upper level missing. For a given missing hour of data, this data could be for wind speed, wind direction, stability class, or a combination of these parameters. The overall data recovery rate of this set of 1 year of data well exceeds the RG 1.23 (Reference 2.3.3-210) specification of at least 90%. Because only a small amount of data is missing (i.e., less than 0.2%), no data substitution was necessary.

2.3.3.3.4.3 Data Reporting

After all data has been validated and verified by the project manager, a monthly report is generated. The monthly report describes:

- 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 have been generated during the month.

2.3.3.3.5 **Instrumentation Surveillance**

Inspection, maintenance, and calibration of the onsite meteorological monitoring system are performed in accordance with Regulatory Position 5 (Instrument Maintenance and Servicing Schedules) in Section C of RG 1.23 (Reference 2.3.3-210) and Section 7 (System Performance) of ANSI/ANS-3.11-2005 (Reference 2.3.3-201).

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

- Verification that the data logger, digital recorder, and the uninterruptible power supply are 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 is functioning properly (unless it is raining or snowing at the time of visit) and is free of debris and cleaned, if necessary.
- Verification of ambient temperature and atmospheric moisture measurements are checked using a psychrometer. A psychrometer measurement is taken to provide a dry bulb and wet bulb temperature. The dry bulb temperature is compared to the 10-meter

ambient temperature reading. The dry and wet bulb temperatures are then used to calculate a dew point that is compared to that being recorded at the 10-meter level.

Detailed instrument calibration procedures and acceptance criteria are strictly followed by qualified technicians during system calibrations. These calibrations help to verify and, if necessary, reestablish accuracies of sensors associated signal processing equipment and data displays. Routine calibrations include obtaining both “as-found” (before maintenance) and “as-left” (final configuration for operation) results. The end-to-end results are compared with expected values. Any observed anomalies that may affect equipment performance or reliability are reported to the field service manager for corrective action. If any acceptance criteria are 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) are initiated. At the end of each month, the project manager performs a thorough data consistency check, and edits the data accordingly, if necessary.

Specifically, the pre-application meteorological monitoring system is calibrated once every 4 months as specified in site procedures. System calibrations include 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 are replaced with calibrated sensors. The sensors that are removed will be tested “as found.” The wind sensors are tested at variable speeds, while the wind direction is tested on the tower.

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

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

The guyed wires of the meteorological tower are inspected annually and anchors are inspected no less than once every 3 years.

2.3.3.3.6 System Accuracy

Based on Regulatory Position 4 in Section C of RG 1.23 (Reference 2.3.3-210), 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 2.3.3-201).

During the pre-application monitoring phase, data collected on the meteorological tower is recorded and processed at the base of the tower inside an environmentally controlled shelter. System accuracies of the site meteorological data collection system are currently being estimated by performing system calibrations, as one of the options suggested in Section 7.1 of ANSI/ANS-3.11-2005 (Reference 2.3.3-201). 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 2.3.3-204. As shown in the table, the sensor and system accuracies meet the regulatory guidance in RG 1.23 (Reference 2.3.3-210) and ANSI/ANS-3.11-2005 (Reference 2.3.3-201).

2.3.3.4 Preoperational Monitoring Phase

Before plant operation, 1 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, a 60-10 meter delta T being 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 the examination are provided in Subsection 2.3.3.6.1.

2.3.3.4.2 Data Collection System

The current onsite meteorological tower will be used for preoperational monitoring. Instrumentation and sensors used 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 current 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 the location for the pre-application 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, will be controlled by plant-specific instrumentation design and procedures to be developed at a later date. Other anticipated, phase-specific monitoring program differences are addressed below.

- Meteorological parameters measured during plant operation include wind speed, wind direction, and ambient temperature at the 10- and 60-meter levels, a 60-10 meter delta-T being referenced to the 10-meter ambient temperature, relative humidity at the 10-meter level, and precipitation at ground level.
- During the pre-application phase, meteorological data is 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 are also required to be determined. Both the 15-minute and hourly averages will be compiled for reporting purposes.
- Although RG 1.97, Revision 4 (Reference 2.3.3-209) allows flexible, performance-based criteria for the selection, performance, design, qualification, display, and quality assurance of accident monitoring variables, the 15-minute average data will be available to the plant control room, technical support center, and/or emergency operations facility designated to serve the new units.
- For instrumentation surveillance, channel checks will be performed daily.
- During system servicing, channel calibrations will 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).
- Wind speed, wind direction, and atmospheric stability data collected by the plant computer system will 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 will be prepared and submitted in accordance with RG 1.21, Revision 1 (Reference 2.3.3-203).

2.3.3.5.2 Emergency Preparedness Support

During the operational phase, the onsite meteorological monitoring program is also intended to 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 2.3.3-205, 2.3.3-206, 2.3.3-208, and 2.3.3-211).

The dispersion estimates input to the dose assessment calculations will 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 2.3.3-211). These 15-minute average values will 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 will be available and presented in a format compatible for their use (Reference 2.3.3-211).

Provisions will 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 COL 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.

Subsection 2.3.3.2 describes topographical characteristics and describe natural and plant-specific features in relation to siting the meteorological tower and the installed instrumentation. Since terrain variations between the tower base and finished plant grade in the power block area are minimal (i.e., <15 feet) and the plant structures and other nearby obstructions to airflow (e.g., trees) are all 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 switchyard is approximately 1300 feet east of the tower, while the planned large concrete or asphalt parking lot, or ventilation source is located more than 2770 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. There are two planned service water cooling towers with the closest tower at approximately 2400 feet from the tower. Figure 2.3.3-204 illustrates the relative positions of the meteorological tower and the plant cooling basin. Winds from the east-northeast through south-southeast directions could potentially carry moist air parcels over the basin toward the meteorological tower. However, due to the large-distance (i.e., 4660 feet) separation between the meteorological tower 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**

Using meteorological data collected at Victoria Regional Airport, Texas, as a surrogate, data collected at the Victoria Regional Airport and that collected at the VCS site was examined to determine how well the onsite data represents long-term conditions at the site.

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 above MSL, while the airport observing station is at 103 feet above MSL. 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.

Meteorological instrumentation (i.e., sensor used, measurement elevation, and methods of data recording) at the airport observing station and the onsite monitoring system is 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) is routinely measured onsite for atmospheric stability class determination, but this meteorological parameter is not measured at the airport. Since a determination of atmospheric stability at these site locations would not be the same, a comparison of stability class for these stations was not performed because it would not be a meaningful exercise.

2.3.3.6.2.1 Comparison of Wind Speed and Wind Direction

Periods of wind data examined include the following:

<u>Victoria Regional Airport</u>

- Long-term (i.e., >25 years) local climatological data summary
- Recent 5 years (i.e., 2003–2007)
- Most recent 1 year (i.e., 2007)
- Six months (i.e., July 1 through December 31) of the most recent 5 years
- Six months (i.e., July 1 through December 31, 2007) of the most recent year

<u>Victoria County Station</u>

- Six months (i.e., July 1 through December 31, 2007) onsite data

Wind measurements made at the Victoria Regional Airport location are in 10-degree increments (i.e., 0 to 360 degrees rounded to the nearest 10 degrees) To be consistent with the airport data-for-data comparison purpose, the wind frequency distribution tables for VCS were produced with directions at 10-degree increments.

The 5-year and recent 1-year wind frequency distributions for Victoria Regional Airport are provided in Tables 2.3.3-205 and 2.3.3-206, respectively. The 6-month wind frequency distribution of onsite meteorological data is presented in Table 2.3.3-207, while the similar information for the airport can be found in Table 2.3.3-208. The 5-year analysis of the July through December data collected at the airport is shown in Table 2.3.3-209. These comparative results are summarized in Table 2.3.3-210.

Findings from the wind data comparison indicate the following:

- For each site and time period data compilations, the highest wind direction classification (i.e., prevailing wind direction) was 160 degrees (south-southeast). The highest average wind speed for each location and time period was also found to be associated with the prevailing wind direction. The specific wind direction that is recorded least often is in general a west wind. Average wind speed was also the lowest when the wind direction had a westerly component.
- The short-term averaged wind speed at both the airport and VCS site were below the long-term average for the airport.
- The 5-year (i.e., 2003–2007) and recent 1-year (i.e., 2007) average wind speeds at the airport were 8.5 and 7.9 mph, respectively. The wind frequency distribution summaries as shown in Tables 2.3.3-205 and 2.3.3-206 show close agreement between the 5-year and recent 1 year of the airport data.
- The long-term (i.e., >25 years) and 5-year average wind speeds for July through December at Victoria Regional Airport were 8.7 and 7.5 mph, respectively. The July through December 2007 average wind speed value at the airport was 6.7 mph while the VCS site recorded a concurrent 6-month hourly average wind speed of 7.1 mph. Thus, the 6-month wind frequency distribution of the onsite data and the concurrent airport data compare reasonably well.

In conclusion, the wind data being collected at the VCS meteorological monitoring site is consistent with data from the Victoria Regional Airport.

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 1-year (i.e., 2007) local climatological data summary

Victoria County Station

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

Monthly total precipitation and ambient temperature were reviewed for a 1-year period (July 2007 through June 2008). The results of the review are summarized in Tables 2.3.3-211 and 2.3.3-212. Relevant data extracted from the long-term and recent year (i.e., 2007) local climatological data annual summary with comparative data for Victoria Regional Airport was also reported in these tables for comparison purpose.

Due to the nature of precipitation events in southeast Texas, comparing precipitation totals from locations that are several miles distant from one another is difficult. Due to the locally heavy rain that falls during thunderstorms, precipitation values can differ significantly over a short distance. The nature of the convective 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.

The airport reported greater monthly precipitation totals than the VCS site for the year reviewed. The rain gages at 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 is being measured at 10 meters at the VCS site, while temperature is being 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 would be expected due to the difference of the measuring heights.

In conclusion, the precipitation and temperature data being 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 and surrounding area (i.e., area within 5 miles) are generally flat, ranging in elevation between 65 and 85 feet above MSL 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 MSL. 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 1 year 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 2.3.3-207) referenced in RG 1.111 (Reference 2.3.3-204).

The XOQDOQ model is a constant mean wind direction model that uses meteorological data from a single station to calculate dispersion estimates out to 50 miles (80 kilometers) from a site of interest. In the model, the option of applying terrain-induced airflow recirculation factors is provided to account for the effects of this phenomenon, if necessary. The application of airflow recirculation factors for sites located in open terrain, such as VCS, is not required. This implies that the meteorological data from a single station is reasonably representative of the entire modeling domain. Therefore, no other offsite meteorological data collection system has been considered in determining the dispersion characteristics of the site area. The dispersion modeling analyses and results are described in Subsections 2.3.4 and 2.3.5.

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 service water cooling towers, regarding visible plume, drift deposition, fogging and icing. In particular, the basis/reasons for making this determination is 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 in these two locations (Subsection 2.3.3.6.1).
- Seasonal and Annual Cooling Tower Impact model used for predicting cooling tower plume impacts calls for twice daily mixing height, cloud ceiling, cloud cover, dry bulb, wet bulb, wind speed, and wind direction that are routinely measured at Victoria Regional Airport except mixing height, but not 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

RG 1.23 (Reference 2.3.3-210) specifies that the minimum amount of onsite meteorological data to be provided at the time of application, for a combined license that does not reference an early site permit, is 24 consecutive months, including the most recent 1-year period that is defendable, representative, and complete. RG 1.206 (Reference 2.3.3-211) stipulates, if 2 years of onsite data is not available at the time the application is submitted, at least one annual cycle of meteorological data collected onsite should be provided with the application.

Data collected from July 1, 2007 through June 30, 2008 is provided.

Specifically, an electronic sequential, hour-by-hour listing of the data set, in the format specified in Appendix A of RG 1.23 (Reference 2.3.3-210), is provided.

The annualized data recovery rates for the period from July 1, 2007 through June 30, 2008 are presented in Table 2.3.3-213 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 2.3.3-210) specification of at least 90%.

Joint frequency distributions of wind speed, wind direction, and atmospheric stability class for the 1 year of onsite data are presented in Tables 2.3.3-209 and 2.3.3-210 for the 10- and 60-meter wind measurement levels. The format follows the example shown in Table 3 of RG 1.23 (Reference 2.3.3-210) for each stability class and for all stability classes combined.

The 1 year of available onsite data was used to calculate both the short-term and long-term atmospheric dispersion estimates presented in Subsections 2.3.4 and 2.3.5. A supplemental submittal, including a reanalysis of the atmospheric dispersion estimates, based on the complete 2-year data set, will be made in accordance with RG 1.206 (Reference 2.3.3-210).

2.3.3.7 **References**

2.3.3-201 American National Standards Institute/American Nuclear Society, *American National Standard for Determining Meteorological Information at Nuclear Facilities*, ANSI/ANS-3.11-2005, December 2005.

2.3.3-202 Murray and Trettle, *P1009 Procedures Manual, P1009 Meteorological Monitoring Program Equipment Servicing and Data Recovery Procedures Manual, Revision 25,* July 2007.

2.3.3-203 U.S. NRC, *Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants*, Regulatory Guide 1.21, Revision 1, June 1974.

2.3.3-204 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.

2.3.3-205 U.S. NRC, *Clarification of TMI Action Plan Requirements*, NUREG-0737, November 1980.

2.3.3-206 U.S. NRC, *Functional Criteria for Emergency Response Facilities*, NUREG-0696, Final Report, February 1981.

2.3.3-207 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.

2.3.3-208 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.

2.3.3-209 U.S. NRC, *Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants*, Regulatory Guide 1.97, Revision 4, June 2006.

2.3.3-210 U.S. NRC, *Meteorological Monitoring Programs for Nuclear Power Plants*, Regulatory Guide 1.23, Revision 1, March 2007.

2.3.3-211 U.S. NRC, *Combined License Applications for Nuclear Power Plants (LWR Edition),* Regulatory Guide 1.206, Revision 0, June 2007.

Table 2.3.3-201
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 above MSL 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 above MSL Finished plant grade at Units 1 and 2: 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 1200 feet from the tower. The minimum distance to the planned large gravel switchyard is 1300 feet, while the closed concrete or asphalt parking lot is more than 3400 feet from 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.

Table 2.3.3-202 (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. All nearby plant buildings and other structures will be located more than 10 times the structure height away from the tower. The tallest structures in the power block are the turbine buildings (166 feet above grade) and the closest turbine building is located 2770 feet from the tower.
Wind sensors should be located to reduce airflow modification and turbulence induced by the supporting structure itself.	Conforms	The wind sensors are 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 currently or planned within 2770 feet of the tower, except the existing U.S. Highway 77 and the planned gravel switchyard, which are approximately 1200 feet and 1300 feet at their 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.

Table 2.3.3-202 (Sheet 2 of 2)
Meteorological Sensor Siting Conformance Status

RG 1.23 Criteria	Conformance Status	Remarks
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 are mounted in fan-aspirated radiation shields pointing to the north. The shield inlet is situated approximately 2.5 feet from the tower (more than 1.5 times the tower's width of 1.5 feet).
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 is 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 are provided to prevent wind-caused under recording of precipitation. The rain gage wind shield is 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 2.3.3-203
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)	A 60-10 meter delta-T measurement being 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 COL 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 plant normal cooling system is a cooling basin. The two small plant service water cooling towers are of conventional wet mechanical draft type with physical tower height of 56 feet (17.1 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 2.3.3-204 (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	0–145 mph (0–65 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	NA	± 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 2.3.3-204 (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	NA	NA	±1.5°C (±2.7°F)	±1.5°C (±2.7°F)	NA	NA	0.1°C (0.1°F)	0.1°C (0.1°F)	Calculated as noted under sensor type

a. All sensor output are 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 are reviewed daily. Time tracking and synchronizing is not necessary during preoperational monitoring.

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 2.3.3-205
Five Year (2003–2007) Wind Frequency Data at Victoria Regional Airport

Wind Dir[a]	Wind Speed (MPH) 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 2.3.3-206
One Year (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	0.52	1.09	1.36	0.93	0.07	0.05				4.01	8.39
02	0.40	0.83	0.99	0.72	0.07	0.01				3.02	8.26
03	0.55	1.14	0.94	0.52	0.07					3.22	7.28
04	0.54	1.13	0.95	0.34	0.05					3.00	6.90
05	0.60	1.09	0.74	0.24	0.01					2.69	6.36
06	0.40	1.03	0.83	0.18	0.01					2.45	6.57
07	0.38	0.85	0.78	0.13	0.01					2.16	6.43
08	0.36	0.72	0.60	0.19	0.01					1.89	6.57
09	0.40	0.80	0.66	0.17		0.01				2.04	6.59
10	0.38	0.79	0.85	0.22	0.02					2.27	6.81
11	0.41	0.90	1.02	0.48	0.08					2.90	7.88
12	0.25	0.89	1.79	1.67	0.49	0.02				5.12	10.33
13[b]	0.31	1.09	2.92	1.97	0.43	0.07				6.80	9.89
14	0.20	0.99	2.29	1.55	0.61	0.12	0.01			5.78	10.38
15	0.20	0.87	1.60	1.60	0.70	0.23				5.19	11.30
16[b]	0.29	0.91	1.62	2.14	0.84	0.24	0.02			6.07	11.69
17	0.31	0.96	1.62	1.36	0.31	0.14	0.01			4.72	10.05
18	0.31	0.61	0.97	0.71	0.14	0.04	0.01			2.80	8.97
19	0.25	0.37	0.64	0.36	0.08	0.02				1.73	8.67
20	0.25	0.37	0.46	0.29	0.01	0.01				1.39	7.74
21	0.12	0.35	0.40	0.11	0.02		0.01			1.01	7.74
22	0.10	0.22	0.35	0.13						0.79	7.68
23	0.12	0.16	0.16	0.08						0.52	7.16
24	0.05	0.16	0.19	0.01						0.41	6.62
25	0.10	0.08	0.12	0.04	0.04					0.37	7.61
26	0.13	0.13	0.08		0.02					0.37	6.23
27	0.08	0.10	0.06	0.02	0.04	0.04				0.34	9.18
28	0.12	0.10	0.08	0.02	0.06					0.38	7.62
29	0.14	0.19	0.22	0.02						0.58	6.25
30	0.11	0.34	0.19	0.11	0.02	0.01	0.01			0.79	7.70
31	0.12	0.31	0.42	0.06	0.08	0.02				1.02	8.21
32	0.19	0.43	0.46	0.17	0.10	0.05				1.39	8.48
33	0.16	0.36	0.37	0.31	0.14	0.12	0.01			1.48	10.60
34	0.20	0.56	0.68	0.53	0.22	0.08	0.01			2.29	9.87
35	0.31	0.56	0.99	1.07	0.25	0.06				3.24	10.11
36	0.30	0.70	1.44	1.07	0.20	0.01				3.72	9.43
Calm	12.03									12.03	
	21.71	22.20	29.85	19.51	5.25	1.37	0.11	0.00	0.00	100	7.90

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 2.3.3-207
6-Month (July through December 2007)
Wind Frequency Data at Victoria County Station

	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	0.54	1.79	0.77	0.88	0.09					4.08	7.19
02	0.45	1.97	0.95	0.41	0.07					3.85	6.36
03	0.50	2.45	0.77	0.50						4.22	6.20
04	0.61	2.20	0.77	0.23						3.81	5.54
05	0.57	1.38	0.59	0.20	0.05					2.79	6.09
06	0.50	1.47	0.50	0.14						2.61	5.53
07	0.48	1.34	0.52	0.11						2.45	5.37
08	0.34	1.07	0.52	0.23						2.15	6.00
09	0.48	1.75	0.86	0.27						3.35	6.11
10	0.68	1.86	1.36	0.32	0.02					4.24	6.21
11	0.48	1.47	1.00	0.41						3.35	6.57
12	0.39	1.43	1.09	0.48						3.38	6.67
13	0.41	1.79	1.95	1.47	0.16					5.78	8.36
14	0.27	2.29	1.81	1.47	0.09					5.94	8.12
15	0.36	2.56	1.81	1.27	0.11					6.12	7.73
16[b]	0.34	1.65	1.79	2.61	0.23					6.62	9.43
17	0.41	1.86	1.31	1.81	0.23	0.11				5.73	8.86
18	0.29	1.31	0.68	0.48	0.05					2.81	7.02
19	0.41	0.68	0.34	0.36	0.09					1.88	7.18
20	0.20	0.45	0.18	0.14						0.97	5.95
21	0.29	0.34	0.29	0.16						1.09	6.35
22	0.09	0.29	0.11	0.09						0.59	6.26
23	0.18	0.20	0.11	0.02						0.52	5.08
24	0.32	0.20	0.16		0.02					0.70	5.06
25	0.25	0.18	0.05							0.48	4.18
26	0.25	0.25		0.05						0.54	4.05
27	0.29	0.32	0.02	0.02	0.02					0.68	4.56
28	0.18	0.20	0.11	0.05	0.02					0.57	5.89
29	0.29	0.41	0.14	0.09		0.02				0.95	5.81
30	0.32	0.48	0.14	0.09		0.02				1.04	5.50
31	0.18	0.36	0.16	0.18		0.05				0.93	7.14
32	0.29	0.77	0.41	0.25	0.14					1.86	7.17
33	0.59	0.84	0.32	0.23	0.32	0.16				2.45	8.49
34	0.57	1.20	0.27	0.34	0.23	0.05				2.65	7.14
35	0.66	1.47	0.86	0.93	0.11	0.02				4.06	7.44
36	0.57	1.68	1.18	0.86	0.23					4.51	7.69
Calm	0.25									0.25	
	14.28	41.98	23.91	17.14	2.27	0.43	0.00	0.00	0.00	100	7.09

a. Wind direction recorded at the Victoria County Station 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 2.3.3-208
6-Month (July through December 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	0.83	1.36	1.12	0.52	0.07	0.07				3.98	7.31
02	0.60	1.12	0.76	0.31	0.07	0.02				2.89	6.83
03	0.83	1.57	0.88	0.33	0.02					3.65	6.24
04	0.76	1.26	0.98	0.36	0.02					3.39	6.56
05	0.83	1.24	0.95	0.26	0.02					3.32	6.27
06	0.62	1.15	0.72	0.14						2.62	5.92
07	0.57	1.07	0.69	0.17	0.02					2.53	6.17
08	0.43	0.93	0.67	0.21						2.24	6.39
09	0.60	0.83	0.62	0.19						2.24	6.14
10	0.48	0.93	0.76	0.19	0.02					2.39	6.40
11	0.60	0.91	1.10	0.50						3.10	7.32
12	0.31	1.00	1.38	0.91	0.02					3.63	8.49
13	0.29	1.24	2.19	0.69	0.17					4.58	8.32
14	0.29	1.15	1.62	0.91	0.21	0.02				4.20	8.66
15	0.21	0.93	1.00	1.10	0.29	0.02				3.55	9.77
16[b]	0.43	1.17	1.77	2.22	0.45	0.10	0.02			6.15	10.43
17	0.33	1.26	1.84	1.53	0.21	0.07	0.02			5.27	9.52
18	0.36	0.81	0.93	0.74	0.14					2.98	8.56
19	0.29	0.36	0.72	0.50	0.10					1.96	8.73
20	0.29	0.45	0.48	0.29	0.02	0.02				1.55	7.85
21	0.12	0.41	0.31	0.05						0.88	6.38
22	0.14	0.24	0.31	0.14						0.83	7.29
23	0.10	0.14	0.12	0.10						0.45	7.47
24	0.07	0.14	0.12	0.02						0.36	6.20
25	0.14	0.05	0.10	0.02						0.31	5.62
26	0.14	0.14	0.07							0.36	5.00
27	0.12	0.12	0.05	0.05	0.02					0.36	6.53
28	0.07	0.10	0.07		0.02					0.26	6.36
29	0.17	0.21	0.21	0.02						0.62	6.04
30	0.17	0.41	0.17	0.19	0.05	0.02	0.02			1.03	8.30
31	0.14	0.33	0.38	0.10	0.17	0.02				1.15	9.00
32	0.24	0.60	0.50	0.14	0.07	0.07				1.62	8.09
33	0.19	0.33	0.12	0.33	0.19	0.12	0.02			1.31	11.38
34	0.36	0.67	0.64	0.50	0.17	0.14	0.02			2.50	9.49
35	0.48	0.83	0.83	0.67	0.02	0.02				2.86	7.90
36	0.48	0.93	1.22	0.81	0.14					3.58	8.42
Calm	15.29									15.29	
	28.36	26.41	26.41	15.22	2.74	74.00	0.12	0.00	0.00	100	6.73

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 2.3.3-209
5-Year (2003–2007) Wind Frequency Data for July through December 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	0.35	1.12	1.33	0.77	0.22	0.02	0.00	0.00		3.82	8.70
02	0.27	0.91	1.28	0.45	0.08	0.02				3.01	8.05
03	0.42	1.23	1.35	0.50	0.06	0.01				3.57	7.49
04	0.40	1.15	1.25	0.41	0.02	0.00	0.00			3.24	7.33
05	0.38	1.17	1.29	0.33	0.08	0.01				3.26	7.38
06	0.41	1.09	1.12	0.35	0.05	0.01	0.01			3.05	7.33
07	0.36	0.99	1.07	0.27	0.02					2.72	7.05
08	0.31	0.86	0.88	0.22	0.03					2.31	6.99
09	0.40	0.84	0.82	0.21	0.02					2.28	6.77
10	0.39	0.90	0.78	0.20	0.03					2.30	6.76
11	0.38	0.94	1.00	0.44	0.07		0.00			2.84	7.61
12	0.28	0.83	1.32	0.83	0.16	0.00				3.43	8.86
13	0.22	1.10	1.98	0.93	0.09	0.00				4.33	8.58
14	0.22	0.97	1.97	0.86	0.17	0.02				4.22	8.84
15	0.20	0.99	1.63	1.23	0.32	0.02	0.00			4.39	9.74
16[b]	0.25	0.99	2.05	1.90	0.62	0.04	0.00			5.86	10.56
17	0.31	0.98	1.77	1.77	0.40	0.06	0.00			5.30	10.26
18	0.29	0.72	1.44	1.06	0.28	0.05				3.84	9.80
19	0.20	0.56	0.99	0.82	0.18	0.03	0.01			2.80	9.76
20	0.22	0.55	0.73	0.46	0.10	0.03				2.09	8.88
21	0.19	0.46	0.52	0.23	0.02	0.00				1.43	7.73
22	0.14	0.33	0.38	0.13	0.01					0.99	7.36
23	0.09	0.24	0.25	0.06	0.00					0.66	6.86
24	0.11	0.23	0.25	0.03		0.00				0.62	6.58
25	0.07	0.17	0.23	0.07	0.00					0.54	7.28
26	0.13	0.15	0.20	0.02	0.00					0.50	6.24
27	0.08	0.18	0.14	0.03	0.01					0.45	6.74
28	0.07	0.22	0.29	0.02	0.02	0.00				0.62	7.25
29	0.07	0.24	0.37	0.07	0.01		0.01			0.77	7.87
30	0.08	0.28	0.26	0.12	0.03	0.01	0.01			0.80	8.26
31	0.08	0.31	0.46	0.10	0.08	0.03	0.00			1.08	8.66
32	0.15	0.41	0.65	0.18	0.08	0.06	0.03			1.57	9.17
33	0.15	0.42	0.50	0.28	0.13	0.06	0.01	0.00		1.54	9.52
34	0.20	0.61	0.71	0.37	0.16	0.05	0.00			2.11	8.98
35	0.28	0.70	0.78	0.55	0.20	0.04	0.00			2.56	9.11
36	0.29	0.90	1.09	0.79	0.21	0.03				3.31	9.06
Calm	11.81									11.81	
	20.28	24.77	33.15	17.06	3.97	0.64	0.12	0.01	0.00	100	7.54

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 2.3.3-210
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 (>25 yrs)	9.7	SSE (Dir 16)	10.5	N/A	N/A
Recent 5-Years (2003–2007)	8.5	SSE (Dir 16)	11.9	W (Dir 26)	6.8
Most recent 1-year (2007)	7.9	SE (Dir 13) to SSE (Dir 16)	10.8	W (Dir 27)	9.2
Long-term >25 yrs (Jul-Dec)	8.7	N/A	N/A	N/A	N/A
Recent 5-year (Jul-Dec 2003–2007)	7.5	SSE (Dir 16)	10.6	W (Dir 27)	6.7
Most recent 6-month (Jul-Dec 2007)	6.7	SSE (Dir 16)	10.4	W (Dir 28)	6.4
Victoria County Station					
Most recent 6-month (Jul-Dec 2007)	7.1	SSE (Dir 16)	9.4	WSW (Dir 25)	4.18

Table 2.3.3-211
Comparative Precipitation Data Summary

	Recent Year Period (7/2007–6/2008) Victoria County Station[a]	Recent Year Period (7/2007–6/2008) Victoria Regional Airport[b]	Short-Term (2004 Summary) Victoria Regional Airport[b]	Long-Term (30 yrs) Victoria Regional Airport[b]
July	17.95	20.34	3.51	2.90
August	3.63	5.73	3.78	3.05
September	3.39	4.15	2.54	5.00
October	2.07	3.87	5.81	4.26
November	1.44	1.35	16.14	2.64
December	0.20	0.34	1.91	2.47
January	3.66	3.52	3.02	2.44
February	0.88	1.16	3.20	2.04
March	2.95	3.36	1.29	2.25
April	1.05	1.60	6.29	2.97
May	0.53	0.33	12.66	5.12
June	0.25	0.11	13.50	4.96

Notes:

Measurement Height

a. VCS (onsite) — 10 meters
b. Victoria Regional Airport — Ground level

Table 2.3.3-212
Comparative Temperature Data Summary

	Recent Year Period (7/2007–6/2008) Victoria County Station[a]	Recent Year Period (7/2007–6/2008) Victoria Regional Airport[b]	Short-Term (2004 Summary) Victoria Regional Airport[b]	Long-Term (30 yrs) Victoria Regional Airport[b]
July	79.3	81.2	82.9	84.2
August	81.5	84.2	82.4	84.2
September	78.8	80.8	80.3	80.1
October	71.7	72.7	77.0	72.3
November	63.6	63.8	63.4	62.7
December	60.0	58.6	54.5	55.2
January	54.0	52.6	56.3	53.2
February	62.0	61.2	54.7	56.7
March	63.7	63.7	67.4	63.7
April	69.9	68.5	69.5	69.7
May	77.4	79.0	75.8	76.6
June	81.9	84.8	81.1	81.8

Notes:

Measurement Height

a. VCS (onsite) —10 meters
b. Victoria Regional Airport — Ground level

Table 2.3.3-213
Annual Data Recovery Rates (Percent) for the Victoria County Station Meteorological Monitoring System (7/1/2007–6/30/2008)[a]

Parameter	**7/1/07 - 6/30/08[b]**
Wind Speed (10 meter)	99.9
Wind Speed (60 meter)	99.9
Wind Direction (10 meter)	99.9
Wind Direction (60 meter)	99.9
Delta-Temperature (60 meter – 10 meter)[c]	99.9
Ambient Temperature (10 meter)	99.9
Relative Humidity (10 meter)	99.9
Precipitation (Ground-Level)	99.9
Composite Parameters	
WS/WD (10m), Delta-T (60m-10m)[c]	99.9
WS/WD (60m), Delta-T (60m-10m)[c]	99.9

a. Pre-application monitoring began in June 28, 2007. Meteorological data from July 1, 2007, to June 30, 2008, are used to make the dispersion estimates (i.e., X/Qs) in the COL Application.
b. Relative humidity measured at the 60-meter level began on November 28, 2007.
c. Delta-T between 60-m and 10-m levels.

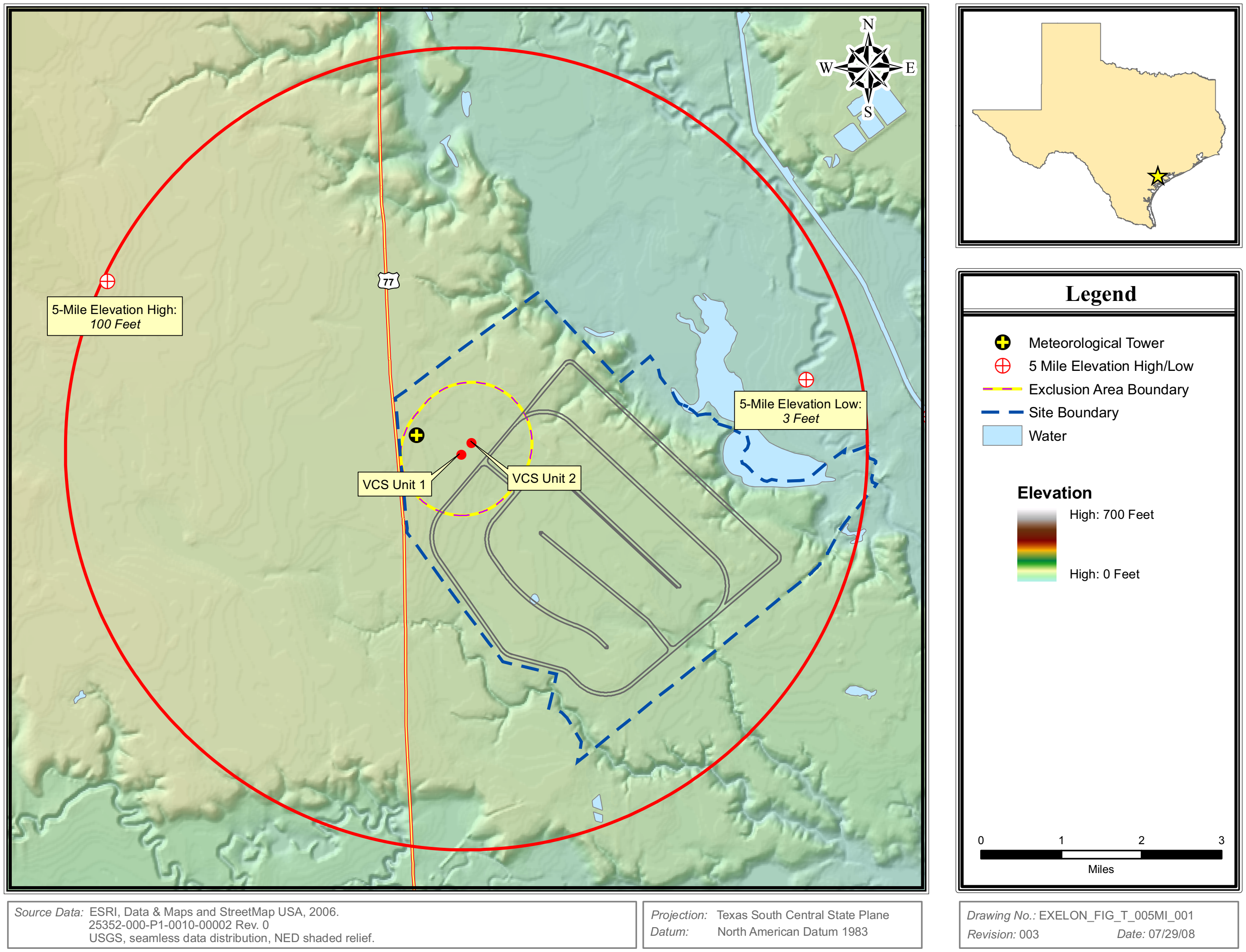


Figure 2.3.3-201 Site and Vicinity Map (5-Mile Radius)

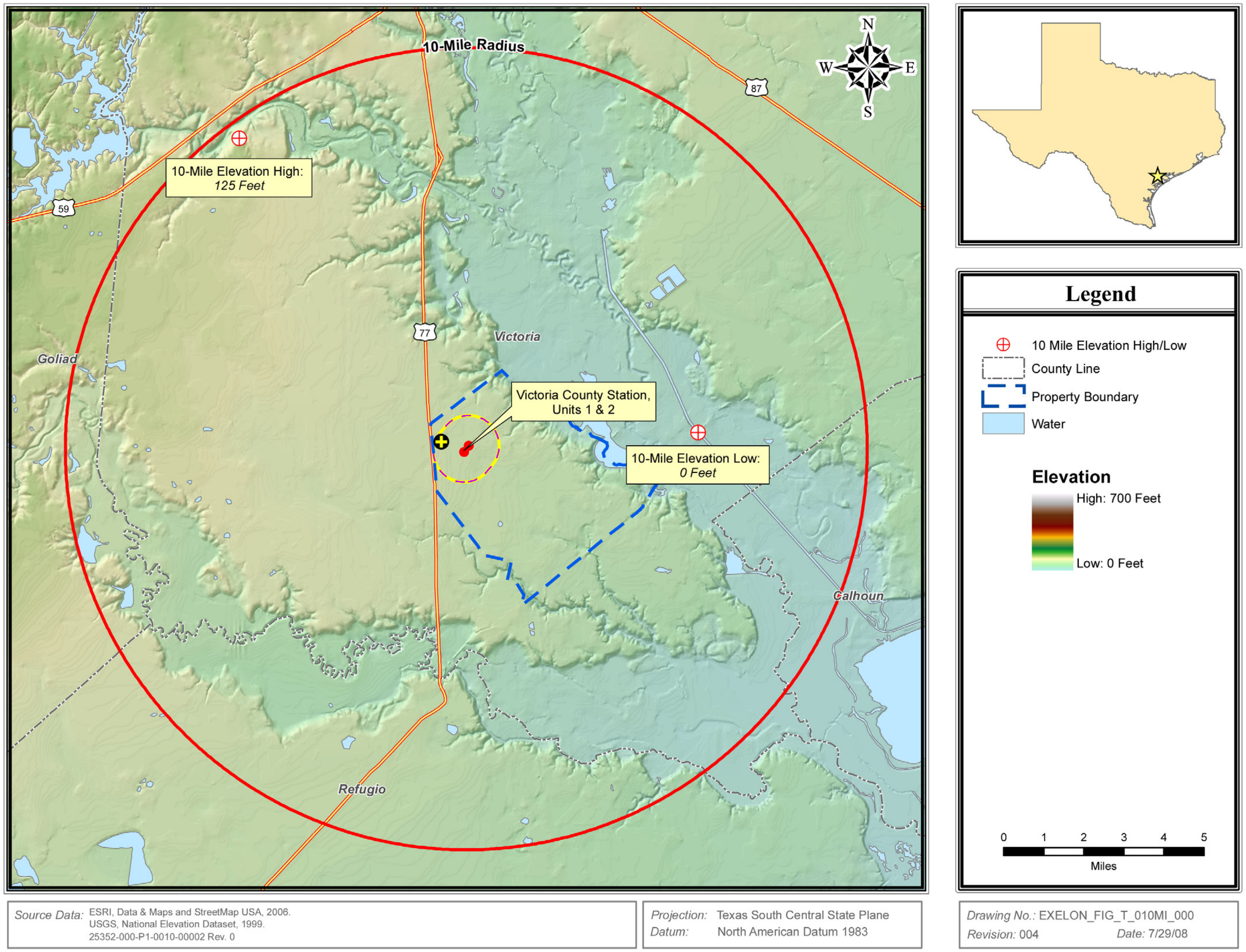


Figure 2.3.3-202 Site and Vicinity Map (10-Mile Radius)

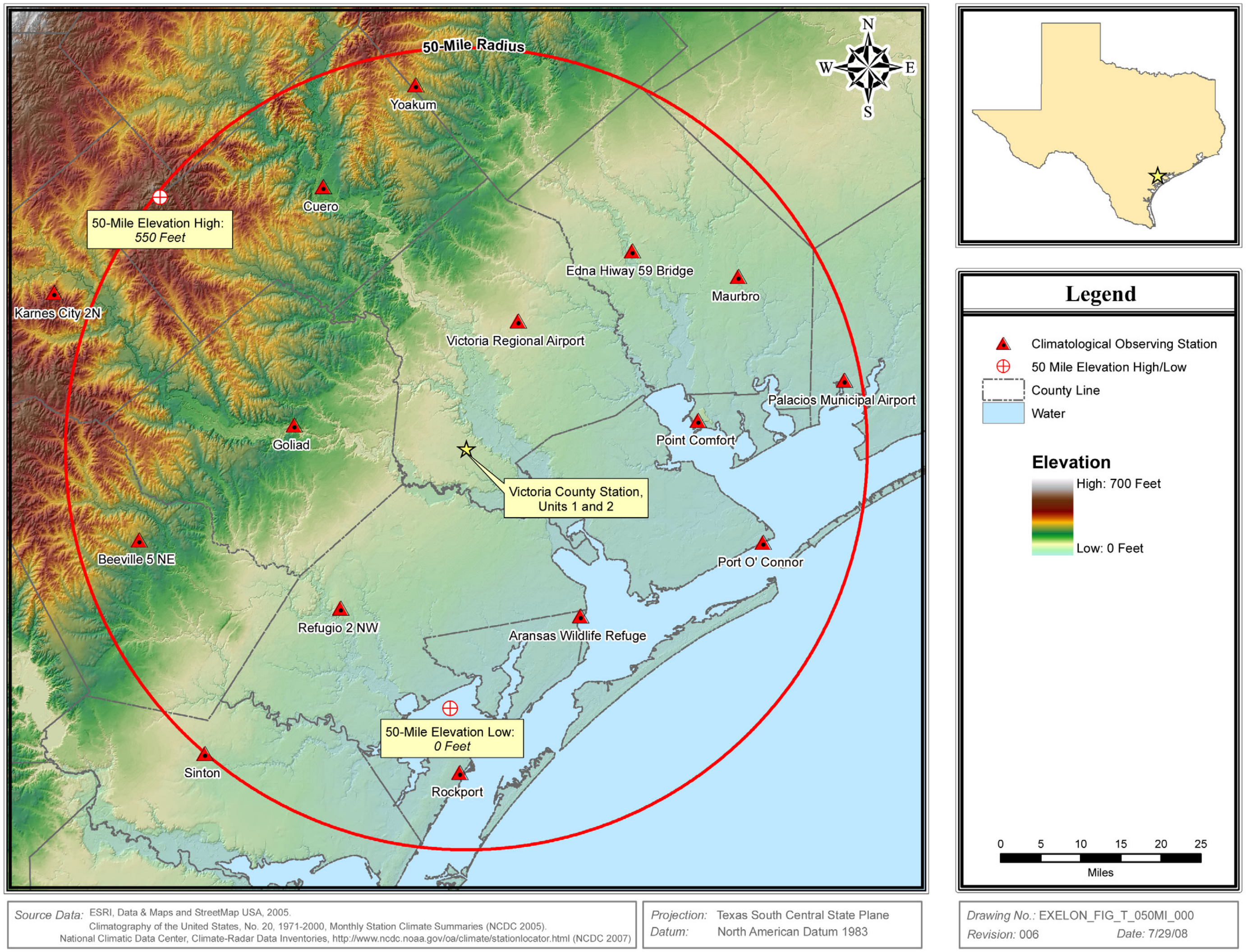


Figure 2.3.3-203 Climatological Observing Stations near the Victoria County Station

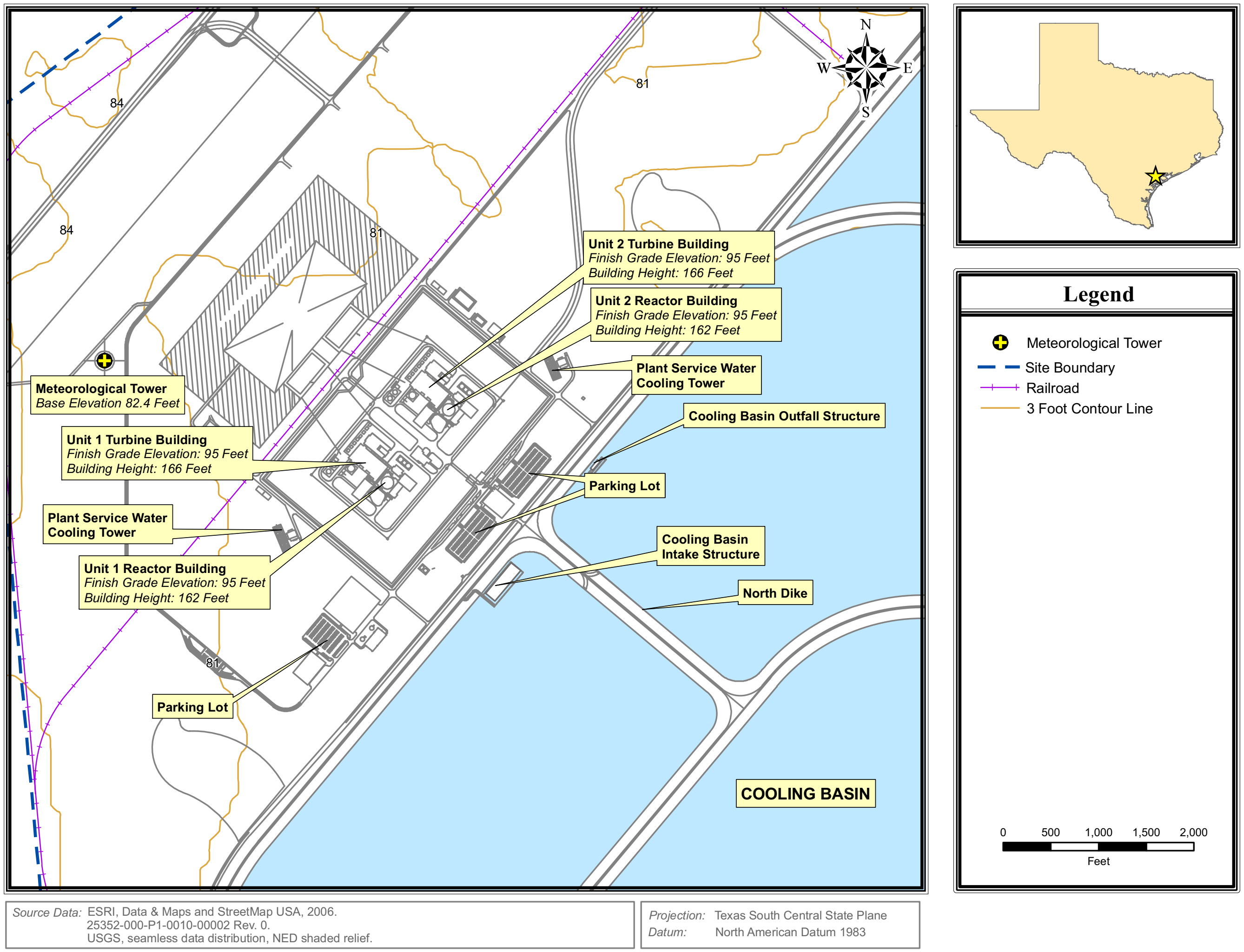


Figure 2.3.3-204 Location of Meteorological Tower Relative to Major Plant Structures and Other Features

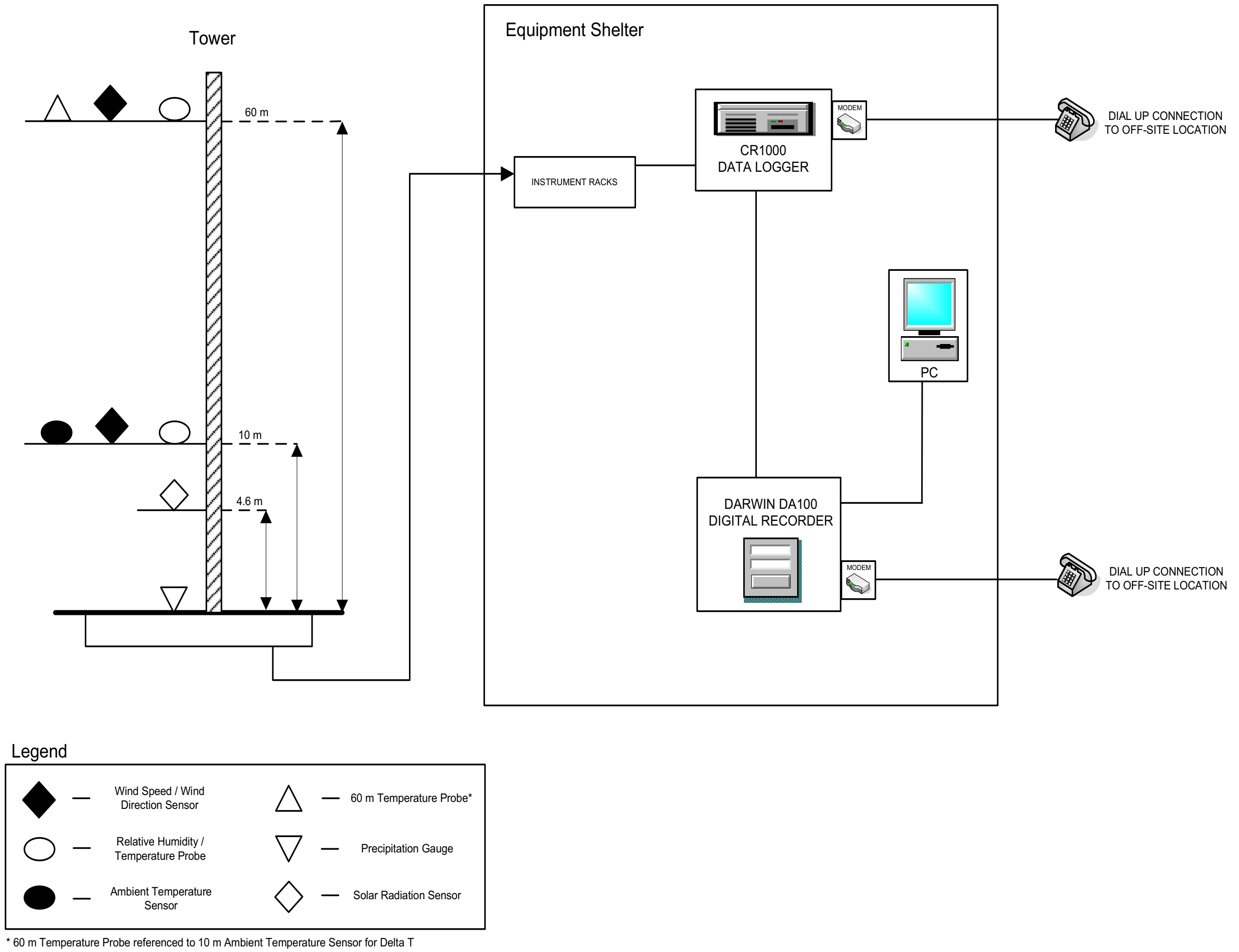


Figure 2.3.3-205 Onsite Meteorological Monitoring System Block Diagram

2.3.4 Short-Term Atmospheric Dispersion Estimates for Accident Releases

2.3.4.1 Basis

VCS COL 2.0-10-A

To evaluate potential health effects of design-basis accidents (DBAs) at VCS Units 1 and 2, 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 2.3.4-201) 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 12-month period of record for July 2007 to June 2008 was used to quantitatively evaluate such a hypothetical accident at the site. A supplemental submittal, including a reanalysis of the atmospheric dispersion estimates, based on the complete 2-year data set, will be made in accordance with RG 1.206 (Reference 2.3.4-203).

According to 10 CFR 100, it is necessary to consider the doses for various time periods immediately following the onset of a postulated ground-level release at the EAB and for the duration of the exposure for the LPZ. Therefore, the relative X/Qs are estimated for various time periods ranging from 2 hours to 30 days.

Meteorological data is used to determine various postulated accident conditions as specified in RG 1.145. Compared to an elevated release, a ground-level release usually results in higher ground-level concentrations at downwind receptors due to less dispersion as a result of shorter traveling distances. Section 4.4 of the PAVAN code (Reference 2.3.4-201) specifies that ground-level releases include all release points or areas that are lower than 2-1/2 times the height of adjacent solid structures. Because the ground-level release scenario provides a bounding case, and none of the release heights is greater than 2-1/2 times the height of the nearby reactor building, elevated releases are not considered.

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% 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% of the total time.

The greater of the two values (i.e., the maximum sector-dependent 0.5% X/Q or the overall site 5% 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, 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.

The PAVAN model input data are presented below:

- Meteorological data: 12 months (July 2007–June 2008) onsite joint frequency distributions (JFDs) of wind speed, wind direction, and atmospheric stability (see Section 2.3.2)
- Type of release: Ground-level
- Wind sensor height: 33 feet (10 meters)
- Vertical temperature difference: as measured at the 33-foot (10-meter) and 196.9-foot (60-meter) levels of the primary meteorological tower
- Number of wind speed categories: 12 (including calm and the 11 categories listed in Table 2.3.2-205)
- Release height: 33 feet (10 meters), default height
- Distances from release point to EAB for all downwind sectors
- Distances from release point to LPZ for all downwind sectors

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

General Design Criteria 19 of 10 CFR 50, Appendix A sets forth the requirements for control rooms at nuclear power plants. The NRC-sponsored ARCON96 computer code was used to estimate X/Q values in building wakes.

Hourly meteorological data collected onsite during July 2007 to June 2008 is used as part of the input for the ARCON96 program.

The ARCON96 code produces 95% X/Q values for standard averaging intervals of 0-2 hours, 2–8 hours, 8-24 hours, 1-4 days, and 4-30 days in the vicinity of buildings.

RG 1.194 provides guidance on the use of ARCON96 for determining X/Qs to be used in the design basis evaluation of control room radiological habitability. Section 3.2.2 of RG 1.194 specifies that a stack release should be more than 2-1/2 times the height of the adjacent structure. Since all the potential releases are all less than 2-1/2 times the height of each associated building, they are considered to be ground-level sources in the ARCON96 modeling. All the potential release sources shown in Table 2.3.4-203 are conservatively treated as ground-level sources. The diffuse area source representation in ARCON96 requires the building cross-sectional area to be calculated from the maximum building dimensions projected onto a vertical plane perpendicular to the line of sight from the building to the intake. Therefore, a fuel building width of 48.4 meters is used as shown in Table 2.3.4-204, Sheet 2 of 2.

2.3.4.2 **PAVAN Modeling Results**

The PAVAN model has been configured to calculate offsite X/Q values assuming both “wake-credit allowed” and “wake-credit not allowed.” For all sectors, the EAB and LPZ are located beyond the wake influence zone induced by the reactor 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. VCS Units 1 and 2 were conservatively treated as one unit in estimating the shortest distance to each boundary receptor in each direction. This was done by using a source boundary (Figure 2.3.4-201) which encloses both Units 1 and 2. Using the source boundary approach, the shortest distance from the source boundary to the EAB is a constant (1036 meters) in all the 16 direction sectors. The maximum direction-dependent 0.5% X/Q value and the overall site 5% 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 (4.792 miles or 7710 meters) (Figure 2.3.4-202) 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%, direction-dependent X/Q value is compared with the 5% 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 2.3.4-201 and 2.3.4-202 present the X/Qs for the EAB and LPZ, respectively, for each of the 16 downwind sectors for the appropriate time period(s). The overall site 5% X/Q value at the LPZ is higher than the sector-dependent 0.5% X/Q value. At the EAB, the sector dependent 0.5% X/Q value is greater than the overall site 5% X/Q value. The maximum X/Qs are summarized below.

Summary of PAVAN Results, X/Q (sec/m^3)
(Limiting Case, 2007–2008 Meteorological Data)}

Receptor Location	0–2 hrs	0–8 hrs	8–24 hrs	1–4 days	4–30 days	Annual Average
EAB	2.34×10^{-4}	—	—	—	—	—
LPZ	—	1.67×10^{-5}	1.11×10^{-5}	4.60×10^{-6}	1.29×10^{-6}	2.73×10^{-7}

The results provided in Tables 2.3.4-201 and 2.3.4-202 show that the X/Q values determined by the PAVAN modeling analyses at the EAB and LPZ, respectively, are bounded by the ESBWR standard plant site design parameters as defined in Table 2.0-1 of the ESBWR DCD (Reference 2.3.4-202). The PAVAN-predicted maximum 0–2 hour EAB X/Q value (2.34×10^{-4} s/m^3) is lower than the corresponding DCD EAB X/Q value (2.00×10^{-3} s/m^3). Similarly, the PAVAN-predicted maximum 0–8 hour LPZ X/Q value (1.67×10^{-5} s/m^3) is lower than the corresponding DCD LPZ X/Q value (1.90×10^{-4} s/m^3).

2.3.4.3 **ARCON96 Modeling Results**

Onsite X/Qs are estimated using the ARCON96 model as described in NUREG/CR-6331 (Reference 2.3.4-203) and consider the air intake height, release height, release type, source-to-receptor distance, and building area. Onsite receptor/source locations are listed in Table 2.3.4-203.

Table 2.3.4-204 identifies 38 source-to-receptor combinations that were considered. The locations of all potential source and receptor locations are shown in Figure 2.3.4-203. ARCON96 inputs used for the determination of bounding X/Q values are presented in Table 2.3.4-204.

Control room (CR) and technical support center (TSC) X/Qs for the 95% time averaging periods (0–2 hour, 2–8 hours, 8–24 hours, 1–4 days, and 4–30 days) obtained from the ARCON96 modeling results are summarized in Table 2.3.4-205. Refer to Table 2.0-201 for a comparison to the corresponding ESBWR site parameter values.

2.3.4.4 **Impact of Toxic Chemical Accidents to the Control Room and Technical Support Center**

Pollutant concentrations are also estimated at the VCS Units 1 and 2 control room air intakes for postulated accidental releases of hazardous materials (i.e., flammable vapor clouds, toxic chemicals, and smoke from fires) from materials stored onsite, offsite, and for toxic or flammable material passing close to the site on nearby transportation routes.

A detailed description of potential toxic chemical accidents to be considered as design-basis events and their impacts are discussed in Subsection 2.2.3.1. Conservative meteorological conditions are used in this toxic chemical analysis and not the conditions derived from collected site data. Estimated values of control room concentrations due to potential hazardous material releases are presented in Table 2.2-212.

2.3.4.5 **References**

2.3.4-201 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.

2.3.4-202 ESBWR Design Control Document, Tier 2, Revision 4, September 2007, GE-Hitachi Nuclear Energy.

2.3.4-203 U.S. Nuclear Regulatory Commission, *Atmospheric Relative Concentrations in Building Wakes*, NUREG/CR-6331, Revision 1, May 1997.

Table 2.3.4-201
PAVAN Results - X/Q Values at the EAB (Building Wake Credit Not Included)

```
/PLANT NAME: Victoria Site                      METEOROLOGICAL INSTRUMENTATION
 DATA PERIOD: 2007-08 (12 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 (S/CUBIC METER)
                                                        VERSUS                                 HOURS PER YEAR MAX
                                                    AVERAGING TIME                                  0-2 HR X/Q IS
```

DOWNWIND SECTOR	DISTANCE (METERS)	0-2 HOURS	0-8 HOURS	8-24 HOURS	1-4 DAYS	4-30 DAYS	ANNUAL AVERAGE	EXCEEDED IN SECTOR	DOWNWIND SECTOR
S	1036.	2.26E-04	1.45E-04	1.16E-04	7.20E-05	3.61E-05	1.55E-05	41.0	S
SSW	1036.	2.13E-04	1.35E-04	1.07E-04	6.54E-05	3.21E-05	1.34E-05	270.9	SSW
SW	1036.	2.07E-04	1.30E-04	1.03E-04	6.22E-05	3.02E-05	1.25E-05	33.4	SW
WSW	1036.	1.54E-04	9.72E-05	7.73E-05	4.70E-05	2.30E-05	9.62E-06	18.9	WSW
W	1036.	1.78E-04	1.14E-04	9.12E-05	5.63E-05	2.82E-05	1.21E-05	24.4	W
WNW	1036.	2.14E-04	1.36E-04	1.09E-04	6.65E-05	3.29E-05	1.39E-05	36.6	WNW
NW	1036.	2.34E-04	1.57E-04	1.29E-04	8.35E-05	4.49E-05	2.10E-05	43.7	NW
NNW	1036.	2.29E-04	1.54E-04	1.27E-04	8.24E-05	4.45E-05	2.09E-05	41.7	NNW
N	1036.	1.75E-04	1.10E-04	8.78E-05	5.34E-05	2.62E-05	1.09E-05	24.0	N
NNE	1036.	1.20E-04	7.03E-05	5.39E-05	3.02E-05	1.32E-05	4.77E-06	14.3	NNE
NE	1036.	8.40E-05	5.02E-05	3.88E-05	2.22E-05	9.94E-06	3.73E-06	13.9	NE
ENE	1036.	1.28E-04	7.36E-05	5.57E-05	3.05E-05	1.28E-05	4.42E-06	16.0	ENE
E	1036.	1.18E-04	6.82E-05	5.17E-05	2.84E-05	1.20E-05	4.19E-06	14.2	E
ESE	1036.	1.53E-04	8.92E-05	6.81E-05	3.80E-05	1.64E-05	5.89E-06	20.3	ESE
SE	1036.	1.47E-04	8.68E-05	6.67E-05	3.77E-05	1.66E-05	6.12E-06	17.2	SE
SSE	1036.	2.20E-04	1.35E-04	1.06E-04	6.20E-05	2.89E-05	1.14E-05	38.7	SSE
MAX X/Q		2.34E-04				TOTAL HOURS AROUND SITE:		669.3	
SRP 2.3.4	1036.	8.44E-04	4.58E-04	3.38E-04	1.74E-04	6.73E-05	2.10E-05		
SITE LIMIT		1.76E-04	1.24E-04	1.04E-04	7.09E-05	4.10E-05	2.10E-05		

Table 2.3.4-202
PAVAN Results - X/Q Values at the LPZ (Building Wake Credit Not Included)

```
/PLANT NAME: Victoria Site                       METEOROLOGICAL INSTRUMENTATION
 DATA PERIOD: 2007-08 (12 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 (S/CUBIC METER)
                                                            VERSUS                               HOURS PER YEAR MAX
                                                        AVERAGING TIME                                0-2 HR X/Q IS
 DOWNWIND DISTANCE                                                                                         EXCEEDED  DOWNWIND
 SECTOR   (METERS)        0-2 HOURS     0-8 HOURS    8-24 HOURS      1-4 DAYS     4-30 DAYS ANNUAL AVERAGE IN SECTOR    SECTOR
      S      7710.         3.56E-05      1.52E-05      9.93E-06      3.95E-06      1.05E-06      2.07E-07       43.7         S
    SSW      7710.         3.11E-05      1.32E-05      8.64E-06      3.42E-06      9.02E-07      1.77E-07      485.1       SSW
     SW      7710.         3.03E-05      1.28E-05      8.32E-06      3.27E-06      8.54E-07      1.65E-07       32.1        SW
    WSW      7710.         2.16E-05      9.23E-06      6.04E-06      2.40E-06      6.41E-07      1.27E-07       18.4       WSW
      W      7710.         2.51E-05      1.09E-05      7.15E-06      2.88E-06      7.81E-07      1.58E-07       22.8         W
    WNW      7710.         3.12E-05      1.34E-05      8.74E-06      3.48E-06      9.31E-07      1.85E-07       34.4       WNW
     NW      7710.         3.25E-05      1.48E-05      9.95E-06      4.22E-06      1.23E-06      2.73E-07       36.1        NW
    NNW      7710.         3.15E-05      1.44E-05      9.71E-06      4.14E-06      1.22E-06      2.72E-07       34.4       NNW
      N      7710.         2.65E-05      1.12E-05      7.26E-06      2.85E-06      7.42E-07      1.43E-07       25.2         N
    NNE      7710.         1.65E-05      6.60E-06      4.17E-06      1.54E-06      3.69E-07      6.41E-08       13.6       NNE
     NE      7710.         9.02E-06      3.83E-06      2.50E-06      9.85E-07      2.59E-07      5.06E-08       13.0        NE
    ENE      7710.         1.90E-05      7.35E-06      4.58E-06      1.64E-06      3.75E-07      6.16E-08       17.4       ENE
      E      7710.         1.69E-05      6.61E-06      4.13E-06      1.49E-06      3.46E-07      5.77E-08       15.7         E
    ESE      7710.         2.29E-05      9.03E-06      5.67E-06      2.07E-06      4.85E-07      8.23E-08       22.0       ESE
     SE      7710.         2.22E-05      8.81E-06      5.55E-06      2.03E-06      4.82E-07      8.27E-08       18.2        SE
    SSE      7710.         3.49E-05      1.43E-05      9.13E-06      3.46E-06      8.60E-07      1.57E-07       42.2       SSE
 MAX X/Q                   3.56E-05                                               TOTAL HOURS AROUND SITE:     874.1

 SRP 2.3.4  7710.          5.14E-05      2.16E-05      1.40E-05      5.48E-06      1.42E-06      2.73E-07
 SITE LIMIT                3.78E-05      1.67E-05      1.11E-05      4.60E-06      1.29E-06      2.73E-07
```

Table 2.3.4-203
Onsite Receptor/Source Locations

Receptors	**Designation**
Control Building Louvers	CBL
North Emergency and Normal Air Intakes	EN
South Emergency and Normal Air Intakes	ES
Normal Air Intake on South Face of CB	N
West TSC Intake	TSCW
East TSC Intake	TSCE
Sources	**Designation**
Reactor Building	RB
Passive Containment Cooling System Vent	PCCS
Turbine Building	TB
Turbine Building Truck Doors	TB-TD
Fuel Building	FB
Fuel Building Cask Door	FB-CD
Radwaste Building	RW
North Reactor Building Blowout Panel Near the East Edge of the Reactor Building Roof	BPN
South Reactor Building Blowout Panel Near the East Edge of the Reactor Building Roof	BPS

Table 2.3.4-204 (Sheet 1 of 2)
ARCON96 Design Inputs Used for the Determination of Bounding X/Q Values from Sources

Source/Receptor	Source Type	Distance (m)	Release Height (m)	Building Area (m^2)	Intake Height (m)	Total Height (m)	Total Width (m)	σ_y	σ_z	Direction (degrees from plant North)
RB to CBL	Diffuse	10	24.0	2945	2.5	48.1	49.0	8.17	8.01	220
RB to EN	Diffuse	33	24.0	2945	7.5	48.1	49.0	8.17	8.01	210
RB to ES	Diffuse	33	24.0	2945	7.5	48.1	49.0	8.17	8.01	230
RB to N	Diffuse	29	24.0	2945	7.5	48.1	49.0	8.17	8.01	234
RB to TSCE	Diffuse	131	24.0	2726	22.4	48.1	65.7	10.95	8.01	162
RB to TSCW	Diffuse	118	24.0	2726	22.4	48.1	65.7	10.95	8.01	150
PCCS to CBL	Point	38	47.8	2945	2.5	N/A	N/A	N/A	N/A	259
PCCS to EN	Point	54	47.8	2945	7.5	N/A	N/A	N/A	N/A	235
PCCS to ES	Point	63	47.8	2945	7.5	N/A	N/A	N/A	N/A	254
PCCS to N	Point	62	47.8	2945	7.5	N/A	N/A	N/A	N/A	258
PCCS to TSCE	Point	138	47.8	2726	22.4	N/A	N/A	N/A	N/A	164
PCCS to TSCW	Point	122	47.8	2726	22.4	N/A	N/A	N/A	N/A	151
TB to CBL	Diffuse	31	24.7	5513	2.5	49.4	111.6	18.6	8.23	293
TB to EN	Diffuse	29	24.7	5513	7.5	49.4	111.6	18.6	8.23	274
TB to ES	Diffuse	46	24.7	5513	7.5	49.4	111.6	18.6	8.23	281
TB to N	Diffuse	49	24.7	5513	7.5	49.4	111.6	18.6	8.23	286
TB to TSCE	Diffuse	40	24.7	3853	22.4	49.4	78.0	13.00	8.23	182
TB to TSCW	Diffuse	10	24.7	3853	22.4	49.4	78.0	13.00	8.23	164
TB-TD to CBL	Point	152	1.0	7320	2.5	N/A	N/A	N/A	N/A	288
TB-TD to EN	Point	155	1.0	7320	7.5	N/A	N/A	N/A	N/A	278

Table 2.3.4-204 (Sheet 2 of 2)
ARCON96 Design Inputs Used for the Determination of Bounding X/Q Values from Sources

Source/Receptor	Source Type	Distance (m)	Release Height (m)	Building Area (m^2)	Intake Height (m)	Total Height (m)	Total Width (m)	σ_y	σ_z	Direction (degrees from plant North)
TB-TD to TSCW	Point	72	1.0	7320	22.4	N/A	N/A	N/A	N/A	220
FB to CBL	Diffuse	28	11.4	2945	2.5	22.9	48.4[a]	7.08	3.81	178
FB to EN	Diffuse	51	11.4	2945	7.5	22.9	22.8	3.81	3.81	184
FB to ES	Diffuse	40	11.4	2945	7.5	22.9	22.8	3.81	3.81	198
FB to N	Diffuse	34	11.4	2945	7.5	22.9	22.8	3.81	3.81	202
FB-CD to CBL	Point	72	1.0	2945	2.5	N/A	N/A	N/A	N/A	191
FB-CD to EN	Point	96	1.0	2945	7.5	N/A	N/A	N/A	N/A	194
FB-CD to ES	Point	91	1.0	2945	7.5	N/A	N/A	N/A	N/A	202
FB-CD to N	Point	84	1.0	2945	7.5	N/A	N/A	N/A	N/A	206
RW to N	Point	112	7.5	2945	7.5	N/A	N/A	N/A	N/A	154
BPN to CBL	Point	27	47.8	2945	2.5	N/A	N/A	N/A	N/A	272
BPN to EN	Point	40	47.8	2945	7.5	N/A	N/A	N/A	N/A	235
BPN to ES	Point	49	47.8	2945	7.5	N/A	N/A	N/A	N/A	256
BPN to N	Point	50	47.8	2945	7.5	N/A	N/A	N/A	N/A	265
BPS to CBL	Point	27	47.8	2945	2.5	N/A	N/A	N/A	N/A	169
BPS to EN	Point	49	47.8	2945	7.5	N/A	N/A	N/A	N/A	179
BPS to ES	Point	41	47.8	2945	7.5	N/A	N/A	N/A	N/A	205
BPS to N	Point	36	47.8	2945	7.5	N/A	N/A	N/A	N/A	209

a. For releases from FB as a diffuse source to CBL, the total width used in ARCON96 modeling is the projected FB width that is perpendicular to the line that connects the CBL and the center of the FB.

Table 2.3.4-205 (Sheet 1 of 3)
ARCON96 X/Q (s/m^3) Values for Sources

Source: Reactor Building Diffuse (RB)						
Receptor:	**CBL**	**EN**	**ES**	**N**	**TSCW**	**TSCE**
0 to 2 hours	8.61×10^{-4}	7.93×10^{-4}	5.83×10^{-4}	5.39×10^{-4}	2.89×10^{-4}	2.58×10^{-4}
2 to 8 hours	4.54×10^{-4}	3.84×10^{-4}	2.99×10^{-4}	3.19×10^{-4}	2.33×10^{-4}	1.98×10^{-4}
8 to 24 hours	1.65×10^{-4}	1.59×10^{-4}	1.12×10^{-4}	1.21×10^{-4}	8.66×10^{-5}	7.54×10^{-5}
1 to 4 days	1.05×10^{-4}	1.07×10^{-4}	6.95×10^{-5}	7.59×10^{-5}	9.47×10^{-5}	8.06×10^{-5}
4 to 30 days	7.90×10^{-5}	8.23×10^{-5}	4.88×10^{-5}	4.83×10^{-5}	7.08×10^{-5}	5.86×10^{-5}

Source: Passive Containment Cooling System (PCCS)						
Receptor:	**CBL**	**EN**	**ES**	**N**	**TSCW**	**TSCE**
0 to 2 hours	5.75×10^{-4}	9.30×10^{-4}	3.86×10^{-4}	3.88×10^{-4}	5.03×10^{-4}	4.03×10^{-4}
2 to 8 hours	5.00×10^{-4}	4.89×10^{-4}	3.29×10^{-4}	3.20×10^{-4}	4.28×10^{-4}	3.34×10^{-4}
8 to 24 hours	1.81×10^{-4}	1.92×10^{-4}	1.35×10^{-4}	1.26×10^{-4}	1.60×10^{-4}	1.28×10^{-4}
1 to 4 days	1.17×10^{-4}	1.04×10^{-4}	6.91×10^{-5}	7.63×10^{-5}	1.75×10^{-4}	1.35×10^{-4}
4 to 30 days	5.28×10^{-5}	6.78×10^{-5}	3.70×10^{-5}	3.40×10^{-5}	1.32×10^{-4}	1.02×10^{-4}

Source: Turbine Building Diffuse (TB)						
Receptor:	**CBL**	**EN**	**ES**	**N**	**TSCW**	**TSCE**
0 to 2 hours	3.93×10^{-4}	2.98×10^{-4}	2.99×10^{-4}	3.04×10^{-4}	9.88×10^{-4}	6.55×10^{-4}
2 to 8 hours	2.01×10^{-4}	1.96×10^{-4}	1.67×10^{-4}	1.61×10^{-4}	7.23×10^{-4}	4.27×10^{-4}
8 to 24 hours	8.29×10^{-5}	7.10×10^{-5}	6.25×10^{-5}	6.19×10^{-5}	3.14×10^{-4}	1.86×10^{-4}
1 to 4 days	6.42×10^{-5}	4.34×10^{-5}	4.40×10^{-5}	4.60×10^{-5}	3.24×10^{-4}	1.73×10^{-4}
4 to 30 days	3.72×10^{-5}	2.79×10^{-5}	2.56×10^{-5}	2.64×10^{-5}	2.49×10^{-4}	1.33×10^{-4}

Receptor Acronyms:

CBL	Control Building Louvers
EN	Normal and Emergency Air Intakes on East face of Control Building near the North end
ES	Normal and Emergency Air Intakes on East face of Control Building near the South end
N	Normal Air Intake on South Face of Control Building
TSCW	Tech Support Center Intake on North Face of Electrical Building near the West end
TSCE	Tech Support Center Intake on North Face of Electrical Building near the East end

Table 2.3.4-205 (Sheet 2 of 3)
ARCON96 X/Q (s/m^3) Values for Sources

Source: Turbine Building Truck Doors (TB-TD)			
Receptor:	CBL	EN	TSCW
0 to 2 hours	2.01×10^{-4}	1.75×10^{-4}	8.14×10^{-4}
2 to 8 hours	8.37×10^{-5}	6.70×10^{-5}	3.67×10^{-4}
8 to 24 hours	4.11×10^{-5}	3.71×10^{-5}	1.41×10^{-4}
1 to 4 days	2.38×10^{-5}	2.05×10^{-5}	7.40×10^{-5}
4 to 30 days	1.46×10^{-5}	1.11×10^{-5}	6.13×10^{-5}

Source: Fuel Building Diffuse (FB)				
Receptor:	CBL	EN	ES	N
0 to 2 hours	2.24×10^{-3}	1.38×10^{-3}	1.79×10^{-3}	2.12×10^{-3}
2 to 8 hours	1.52×10^{-3}	9.97×10^{-4}	1.03×10^{-3}	1.15×10^{-3}
8 to 24 hours	6.02×10^{-4}	3.91×10^{-4}	4.36×10^{-4}	4.82×10^{-4}
1 to 4 days	6.03×10^{-4}	3.51×10^{-4}	3.39×10^{-4}	3.53×10^{-4}
4 to 30 days	4.43×10^{-4}	2.77×10^{-4}	2.23×10^{-4}	2.52×10^{-4}

Source: Fuel Building Cask Door (FB-CD)				
Receptor:	CBL	EN	ES	N
0 to 2 hours	1.23×10^{-3}	7.02×10^{-4}	7.23×10^{-4}	8.02×10^{-4}
2 to 8 hours	8.51×10^{-4}	4.65×10^{-4}	4.28×10^{-4}	4.48×10^{-4}
8 to 24 hours	3.59×10^{-4}	2.08×10^{-4}	1.84×10^{-4}	1.85×10^{-4}
1 to 4 days	2.86×10^{-4}	1.54×10^{-4}	1.25×10^{-4}	1.21×10^{-4}
4 to 30 days	2.04×10^{-4}	1.06×10^{-4}	8.35×10^{-5}	8.47×10^{-5}

Receptor Acronyms:

CBL	Control Building Louvers	N	Normal Air Intake on South Face of Control Building
EN	Normal and Emergency Air Intakes on East face of Control Building near the North end	TSCW	Tech Support Center Intake on North Face of Electrical Building near the West end
ES	Normal and Emergency Air Intakes on East face of Control Building near the South end	TSCE	Tech Support Center Intake on North Face of Electrical Building near the East end

Table 2.3.4-205 (Sheet 3 of 3)
ARCON96 X/Q (s/m^3) Values for Sources

Source: North Reactor Building Blowout Panel (BPN)				
Receptor:	CBL	EN	ES	N
0 to 2 hours	6.98×10^{-4}	1.32×10^{-3}	5.29×10^{-4}	5.01×10^{-4}
2 to 8 hours	5.38×10^{-4}	6.71×10^{-4}	4.37×10^{-4}	3.77×10^{-4}
8 to 24 hours	2.45×10^{-4}	2.72×10^{-4}	1.76×10^{-4}	1.82×10^{-4}
1 to 4 days	1.31×10^{-4}	1.46×10^{-4}	9.85×10^{-5}	8.64×10^{-5}
4 to 30 days	5.85×10^{-5}	9.11×10^{-5}	4.75×10^{-5}	4.60×10^{-5}

Source: South Reactor Building Blowout Panel (BPS)				
Receptor:	CBL	EN	ES	N
0 to 2 hours	2.57×10^{-3}	1.77×10^{-3}	2.02×10^{-3}	2.21×10^{-3}
2 to 8 hours	2.10×10^{-3}	1.45×10^{-3}	1.45×10^{-3}	1.50×10^{-3}
8 to 24 hours	7.95×10^{-4}	5.47×10^{-4}	4.68×10^{-4}	4.75×10^{-4}
1 to 4 days	8.50×10^{-4}	5.81×10^{-4}	4.32×10^{-4}	4.24×10^{-4}
4 to 30 days	6.30×10^{-4}	4.28×10^{-4}	3.12×10^{-4}	2.99×10^{-4}

Source: Radwaste Building (RW)	
Receptor:	N
0 to 2 hours	2.24×10^{-4}
2 to 8 hours	1.21×10^{-4}
8 to 24 hours	5.96×10^{-5}
1 to 4 days	2.98×10^{-5}
4 to 30 days	1.58×10^{-5}

Receptor Acronyms:

CBL	Control Building Louvers	N	Normal Air Intake on South Face of Control Building
EN	Normal and Emergency Air Intakes on East face of Control Building near the North end	TSCW	Tech Support Center Intake on North Face of Electrical Building near the West end
ES	Normal and Emergency Air Intakes on East face of Control Building near the South end	TSCE	Tech Support Center Intake on North Face of Electrical Building near the East end

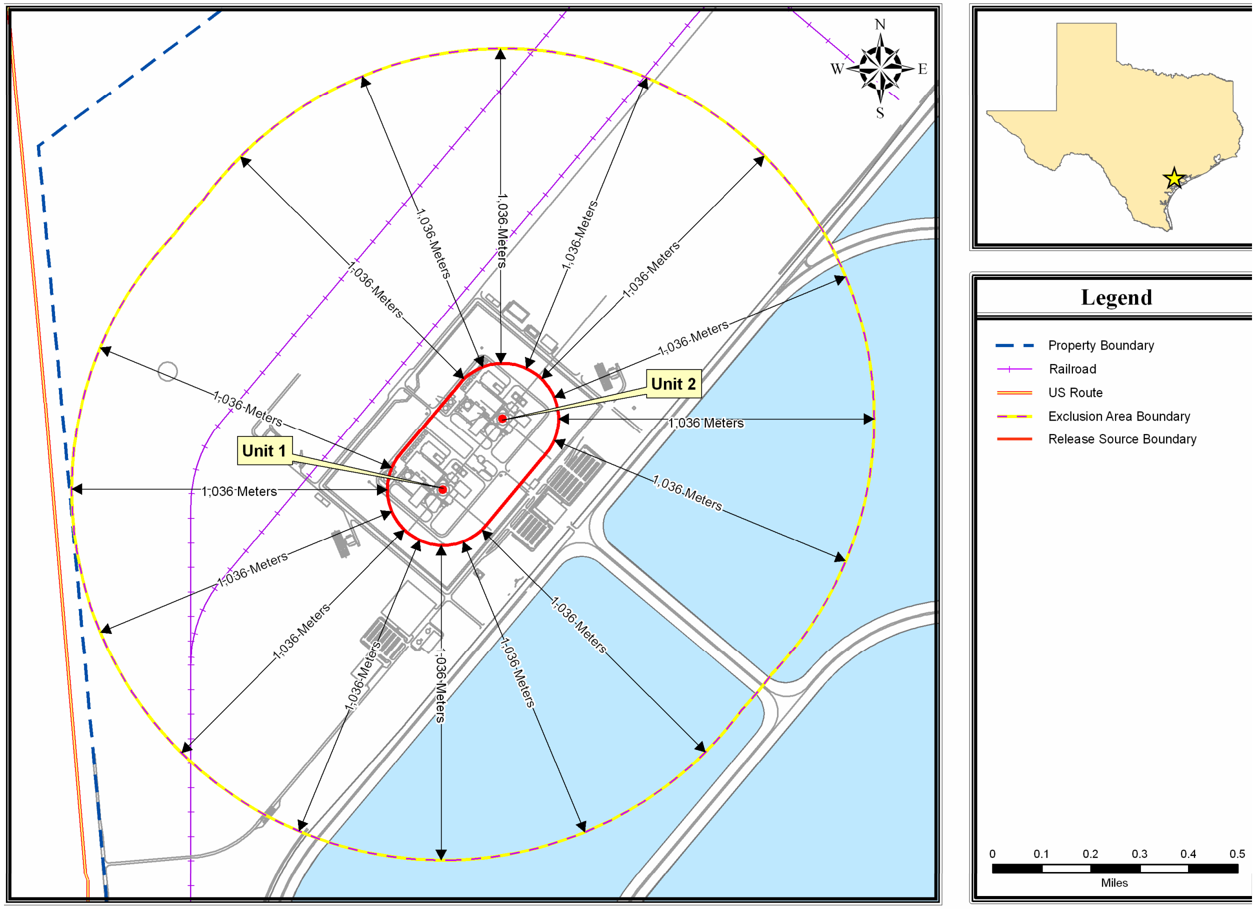


Figure 2.3.4-201 Distance to EAB from the Source Boundary

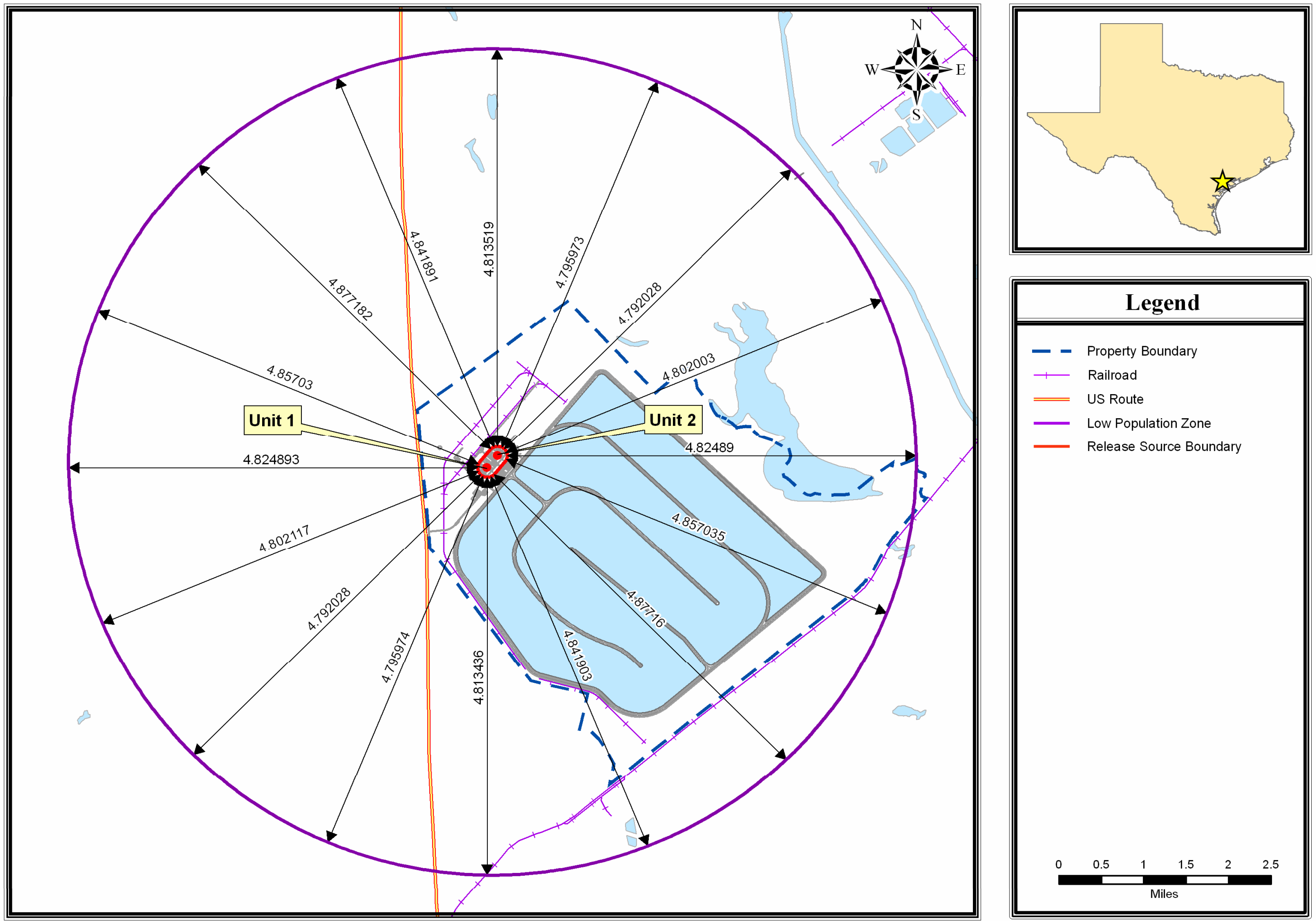


Figure 2.3.4-202 Distance to the LPZ from the Source Boundary

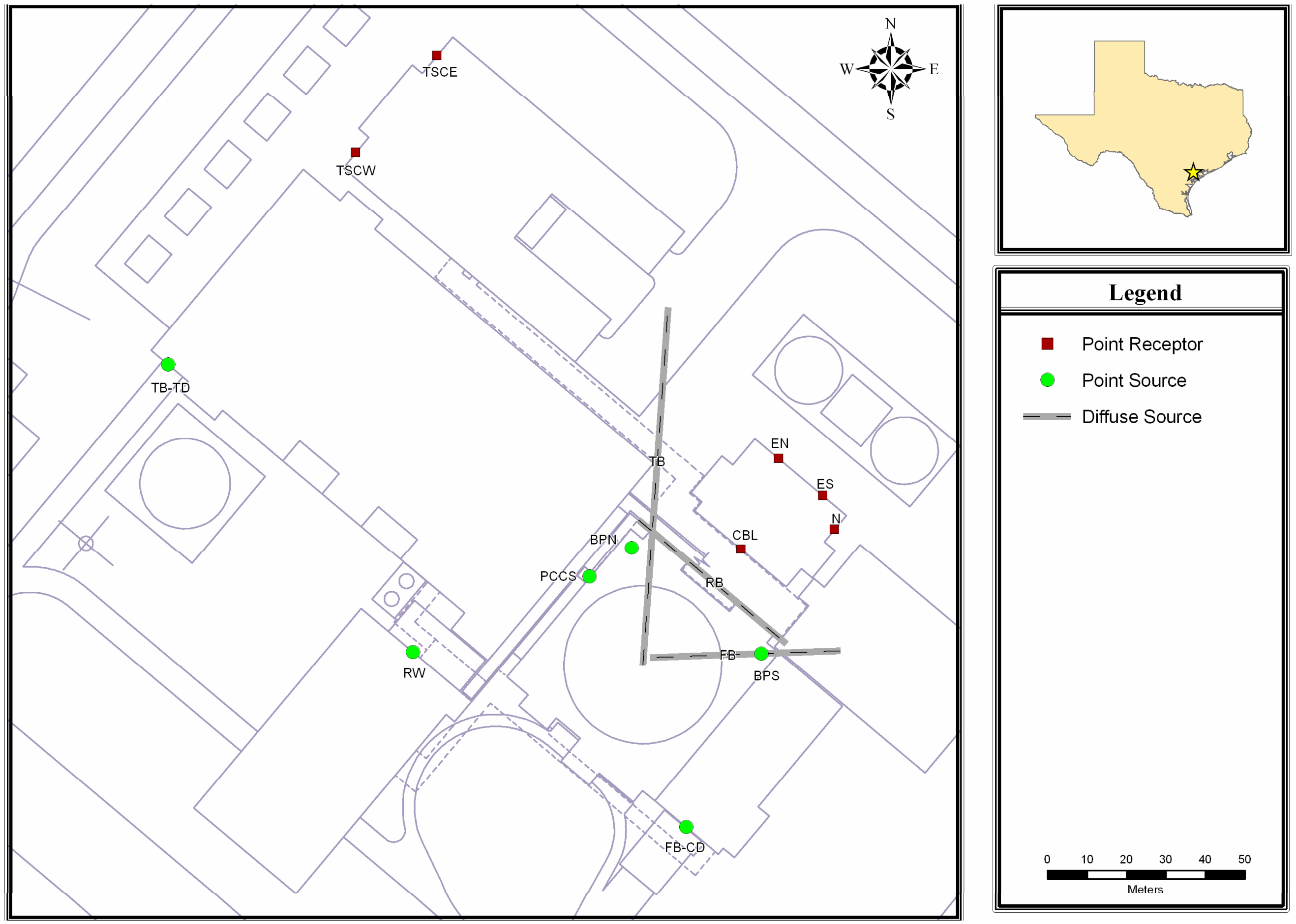


Figure 2.3.4-203 Potential Radiological Sources and Receptors for the ESBWR

2.3.5 Long-Term Atmospheric Dispersion Estimates for Routine Releases

2.3.5.1 Basis

VCS COL 2.0-11-A

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) from the VCS site for annual average release limit calculations and person-rem estimates.

The NRC-sponsored XOQDOQ computer program (Reference 2.3.5-201) 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 receptors of interest (e.g., property boundaries, nearest resident, nearest vegetable garden, nearest milk cow/goat, and nearest meat animal). RG 1.206 requires X/Q and D/Q estimates at the above receptor locations. 10 CFR 100 requires an "exclusion area" surrounding the reactor in which the reactor licensee has the authority to determine all activities, including exclusion or removal of personnel and property.

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 2-1/2 times the height of nearby structures. Besides 11 wind speed categories as 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 XOQDOQ modeling run.

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. A straight-line trajectory is assumed between the release point and all receptors.

Since 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: 1-year (July 2007–June 2008) onsite joint frequency distributions of wind speed, wind direction, and atmospheric stability (see Subsection 2.3.2). The determinations for the atmospheric stability classes are based on the vertical ΔT method as specified in RG 1.145
- Type of release: Ground-level
- Wind sensor height: 10 meters
- Vertical temperature difference: (10–60 meters)
- Number of wind speed categories: 12
- Release height: 10 meter (default height)
- Minimum reactor building cross-sectional area: 2352 square meters
- Effective Reactor building height: 48 meters above grade
- Distances from the release point to the nearest residence, nearest property boundaries, vegetable garden, and meat animal (Table 2.3.5-201)
- No milk cows/goats are identified within 5 miles of the VCS site, and no dairies are identified within 50 miles.

The ESBWR reactor design is used to calculate the minimum building cross-sectional area as called for in NUREG/CR-2919 (Reference 2.3.5-201) for evaluating building downwash effects on dispersion. The Reactor Building is a rectangular structure. The physical height of the reactor building is 162 feet (49.4 m), including parapets. To be conservative, an effective building height of 48 meters is assumed for modeling purposes. Therefore, based on the width (49 meters) and effective height above grade (48 meters) of the reactor building, the cross-sectional area of the reactor structure is calculated to be 2352 square meters.

The shortest distances from the VCS Units 1 and 2 reactors 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 2.3.5-201. Sensitive receptors within 5 miles were evaluated based on guidance in Subsection 2.3.5 of NUREG-0800. Directional sectors without a receptor within 5 miles were not modeled. The distance from the closer of the two units was used for each sector.

As previously stated, there are no milk cow/goat receptors within 5 miles of the site.

The distance from the source boundary to the site boundary was determined for each directional sector. The results are presented in Table 2.3.5-202. Distances provided in Table 2.3.5-202 are the shortest distance within each directional sector.

To account for possible effects from Matagorda Bay and 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 12-month period of record is used to quantitatively evaluate diffusion estimates. Therefore, the lower level (10 meters) 1-year (July 2007–June 2008) joint frequency distributions of wind speed, wind direction, and atmospheric stability are used as input in the XQODOQ modeling analysis. When the 24-month period of data becomes available, long-term X/Q estimates will be recalculated and submitted to the NRC.

2.3.5.2 **Calculations**

Table 2.3.5-203 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 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 other sensitive receptor types are:

- 2.2×10^{-6} sec/m^3 for the nearest resident and meat animal occurring in the north-northwest sector at a distance of 1.53 miles
- 1.6×10^{-6} sec/m^3 for the nearest vegetable garden in the northwest sector at a distance of 1.79 miles

- 7.4×10^{-6} sec/m^3 for the nearest property boundary occurring in the west sector at a distance of 0.66 miles

Tables 2.3.5-204 through 2.3.5-207 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 2.3.5-208 presents the annual average X/Q and D/Q values at sensitive receptors.

2.3.5.3 **References**

2.3.5-201 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 2.3.5-201
Shortest Distances from the Source Boundary to Receptor of Interest by Downwind Direction Sector for XOQDOQ Modeling

	Distance to Vegetable Garden, Meat Animal, and Resident (meters) from		Closer of two (meters)
Direction	VCS Unit 1	VCS Unit 2	VCS Unit 1 or Unit 2
N	5198	4973	4973
NNE	7306	7017	7017
NE	4056	3750	3750
ENE	9624	9366	9366
E	13245	13036	13036
ESE	8610	8513	8513
SE	—	—	—
SSE	6856	7049	6856
S	9624	9865	9624
SSW	3911	4217	3911
SW	3766	4056	3766
WSW	10075	10316	10075
W	7435	7596	7435
WNW	7500	7580	7500
NW	2945	2881	2881
NNW[a]	2607	2462	2462

a. Vegetable garden location for NNW sector is 4233 meters.

Note: No receptors of interest in a given sector are indicated by a dash (—).

Table 2.3.5-202
Shortest Distance from the Source Boundary to Reseptors of Interest by Downwind Direction Sectors for XOQDOQ Modeling

Direction	Distance (m)
N	1558
NNE	2167
NE	2856
ENE	2899
E	4080
ESE	6444
SE	6100
SSE	4191
S	2387
SSW	1761
SW	1205
WSW	1040
W	1063
WNW	1170
NW	1478
NNW	1477

Table 2.3.5-203
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)
No Decay	Property Boundary	W	0. 66	7.40E-06
	Resident	NNW	1.53	2.20E-06
	Meat Animal	NNW	1.53	2.20E-06
	Vegetable Garden	NW	1.79	1.60E-06
	Unit 2 Reactor	NNE	0.19	2.30E-05
2.26 Day Decay	Property Boundary	W	0.66	7.40E-06
	Resident	NNW	1.53	2.20E-06
	Meat Animal	NNW	1.53	2.20E-06
	Vegetable Garden	NW	1.79	1.60E-06
	Unit 2 Reactor	NNE	0.19	2.30E-05
8 Day Decay	Property Boundary	W	0.66	6.70E-06
	Resident	NNW	1.53	1.80E-06
	Meat Animal	NNW	1.53	1.80E-06
	Vegetable Garden	NW	1.79	1.30E-06
	Unit 2 Reactor	NNE	0.19	2.20E-05
	Type of Location	**Direction from Site**	**Distance (miles)**	**D/Q (1/m^2)**
	Property Boundary	NNW	0.92	4.40E-08
	Resident	NNW	1.53	1.20E-08
	Meat Animal	NNW	1.53	1.20E-08
	Vegetable Garden	NW	1.79	7.70E-09
	Unit 2 Reactor	NNE	0.19	7.90E-08

Table 2.3.5-204 (Sheet 1 of 2)
XOQDOQ-Predicted Annual Average X/Q Values at the Standard Radial Distances and Distance-Segment Boundaries (July 2007 through June 2008)

```
No Decay Undepleted X/Qs at Various Distances
Release Point - Ground Level - No Intermittent Releases
NO DECAY, UNDEPLETED; CORRECTED USING STANDARD OPEN TERRAIN FACTORS
ANNUAL AVERAGE CHI/Q (SEC/METER CUBED)            DISTANCE IN MILES FROM THE SITE
```

SECTOR	.250	.500	.750	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500
S	4.700E-05	1.467E-05	7.600E-06	3.797E-06	1.554E-06	8.601E-07	5.540E-07	3.917E-07	2.949E-07	2.321E-07	1.889E-07
SSW	4.143E-05	1.307E-05	6.817E-06	3.416E-06	1.394E-06	7.682E-07	4.934E-07	3.480E-07	2.614E-07	2.054E-07	1.670E-07
SW	3.781E-05	1.186E-05	6.199E-06	3.113E-06	1.274E-06	7.042E-07	4.531E-07	3.201E-07	2.408E-07	1.894E-07	1.541E-07
WSW	2.889E-05	9.073E-06	4.787E-06	2.420E-06	9.910E-07	5.467E-07	3.513E-07	2.479E-07	1.863E-07	1.464E-07	1.190E-07
W	3.678E-05	1.164E-05	6.153E-06	3.109E-06	1.268E-06	6.973E-07	4.471E-07	3.149E-07	2.363E-07	1.855E-07	1.506E-07
WNW	4.183E-05	1.295E-05	6.748E-06	3.399E-06	1.397E-06	7.738E-07	4.989E-07	3.529E-07	2.658E-07	2.093E-07	1.704E-07
NW	6.584E-05	2.083E-05	1.104E-05	5.585E-06	2.275E-06	1.249E-06	7.995E-07	5.625E-07	4.217E-07	3.307E-07	2.684E-07
NNW	6.566E-05	2.076E-05	1.098E-05	5.547E-06	2.256E-06	1.238E-06	7.920E-07	5.570E-07	4.175E-07	3.274E-07	2.656E-07
N	3.357E-05	1.058E-05	5.517E-06	2.760E-06	1.124E-06	6.187E-07	3.971E-07	2.799E-07	2.102E-07	1.651E-07	1.342E-07
NNE	1.425E-05	4.372E-06	2.235E-06	1.112E-06	4.569E-07	2.537E-07	1.639E-07	1.162E-07	8.762E-08	6.909E-08	5.632E-08
NE	1.072E-05	3.301E-06	1.690E-06	8.409E-07	3.467E-07	1.932E-07	1.251E-07	8.885E-08	6.711E-08	5.298E-08	4.323E-08
ENE	1.254E-05	3.766E-06	1.888E-06	9.322E-07	3.890E-07	2.194E-07	1.433E-07	1.024E-07	7.780E-08	6.171E-08	5.055E-08
E	1.201E-05	3.655E-06	1.843E-06	9.091E-07	3.771E-07	2.116E-07	1.378E-07	9.827E-08	7.449E-08	5.899E-08	4.826E-08
ESE	1.694E-05	5.079E-06	2.540E-06	1.251E-06	5.230E-07	2.955E-07	1.933E-07	1.383E-07	1.052E-07	8.348E-08	6.843E-08
SE	4.243E-05	1.256E-05	6.191E-06	3.028E-06	1.272E-06	7.229E-07	4.749E-07	3.410E-07	2.600E-07	2.068E-07	1.699E-07
SSE	3.355E-05	1.022E-05	5.171E-06	2.557E-06	1.061E-06	5.953E-07	3.875E-07	2.762E-07	2.093E-07	1.657E-07	1.355E-07

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ANNUAL AVERAGE CHI/Q (SEC/METER CUBED)            DISTANCE IN MILES FROM THE SITE
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SECTOR	5.000	7.500	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	50.000
S	1.578E-07	8.396E-08	5.575E-08	3.308E-08	2.295E-08	1.731E-08	1.376E-08	1.135E-08	9.608E-09	8.299E-09	7.283E-09
SSW	1.393E-07	7.370E-08	4.876E-08	2.879E-08	1.990E-08	1.497E-08	1.188E-08	9.776E-09	8.264E-09	7.129E-09	6.248E-09
SW	1.286E-07	6.828E-08	4.526E-08	2.679E-08	1.855E-08	1.397E-08	1.110E-08	9.143E-09	7.733E-09	6.675E-09	5.853E-09
WSW	9.928E-08	5.256E-08	3.478E-08	2.053E-08	1.418E-08	1.066E-08	8.455E-09	6.956E-09	5.877E-09	5.067E-09	4.439E-09
W	1.255E-07	6.621E-08	4.370E-08	2.572E-08	1.773E-08	1.331E-08	1.055E-08	8.669E-09	7.319E-09	6.306E-09	5.522E-09
WNW	1.423E-07	7.578E-08	5.033E-08	2.987E-08	2.071E-08	1.562E-08	1.242E-08	1.023E-08	8.663E-09	7.481E-09	6.563E-09
NW	2.235E-07	1.177E-07	7.758E-08	4.556E-08	3.136E-08	2.352E-08	1.862E-08	1.529E-08	1.290E-08	1.111E-08	9.720E-09
NNW	2.212E-07	1.164E-07	7.674E-08	4.507E-08	3.103E-08	2.328E-08	1.843E-08	1.514E-08	1.277E-08	1.100E-08	9.629E-09
N	1.119E-07	5.924E-08	3.920E-08	2.315E-08	1.601E-08	1.205E-08	9.561E-09	7.871E-09	6.655E-09	5.741E-09	5.033E-09
NNE	4.710E-08	2.520E-08	1.679E-08	1.002E-08	6.977E-09	5.280E-09	4.209E-09	3.478E-09	2.950E-09	2.552E-09	2.243E-09
NE	3.619E-08	1.941E-08	1.296E-08	7.745E-09	5.398E-09	4.087E-09	3.259E-09	2.694E-09	2.286E-09	1.978E-09	1.738E-09
ENE	4.247E-08	2.307E-08	1.553E-08	9.385E-09	6.587E-09	5.014E-09	4.016E-09	3.331E-09	2.834E-09	2.459E-09	2.166E-09
E	4.049E-08	2.190E-08	1.471E-08	8.858E-09	6.205E-09	4.716E-09	3.773E-09	3.127E-09	2.658E-09	2.305E-09	2.029E-09
ESE	5.752E-08	3.131E-08	2.111E-08	1.278E-08	8.980E-09	6.841E-09	5.482E-09	4.550E-09	3.873E-09	3.361E-09	2.962E-09
SE	1.430E-07	7.835E-08	5.305E-08	3.230E-08	2.278E-08	1.740E-08	1.398E-08	1.162E-08	9.907E-09	8.610E-09	7.597E-09
SSE	1.137E-07	6.146E-08	4.125E-08	2.482E-08	1.737E-08	1.320E-08	1.055E-08	8.739E-09	7.427E-09	6.437E-09	5.666E-09

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                                                                VENT AND BUILDING PARAMETERS:
RELEASE HEIGHT  (METERS)     .00              REP. WIND HEIGHT        (METERS)        10.0
DIAMETER        (METERS)     .00              BUILDING HEIGHT         (METERS)        48.0
EXIT VELOCITY   (METERS)     .00              BLDG.MIN.CRS.SEC.AREA   (SQ.METERS)   2352.0
                                              HEAT EMISSION RATE      (CAL/SEC)         .0
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Table 2.3.5-204 (Sheet 2 of 2)
XOQDOQ-Predicted Annual Average X/Q Values at the Standard Radial Distances and Distance-Segment Boundaries
(July 2007 through June 2008)

No Decay X/Qs at Various Segments

Release Point - Ground Level - No Intermittent Releases
NO DECAY, UNDEPLETED
CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT
SEGMENT BOUNDARIES IN MILES FROM THE SITE

DIRECTION	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
FROM SITE										
S	7.481E-06	1.744E-06	5.707E-07	2.986E-07	1.902E-07	8.783E-08	3.361E-08	1.739E-08	1.138E-08	8.310E-09
SSW	6.694E-06	1.565E-06	5.085E-07	2.648E-07	1.681E-07	7.718E-08	2.927E-08	1.505E-08	9.800E-09	7.139E-09
SW	6.085E-06	1.430E-06	4.669E-07	2.439E-07	1.551E-07	7.146E-08	2.723E-08	1.404E-08	9.165E-09	6.684E-09
WSW	4.688E-06	1.111E-06	3.621E-07	1.887E-07	1.198E-07	5.504E-08	2.087E-08	1.072E-08	6.973E-09	5.074E-09
W	6.019E-06	1.423E-06	4.609E-07	2.394E-07	1.516E-07	6.938E-08	2.616E-08	1.339E-08	8.691E-09	6.316E-09
WNW	6.637E-06	1.565E-06	5.138E-07	2.692E-07	1.715E-07	7.926E-08	3.034E-08	1.569E-08	1.026E-08	7.491E-09
NW	1.079E-05	2.554E-06	8.245E-07	4.273E-07	2.702E-07	1.234E-07	4.637E-08	2.365E-08	1.533E-08	1.112E-08
NNW	1.074E-05	2.535E-06	8.168E-07	4.230E-07	2.674E-07	1.221E-07	4.587E-08	2.341E-08	1.518E-08	1.102E-08
N	5.418E-06	1.263E-06	4.093E-07	2.130E-07	1.351E-07	6.204E-08	2.354E-08	1.211E-08	7.890E-09	5.750E-09
NNE	2.211E-06	5.123E-07	1.688E-07	8.872E-08	5.669E-08	2.633E-08	1.017E-08	5.304E-09	3.486E-09	2.555E-09
NE	1.671E-06	3.883E-07	1.288E-07	6.794E-08	4.351E-08	2.027E-08	7.860E-09	4.105E-09	2.700E-09	1.980E-09
ENE	1.881E-06	4.343E-07	1.472E-07	7.871E-08	5.086E-08	2.403E-08	9.507E-09	5.034E-09	3.337E-09	2.462E-09
E	1.831E-06	4.218E-07	1.417E-07	7.538E-08	4.856E-08	2.283E-08	8.978E-09	4.736E-09	3.133E-09	2.308E-09
ESE	2.532E-06	5.838E-07	1.986E-07	1.064E-07	6.885E-08	3.260E-08	1.294E-08	6.868E-09	4.558E-09	3.365E-09
SE	6.201E-06	1.418E-06	4.875E-07	2.629E-07	1.709E-07	8.148E-08	3.268E-08	1.747E-08	1.164E-08	8.619E-09
SSE	5.130E-06	1.186E-06	3.984E-07	2.118E-07	1.364E-07	6.409E-08	2.516E-08	1.325E-08	8.757E-09	6.445E-09

Exelon Victoria County Months:Jul - Jun Years: 2007 - 2008

Table 2.3.5-205 (Sheet 1 of 2)
XOQDOQ-Predicted Annual Average D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries
(July 2007 through June 2008)

Site: Exelon Victoria County
Period: Months Jul-Jun for years 2007 - 2008
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	15	58	99	164	120	106	116	131	21	8	838
NNE	0	12	47	95	195	128	83	90	42	8	0	700
NE	0	19	53	80	197	79	40	22	16	2	0	508
ENE	0	22	37	71	127	60	33	16	5	0	0	371
E	0	16	55	82	186	96	55	30	28	0	0	548
ESE	0	21	49	66	183	114	90	53	39	8	0	623
SE	0	11	48	107	320	223	216	193	307	88	5	1518
SSE	0	22	36	97	329	209	182	244	303	157	51	1630
S	0	19	30	59	132	82	100	87	86	70	17	682
SSW	0	7	25	25	47	35	24	23	10	1	0	197
SW	0	11	19	16	29	15	13	5	2	0	0	110
WSW	0	9	24	24	23	9	6	2	3	0	0	100
W	0	9	25	26	19	6	10	8	2	4	0	109
WNW	0	16	22	34	28	10	7	10	14	0	3	144
NW	1	8	26	43	58	33	14	17	26	14	17	257
NNW	0	9	56	77	88	47	25	37	36	34	11	420
Tot	1	226	610	1001	2125	1266	1004	953	1050	407	112	8755

Hours of Calm	13
Hours of Variable Direction	5
Hours of Valid Data	8773
Hours of Missing Data	11
Hours in Period	8784

Table 2.3.5-205 (Sheet 2 of 2)
XOQDOQ-Predicted Annual Average D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries
(July 2007 through June 2008)

No Decay D/Qs Along Various Segments

Release Point - Ground Level - No Intermittent Releases

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

SEGMENT BOUNDARIES IN MILES

DIRECTION	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
										FROM SITE
S	3.757E-08	7.695E-09	2.009E-09	9.022E-10	5.104E-10	1.963E-10	5.678E-11	2.250E-11	1.202E-11	7.438E-12
SSW	3.138E-08	6.428E-09	1.678E-09	7.536E-10	4.263E-10	1.639E-10	4.743E-11	1.880E-11	1.004E-11	6.213E-12
SW	2.277E-08	4.665E-09	1.218E-09	5.469E-10	3.094E-10	1.190E-10	3.442E-11	1.364E-11	7.285E-12	4.509E-12
WSW	1.663E-08	3.407E-09	8.893E-10	3.994E-10	2.260E-10	8.689E-11	2.514E-11	9.963E-12	5.320E-12	3.293E-12
W	2.457E-08	5.032E-09	1.314E-09	5.900E-10	3.338E-10	1.283E-10	3.713E-11	1.472E-11	7.859E-12	4.864E-12
WNW	2.793E-08	5.720E-09	1.493E-09	6.707E-10	3.794E-10	1.459E-10	4.221E-11	1.673E-11	8.934E-12	5.530E-12
NW	6.805E-08	1.394E-08	3.639E-09	1.634E-09	9.245E-10	3.555E-10	1.029E-10	4.077E-11	2.177E-11	1.347E-11
NNW	7.307E-08	1.497E-08	3.907E-09	1.755E-09	9.927E-10	3.818E-10	1.104E-10	4.377E-11	2.338E-11	1.447E-11
N	3.057E-08	6.262E-09	1.635E-09	7.342E-10	4.154E-10	1.597E-10	4.621E-11	1.831E-11	9.780E-12	6.054E-12
NNE	8.831E-09	1.809E-09	4.722E-10	2.121E-10	1.200E-10	4.614E-11	1.335E-11	5.290E-12	2.825E-12	1.749E-12
NE	4.931E-09	1.010E-09	2.637E-10	1.184E-10	6.699E-11	2.576E-11	7.453E-12	2.954E-12	1.577E-12	9.764E-13
ENE	4.483E-09	9.182E-10	2.397E-10	1.077E-10	6.090E-11	2.342E-11	6.776E-12	2.685E-12	1.434E-12	8.876E-13
E	4.886E-09	1.001E-09	2.613E-10	1.173E-10	6.638E-11	2.553E-11	7.385E-12	2.927E-12	1.563E-12	9.675E-13
ESE	6.455E-09	1.322E-09	3.452E-10	1.550E-10	8.770E-11	3.373E-11	9.757E-12	3.867E-12	2.065E-12	1.278E-12
SE	1.192E-08	2.442E-09	6.376E-10	2.864E-10	1.620E-10	6.230E-11	1.802E-11	7.143E-12	3.815E-12	2.361E-12
SSE	1.883E-08	3.857E-09	1.007E-09	4.522E-10	2.558E-10	9.837E-11	2.846E-11	1.128E-11	6.023E-12	3.728E-12

VENT AND BUILDING PARAMETERS:

RELEASE HEIGHT	(METERS)	.00	REP. WIND HEIGHT	(METERS)	10.0
DIAMETER	(METERS)	.00	BUILDING HEIGHT	(METERS)	48.0
EXIT VELOCITY	(METERS)	.00	BLDG.MIN.CRS.SEC.AREA	(SQ.METERS)	2352.0
			HEAT EMISSION RATE	(CAL/SEC)	.0

Table 2.3.5-206 (Sheet 1 of 2)
XOQDOQ-Predicted Annual Average X/Q Values at the Standard Radial Distances and Distance-Segment Boundaries
(July 2007 through June 2008)

2.26 Day Decay, Undepleted X/Qs at Various Distances

Release Point - Ground Level - No Intermittent Releases
2.260 DAY DECAY, UNDEPLETED
CORRECTED USING STANDARD OPEN TERRAIN FACTORS
0ANNUAL 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	4.696E-05	1.465E-05	7.582E-06	3.785E-06	1.547E-06	8.545E-07	5.495E-07	3.879E-07	2.915E-07	2.291E-07	1.861E-07
SSW	4.140E-05	1.305E-05	6.801E-06	3.406E-06	1.387E-06	7.634E-07	4.896E-07	3.448E-07	2.586E-07	2.029E-07	1.646E-07
SW	3.777E-05	1.184E-05	6.183E-06	3.102E-06	1.268E-06	6.991E-07	4.491E-07	3.167E-07	2.378E-07	1.867E-07	1.516E-07
WSW	2.887E-05	9.055E-06	4.773E-06	2.411E-06	9.852E-07	5.424E-07	3.479E-07	2.450E-07	1.837E-07	1.441E-07	1.169E-07
W	3.675E-05	1.162E-05	6.138E-06	3.098E-06	1.261E-06	6.925E-07	4.432E-07	3.116E-07	2.334E-07	1.829E-07	1.482E-07
WNW	4.179E-05	1.292E-05	6.731E-06	3.387E-06	1.390E-06	7.684E-07	4.945E-07	3.492E-07	2.625E-07	2.063E-07	1.676E-07
NW	6.579E-05	2.081E-05	1.102E-05	5.571E-06	2.266E-06	1.242E-06	7.942E-07	5.580E-07	4.177E-07	3.272E-07	2.651E-07
NNW	6.561E-05	2.074E-05	1.096E-05	5.532E-06	2.246E-06	1.231E-06	7.864E-07	5.523E-07	4.133E-07	3.236E-07	2.621E-07
N	3.354E-05	1.057E-05	5.504E-06	2.751E-06	1.118E-06	6.145E-07	3.937E-07	2.771E-07	2.077E-07	1.629E-07	1.321E-07
NNE	1.424E-05	4.364E-06	2.229E-06	1.108E-06	4.543E-07	2.518E-07	1.623E-07	1.148E-07	8.643E-08	6.801E-08	5.532E-08
NE	1.071E-05	3.294E-06	1.685E-06	8.370E-07	3.443E-07	1.914E-07	1.237E-07	8.761E-08	6.602E-08	5.200E-08	4.233E-08
ENE	1.253E-05	3.758E-06	1.882E-06	9.280E-07	3.864E-07	2.174E-07	1.417E-07	1.010E-07	7.657E-08	6.059E-08	4.952E-08
E	1.200E-05	3.647E-06	1.837E-06	9.051E-07	3.746E-07	2.098E-07	1.363E-07	9.697E-08	7.335E-08	5.795E-08	4.730E-08
ESE	1.692E-05	5.067E-06	2.531E-06	1.245E-06	5.193E-07	2.927E-07	1.910E-07	1.364E-07	1.034E-07	8.188E-08	6.696E-08
SE	4.211E-05	1.238E-05	6.062E-06	2.946E-06	1.220E-06	6.834E-07	4.425E-07	3.132E-07	2.353E-07	1.845E-07	1.494E-07
SSE	3.352E-05	1.020E-05	5.158E-06	2.548E-06	1.055E-06	5.911E-07	3.840E-07	2.733E-07	2.067E-07	1.634E-07	1.334E-07

0ANNUAL 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	1.552E-07	8.189E-08	5.391E-08	3.145E-08	2.144E-08	1.590E-08	1.243E-08	1.008E-08	8.390E-09	7.126E-09	6.149E-09
SSW	1.371E-07	7.199E-08	4.725E-08	2.746E-08	1.868E-08	1.383E-08	1.080E-08	8.754E-09	7.285E-09	6.187E-09	5.339E-09
SW	1.263E-07	6.645E-08	4.365E-08	2.537E-08	1.725E-08	1.276E-08	9.958E-09	8.057E-09	6.695E-09	5.676E-09	4.890E-09
WSW	9.733E-08	5.101E-08	3.341E-08	1.932E-08	1.308E-08	9.641E-09	7.494E-09	6.043E-09	5.005E-09	4.231E-09	3.634E-09
W	1.233E-07	6.449E-08	4.219E-08	2.439E-08	1.652E-08	1.219E-08	9.490E-09	7.664E-09	6.359E-09	5.385E-09	4.634E-09
WNW	1.398E-07	7.373E-08	4.852E-08	2.826E-08	1.924E-08	1.424E-08	1.112E-08	8.995E-09	7.475E-09	6.338E-09	5.460E-09
NW	2.205E-07	1.153E-07	7.548E-08	4.371E-08	2.967E-08	2.195E-08	1.713E-08	1.387E-08	1.154E-08	9.803E-09	8.461E-09
NNW	2.180E-07	1.139E-07	7.451E-08	4.311E-08	2.924E-08	2.161E-08	1.685E-08	1.364E-08	1.134E-08	9.622E-09	8.298E-09
N	1.100E-07	5.771E-08	3.784E-08	2.196E-08	1.491E-08	1.102E-08	8.594E-09	6.950E-09	5.773E-09	4.894E-09	4.215E-09
NNE	4.618E-08	2.445E-08	1.613E-08	9.432E-09	6.437E-09	4.773E-09	3.729E-09	3.020E-09	2.510E-09	2.129E-09	1.834E-09
NE	3.535E-08	1.873E-08	1.236E-08	7.213E-09	4.910E-09	3.631E-09	2.829E-09	2.284E-09	1.893E-09	1.601E-09	1.375E-09
ENE	4.150E-08	2.228E-08	1.483E-08	8.759E-09	6.008E-09	4.469E-09	3.499E-09	2.836E-09	2.359E-09	2.001E-09	1.724E-09
E	3.960E-08	2.118E-08	1.407E-08	8.289E-09	5.680E-09	4.224E-09	3.306E-09	2.681E-09	2.230E-09	1.892E-09	1.631E-09
ESE	5.615E-08	3.019E-08	2.011E-08	1.188E-08	8.146E-09	6.056E-09	4.737E-09	3.837E-09	3.189E-09	2.702E-09	2.325E-09
SE	1.240E-07	6.337E-08	4.012E-08	2.154E-08	1.355E-08	9.336E-09	6.839E-09	5.239E-09	4.153E-09	3.385E-09	2.820E-09
SSE	1.117E-07	5.983E-08	3.979E-08	2.351E-08	1.616E-08	1.205E-08	9.466E-09	7.701E-09	6.428E-09	5.472E-09	4.731E-09

0VENT AND BUILDING PARAMETERS:

RELEASE HEIGHT (METERS) .00 REP. WIND HEIGHT (METERS) 10.0
DIAMETER (METERS) .00 BUILDING HEIGHT (METERS) 48.0
EXIT VELOCITY (METERS) .00 BLDG.MIN.CRS.SEC.AREA (SQ.METERS) 2256.0
HEAT EMISSION RATE (CAL/SEC) .0 Release Point - Ground Level - No Intermittent

Table 2.3.5-206 (Sheet 2 of 2)
XOQDOQ-Predicted Annual Average X/Q Values at the Standard Radial Distances and Distance-Segment Boundaries
(July 2007 through June 2008)

2.26 Day Decay, Undepleted X/Qs Along Various Segaments

Release Point - Ground Level - No Intermittent Releases
2.260 DAY DECAY, UNDEPLETED
0CHI/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	7.464E-06	1.737E-06	5.662E-07	2.953E-07	1.874E-07	8.575E-08	3.200E-08	1.599E-08	1.011E-08	7.139E-09
SSW	6.680E-06	1.559E-06	5.047E-07	2.620E-07	1.658E-07	7.546E-08	2.795E-08	1.391E-08	8.780E-09	6.198E-09
SW	6.070E-06	1.423E-06	4.628E-07	2.409E-07	1.526E-07	6.962E-08	2.583E-08	1.284E-08	8.081E-09	5.687E-09
WSW	4.675E-06	1.105E-06	3.586E-07	1.861E-07	1.177E-07	5.348E-08	1.968E-08	9.700E-09	6.062E-09	4.240E-09
W	6.005E-06	1.417E-06	4.571E-07	2.365E-07	1.493E-07	6.766E-08	2.485E-08	1.227E-08	7.689E-09	5.395E-09
WNW	6.621E-06	1.557E-06	5.094E-07	2.658E-07	1.688E-07	7.720E-08	2.875E-08	1.432E-08	9.022E-09	6.350E-09
NW	1.077E-05	2.545E-06	8.192E-07	4.233E-07	2.670E-07	1.210E-07	4.453E-08	2.208E-08	1.392E-08	9.821E-09
NNW	1.072E-05	2.525E-06	8.112E-07	4.188E-07	2.640E-07	1.195E-07	4.393E-08	2.174E-08	1.368E-08	9.640E-09
N	5.406E-06	1.257E-06	4.060E-07	2.105E-07	1.330E-07	6.050E-08	2.236E-08	1.109E-08	6.971E-09	4.903E-09
NNE	2.205E-06	5.096E-07	1.672E-07	8.752E-08	5.570E-08	2.558E-08	9.590E-09	4.799E-09	3.028E-09	2.133E-09
NE	1.666E-06	3.859E-07	1.273E-07	6.684E-08	4.261E-08	1.959E-08	7.333E-09	3.651E-09	2.291E-09	1.604E-09
ENE	1.875E-06	4.316E-07	1.456E-07	7.747E-08	4.983E-08	2.324E-08	8.886E-09	4.491E-09	2.844E-09	2.005E-09
E	1.825E-06	4.192E-07	1.402E-07	7.423E-08	4.761E-08	2.211E-08	8.414E-09	4.245E-09	2.688E-09	1.896E-09
ESE	2.523E-06	5.800E-07	1.963E-07	1.046E-07	6.738E-08	3.148E-08	1.205E-08	6.086E-09	3.847E-09	2.707E-09
SE	6.081E-06	1.365E-06	4.550E-07	2.382E-07	1.504E-07	6.651E-08	2.211E-08	9.460E-09	5.282E-09	3.403E-09
SSE	5.118E-06	1.181E-06	3.949E-07	2.092E-07	1.342E-07	6.244E-08	2.386E-08	1.211E-08	7.720E-09	5.481E-09

Release Point - Ground Level - No Intermittent Releases
2.260 DAY DECAY, UNDEPLETED
0CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT

Table 2.3.5-207 (Sheet 1 of 2) XOQDOQ-Predicted Annual Average X/Q Values at the Standard Radial Distances and Distance-Segment Boundaries (July 2007 through June 2008)

8 Day Decay, Depleted X/Qs at Various Distances

Release Point - Ground Level - No Intermittent Releases
8.000 DAY DECAY, DEPLETED
CORRECTED USING STANDARD OPEN TERRAIN FACTORS
0ANNUAL 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	4.447E-05	1.339E-05	6.768E-06	3.321E-06	1.318E-06	7.109E-07	4.477E-07	3.103E-07	2.293E-07	1.775E-07	1.422E-07
SSW	3.920E-05	1.193E-05	6.071E-06	2.988E-06	1.182E-06	6.350E-07	3.988E-07	2.757E-07	2.034E-07	1.571E-07	1.257E-07
SW	3.577E-05	1.082E-05	5.520E-06	2.722E-06	1.081E-06	5.819E-07	3.661E-07	2.535E-07	1.872E-07	1.448E-07	1.160E-07
WSW	2.734E-05	8.280E-06	4.262E-06	2.116E-06	8.403E-07	4.517E-07	2.838E-07	1.963E-07	1.448E-07	1.119E-07	8.952E-08
W	3.480E-05	1.062E-05	5.480E-06	2.719E-06	1.075E-06	5.763E-07	3.613E-07	2.494E-07	1.837E-07	1.418E-07	1.134E-07
WNW	3.958E-05	1.182E-05	6.009E-06	2.972E-06	1.185E-06	6.395E-07	4.031E-07	2.795E-07	2.067E-07	1.600E-07	1.282E-07
NW	6.230E-05	1.902E-05	9.830E-06	4.886E-06	1.930E-06	1.032E-06	6.464E-07	4.458E-07	3.282E-07	2.531E-07	2.022E-07
NNW	6.213E-05	1.895E-05	9.781E-06	4.852E-06	1.914E-06	1.023E-06	6.402E-07	4.414E-07	3.248E-07	2.505E-07	2.001E-07
N	3.176E-05	9.661E-06	4.913E-06	2.414E-06	9.530E-07	5.113E-07	3.209E-07	2.217E-07	1.635E-07	1.263E-07	1.010E-07
NNE	1.348E-05	3.991E-06	1.990E-06	9.728E-07	3.874E-07	2.097E-07	1.324E-07	9.198E-08	6.811E-08	5.280E-08	4.237E-08
NE	1.014E-05	3.013E-06	1.505E-06	7.351E-07	2.939E-07	1.596E-07	1.010E-07	7.029E-08	5.213E-08	4.046E-08	3.249E-08
ENE	1.186E-05	3.437E-06	1.681E-06	8.150E-07	3.297E-07	1.812E-07	1.157E-07	8.105E-08	6.044E-08	4.713E-08	3.800E-08
E	1.136E-05	3.336E-06	1.641E-06	7.948E-07	3.196E-07	1.748E-07	1.113E-07	7.776E-08	5.787E-08	4.505E-08	3.628E-08
ESE	1.603E-05	4.635E-06	2.261E-06	1.094E-06	4.433E-07	2.440E-07	1.561E-07	1.094E-07	8.168E-08	6.373E-08	5.142E-08
SE	4.007E-05	1.142E-05	5.484E-06	2.630E-06	1.068E-06	5.891E-07	3.770E-07	2.643E-07	1.971E-07	1.536E-07	1.237E-07
SSE	3.175E-05	9.324E-06	4.605E-06	2.236E-06	8.997E-07	4.919E-07	3.131E-07	2.187E-07	1.628E-07	1.267E-07	1.020E-07

0ANNUAL 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	1.171E-07	5.877E-08	3.710E-08	2.028E-08	1.315E-08	9.350E-09	7.052E-09	5.539E-09	4.482E-09	3.710E-09	3.126E-09
SSW	1.034E-07	5.161E-08	3.246E-08	1.766E-08	1.141E-08	8.099E-09	6.098E-09	4.783E-09	3.866E-09	3.197E-09	2.692E-09
SW	9.539E-08	4.776E-08	3.010E-08	1.641E-08	1.061E-08	7.536E-09	5.676E-09	4.452E-09	3.599E-09	2.976E-09	2.505E-09
WSW	7.359E-08	3.674E-08	2.310E-08	1.255E-08	8.093E-09	5.733E-09	4.308E-09	3.373E-09	2.722E-09	2.247E-09	1.889E-09
W	9.310E-08	4.633E-08	2.907E-08	1.575E-08	1.015E-08	7.185E-09	5.398E-09	4.226E-09	3.409E-09	2.815E-09	2.366E-09
WNW	1.056E-07	5.301E-08	3.346E-08	1.828E-08	1.184E-08	8.418E-09	6.345E-09	4.980E-09	4.027E-09	3.331E-09	2.805E-09
NW	1.660E-07	8.250E-08	5.172E-08	2.800E-08	1.803E-08	1.276E-08	9.589E-09	7.508E-09	6.060E-09	5.005E-09	4.210E-09
NNW	1.642E-07	8.158E-08	5.113E-08	2.767E-08	1.782E-08	1.261E-08	9.475E-09	7.418E-09	5.986E-09	4.943E-09	4.157E-09
N	8.302E-08	4.146E-08	2.607E-08	1.418E-08	9.161E-09	6.499E-09	4.891E-09	3.835E-09	3.098E-09	2.561E-09	2.155E-09
NNE	3.492E-08	1.761E-08	1.115E-08	6.124E-09	3.982E-09	2.839E-09	2.145E-09	1.687E-09	1.366E-09	1.131E-09	9.539E-10
NE	2.680E-08	1.355E-08	8.589E-09	4.720E-09	3.069E-09	2.187E-09	1.651E-09	1.298E-09	1.050E-09	8.693E-10	7.324E-10
ENE	3.145E-08	1.610E-08	1.030E-08	5.723E-09	3.748E-09	2.685E-09	2.036E-09	1.606E-09	1.304E-09	1.082E-09	9.142E-10
E	2.999E-08	1.529E-08	9.756E-09	5.405E-09	3.534E-09	2.529E-09	1.917E-09	1.511E-09	1.226E-09	1.017E-09	8.590E-10
ESE	4.258E-08	2.185E-08	1.399E-08	7.784E-09	5.101E-09	3.656E-09	2.773E-09	2.188E-09	1.776E-09	1.474E-09	1.245E-09
SE	1.023E-07	5.187E-08	3.276E-08	1.770E-08	1.125E-08	7.817E-09	5.751E-09	4.403E-09	3.471E-09	2.799E-09	2.298E-09
SSE	8.433E-08	4.300E-08	2.743E-08	1.520E-08	9.940E-09	7.117E-09	5.396E-09	4.256E-09	3.456E-09	2.870E-09	2.425E-09

0VENT AND BUILDING PARAMETERS:

RELEASE HEIGHT	(METERS)	.00	REP. WIND HEIGHT	(METERS)	10.0
DIAMETER	(METERS)	.00	BUILDING HEIGHT	(METERS)	48.0
EXIT VELOCITY	(METERS)	.00	BLDG.MIN.CRS.SEC.AREA	(SQ.METERS)	2352.0
			HEAT EMISSION RATE	(CAL/SEC)	

Table 2.3.5-207 (Sheet 2 of 2)
XOQDOQ-Predicted Annual Average X/Q Values at the Standard Radial Distances and Distance-Segment Boundaries (July 2007 through June 2008)

8 Day Decay, Depleted X/Qs Along Various Segments

Release Point - Ground Level - No Intermittent Releases
8.000 DAY DECAY, DEPLETED
0CHI/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	6.708E-06	1.493E-06	4.629E-07	2.327E-07	1.434E-07	6.210E-08	2.085E-08	9.443E-09	5.569E-09	3.723E-09
SSW	6.002E-06	1.340E-06	4.125E-07	2.064E-07	1.268E-07	5.460E-08	1.817E-08	8.182E-09	4.809E-09	3.208E-09
SW	5.455E-06	1.224E-06	3.786E-07	1.900E-07	1.169E-07	5.050E-08	1.687E-08	7.612E-09	4.477E-09	2.986E-09
WSW	4.202E-06	9.512E-07	2.936E-07	1.470E-07	9.025E-08	3.887E-08	1.291E-08	5.792E-09	3.392E-09	2.255E-09
W	5.396E-06	1.219E-06	3.739E-07	1.865E-07	1.143E-07	4.905E-08	1.622E-08	7.261E-09	4.250E-09	2.825E-09
WNW	5.950E-06	1.340E-06	4.167E-07	2.097E-07	1.292E-07	5.600E-08	1.879E-08	8.502E-09	5.007E-09	3.343E-09
NW	9.674E-06	2.188E-06	6.691E-07	3.332E-07	2.039E-07	8.737E-08	2.884E-08	1.290E-08	7.551E-09	5.023E-09
NNW	9.629E-06	2.171E-06	6.628E-07	3.298E-07	2.017E-07	8.641E-08	2.851E-08	1.275E-08	7.460E-09	4.961E-09
N	4.858E-06	1.081E-06	3.320E-07	1.660E-07	1.018E-07	4.386E-08	1.459E-08	6.566E-09	3.856E-09	2.570E-09
NNE	1.983E-06	4.385E-07	1.368E-07	6.910E-08	4.270E-08	1.859E-08	6.290E-09	2.866E-09	1.695E-09	1.135E-09
NE	1.498E-06	3.322E-07	1.043E-07	5.287E-08	3.274E-08	1.429E-08	4.846E-09	2.208E-09	1.304E-09	8.722E-10
ENE	1.686E-06	3.715E-07	1.193E-07	6.126E-08	3.828E-08	1.693E-08	5.862E-09	2.709E-09	1.614E-09	1.086E-09
E	1.642E-06	3.609E-07	1.148E-07	5.867E-08	3.655E-08	1.610E-08	5.541E-09	2.552E-09	1.518E-09	1.021E-09
ESE	2.270E-06	4.993E-07	1.609E-07	8.277E-08	5.180E-08	2.296E-08	7.970E-09	3.688E-09	2.198E-09	1.479E-09
SE	5.536E-06	1.202E-06	3.885E-07	1.997E-07	1.246E-07	5.458E-08	1.818E-08	7.906E-09	4.433E-09	2.812E-09
SSE	4.601E-06	1.015E-06	3.230E-07	1.650E-07	1.028E-07	4.526E-08	1.558E-08	7.181E-09	4.277E-09	2.879E-09

Release Point - Ground Level - No Intermittent Releases
8.000 DAY DECAY, DEPLETED
0CHI/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	6.708E-06	1.493E-06	4.629E-07	2.327E-07	1.434E-07	6.210E-08	2.085E-08	9.443E-09	5.569E-09	3.723E-09
SSW	6.002E-06	1.340E-06	4.125E-07	2.064E-07	1.268E-07	5.460E-08	1.817E-08	8.182E-09	4.809E-09	3.208E-09
SW	5.455E-06	1.224E-06	3.786E-07	1.900E-07	1.169E-07	5.050E-08	1.687E-08	7.612E-09	4.477E-09	2.986E-09
WSW	4.202E-06	9.512E-07	2.936E-07	1.470E-07	9.025E-08	3.887E-08	1.291E-08	5.792E-09	3.392E-09	2.255E-09
W	5.396E-06	1.219E-06	3.739E-07	1.865E-07	1.143E-07	4.905E-08	1.622E-08	7.261E-09	4.250E-09	2.825E-09
WNW	5.950E-06	1.340E-06	4.167E-07	2.097E-07	1.292E-07	5.600E-08	1.879E-08	8.502E-09	5.007E-09	3.343E-09
NW	9.674E-06	2.188E-06	6.691E-07	3.332E-07	2.039E-07	8.737E-08	2.884E-08	1.290E-08	7.551E-09	5.023E-09
NNW	9.629E-06	2.171E-06	6.628E-07	3.298E-07	2.017E-07	8.641E-08	2.851E-08	1.275E-08	7.460E-09	4.961E-09
N	4.858E-06	1.081E-06	3.320E-07	1.660E-07	1.018E-07	4.386E-08	1.459E-08	6.566E-09	3.856E-09	2.570E-09
NNE	1.983E-06	4.385E-07	1.368E-07	6.910E-08	4.270E-08	1.859E-08	6.290E-09	2.866E-09	1.695E-09	1.135E-09
NE	1.498E-06	3.322E-07	1.043E-07	5.287E-08	3.274E-08	1.429E-08	4.846E-09	2.208E-09	1.304E-09	8.722E-10
ENE	1.686E-06	3.715E-07	1.193E-07	6.126E-08	3.828E-08	1.693E-08	5.862E-09	2.709E-09	1.614E-09	1.086E-09
E	1.642E-06	3.609E-07	1.148E-07	5.867E-08	3.655E-08	1.610E-08	5.541E-09	2.552E-09	1.518E-09	1.021E-09
ESE	2.270E-06	4.993E-07	1.609E-07	8.277E-08	5.180E-08	2.296E-08	7.970E-09	3.688E-09	2.198E-09	1.479E-09
SE	5.536E-06	1.202E-06	3.885E-07	1.997E-07	1.246E-07	5.458E-08	1.818E-08	7.906E-09	4.433E-09	2.812E-09
SSE	4.601E-06	1.015E-06	3.230E-07	1.650E-07	1.028E-07	4.526E-08	1.558E-08	7.181E-09	4.277E-09	2.879E-09

0Exelon Victoria County Months:Jul - Jun Years: 2007 - 2008

Table 2.3.5-208
XOQDOQ-Predicted Annual Average X/Q and D/Q Values at Sensitive Receptors
(July 2007 through June 2008)

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	SSW	2.43	3911.	5.2E-07	5.2E-07	4.2E-07	1.7E-09
A	Res/Meat	SW	2.34	3766.	5.2E-07	5.1E-07	4.2E-07	1.4E-09
A	Res/Meat	W	4.62	7435.	1.4E-07	1.4E-07	1.1E-07	3.1E-10
A	Res/Meat	WNW	4.66	7500.	1.6E-07	1.6E-07	1.2E-07	3.5E-10
A	Res/Meat	NW	1.79	2881.	1.6E-06	1.6E-06	1.3E-06	7.7E-09
A	Res/Meat	NNW	1.53	2462.	2.2E-06	2.2E-06	1.8E-06	1.2E-08
A	Res/Meat	N	3.09	4973.	2.6E-07	2.6E-07	2.1E-07	9.5E-10
A	Res/Meat	NNE	4.36	7017.	5.9E-08	5.8E-08	4.5E-08	1.3E-10
A	Res/Meat	NE	2.33	3750.	1.4E-07	1.4E-07	1.2E-07	3.0E-10
A	Res/Meat	SSE	4.26	6856.	1.5E-07	1.5E-07	1.1E-07	2.9E-10
A	Veg	SSW	2.43	3911.	5.2E-07	5.2E-07	4.2E-07	1.7E-09
A	Veg	SW	2.34	3766.	5.2E-07	5.1E-07	4.2E-07	1.4E-09
A	Veg	W	4.62	7435.	1.4E-07	1.4E-07	1.1E-07	3.1E-10
A	Veg	WNW	4.66	7500.	1.6E-07	1.6E-07	1.2E-07	3.5E-10
A	Veg	NW	1.79	2881.	1.6E-06	1.6E-06	1.3E-06	7.7E-09
A	Veg	NNW	2.63	4233.	7.2E-07	7.1E-07	5.8E-07	3.3E-09
A	Veg	N	3.09	4973.	2.6E-07	2.6E-07	2.1E-07	9.5E-10
A	Veg	NNE	4.36	7017.	5.9E-08	5.8E-08	4.5E-08	1.3E-10
A	Veg	NE	2.33	3750.	1.4E-07	1.4E-07	1.2E-07	3.0E-10
A	Veg	SSE	4.26	6856.	1.5E-07	1.5E-07	1.1E-07	2.9E-10
A	Property Bndry	S	1.48	2387.	1.6E-06	1.6E-06	1.4E-06	6.7E-09
A	Property Bndry	SSW	1.09	1761.	2.8E-06	2.8E-06	2.4E-06	1.2E-08
A	Property Bndry	SW	.75	1205.	6.2E-06	6.2E-06	5.5E-06	2.3E-08
A	Property Bndry	WSW	.65	1040.	6.0E-06	6.0E-06	5.4E-06	2.2E-08
A	Property Bndry	W	.66	1063.	7.4E-06	7.4E-06	6.7E-06	3.1E-08
A	Property Bndry	WNW	.73	1170.	7.1E-06	7.1E-06	6.3E-06	3.0E-08
A	Property Bndry	NW	.92	1478.	6.8E-06	6.8E-06	6.0E-06	4.1E-08
A	Property Bndry	NNW	.92	1477.	6.8E-06	6.8E-06	6.0E-06	4.4E-08
A	Property Bndry	N	.97	1558.	3.0E-06	3.0E-06	2.6E-06	1.6E-08
A	Property Bndry	NNE	1.35	2167.	5.7E-07	5.7E-07	4.9E-07	2.0E-09
A	Property Bndry	NE	1.77	2856.	2.5E-07	2.4E-07	2.1E-07	5.7E-10
A	Property Bndry	ENE	1.80	2899.	2.7E-07	2.7E-07	2.2E-07	5.0E-10
A	Property Bndry	E	2.54	4080.	1.3E-07	1.3E-07	1.1E-07	2.4E-10
A	Property Bndry	ESE	4.00	6444.	8.3E-08	8.2E-08	6.4E-08	1.1E-10
A	Property Bndry	SE	3.79	6100.	2.3E-07	2.0E-07	1.7E-07	2.3E-10
A	Property Bndry	SSE	2.60	4191.	3.6E-07	3.6E-07	2.9E-07	8.7E-10
A	Unit 1 to 2	NNE	.19	305.	2.3E-05	2.3E-05	2.2E-05	7.9E-08
A	Unit 1 to 2	NE	.19	305.	1.7E-05	1.7E-05	1.7E-05	4.4E-08
A	Unit 1 to 2	ENE	.19	305.	2.0E-05	2.0E-05	2.0E-05	4.0E-08

0VENT AND BUILDING PARAMETERS:

RELEASE HEIGHT	(METERS)	.00	REP. WIND HEIGHT	(METERS)	10.0
DIAMETER	(METERS)	.00	BUILDING HEIGHT	(METERS)	48.0
EXIT VELOCITY	(METERS)	.00	BLDG.MIN.CRS.SEC.AREA	(SQ.METERS)	2352.0
			HEAT EMISSION RATE	(CAL/SEC)	.0