switches its path to the south side of the "berm" that was created by the canal's excavation. The westernmost 4.02 km (2.5 mi.) of the trail runs through maritime hammocks and salt marsh. The primary activities occurring along the trail are bicycling, walking and skating, as well as opportunities to observe wildlife, picnic, or bank-fish along the route (Reference 2.2-017). The proposed water intake structure and pumphouse will be constructed on the CFBC, and the pipeline corridor will connect the CFBC and the LNP. Water from the CFBC will be used to provide cooling tower makeup water for the LNP (Figure 2.1-2).

Other boat ramps in the vicinity are located at Inglis, Yankeetown, Vassey Creek, the CFBC, Pumpkin Island, and Williams Landing. No marinas are located within the site boundary, but there are two marinas located within the vicinity (Figure 2.2-5). Freshwater fishing opportunities for bass, bluegill, redear and spotted sunfish occur along the Withlacoochee River from Inglis to Yankeetown, while bream are common in Lake Rousseau. There are no golf courses within the LNP site or vicinity. Natural resource areas such as conservation easements and aquatic preserves within 16 km (10 mi.) of the site are discussed in ER Section 2.4 and illustrated in Figure 2.4-7; detailed information on recreational activities within the region is provided in ER Subsection 2.5.2.7.

2.2.1.5 Land Use Plans

The State of Florida is comprised of state, regional, and local planning authorities. At the local level, a comprehensive land use plan discusses the current and future land use classifications. Each of the counties located within the LNP site and vicinity have prepared comprehensive land use plans, which are discussed below:

- **Levy County**. Chapter 8, Future Land Use Element, of Levy County's 1999 Comprehensive Plan discusses the current and future land use plans for the county which currently designate the 1257-ha (3105-ac.) site as Forestry/Rural Residential (1 dwelling unit [du] per 20 ac). A Large Scale Future Land Use Map (FLUM) and Text Amendment were submitted to the Florida Department of Community Affairs (FDCA) in February 2007 to change the LNP site's designation to Public Use in order to allow a nuclear power generating facility and to change the definition of Public Use in the Comprehensive Plan. The FDCA returned an Objection, Recommendations, and Comments (ORC) report to the Levy County Board of County Commissioners (BOC) on September 28, 2007. After responding to the ORC comments, the BOC adopted ordinances related to the Amendment on March 18, 2008, and the FDCA issued its Notice of Intent on May 8, 2008, that the ordinances are in compliance. The effective dates of the ordinances are pending a 21- day administrative review period, after which the LNP site will be designated as Public Use. Public use provides for public buildings and grounds including public utilities which are defined as gas, water, and electric, water power, well houses, electric substations, power generating facilities, sewerage, telephone facilities, utility poles and street lighting, There are no named streams at the LNP site. Runoff from the site is primarily overland, with storage provided by wetlands. The general direction of the overland flow is to the southwest toward the Lower Withlacoochee River and the Gulf of Mexico. (Reference 2.3-004) Major freshwater bodies in the vicinity of the LNP site include the Withlacoochee River and Lake Rousseau (Figure 2.3-4). Lake Rousseau is located approximately 4.8 km (3.0 mi.) south of the LNP site. The Withlacoochee River and the Rainbow River are the primary sources of water to Lake Rousseau. The Gulf of Mexico is located approximately 12.8 km (7.9 mi.) west of the LNP site.

A portion of the LNP site consists of wetlands (Reference 2.3-005). Extensive salt marsh communities are found between SR-19, the highway to the west of the LNP site, and the open waters of the Gulf of Mexico. Wetlands are described in more detail in ER Subsection 2.4.1.

The principal source of water for the LNP site is the CFBC, which is approximately 5.2 km (3.2 mi.) south of the LNP site. A section of the unfinished barge canal connects Lake Rousseau to the Gulf of Mexico, bifurcating the Withlacoochee River downstream of Lake Rousseau (Figure 2.3-2). The three water control structures in this area are the Inglis Lock, Inglis Bypass Spillway, and the Inglis Dam. These structures are operated by the SWFWMD and were constructed as part of the decommissioned CFBC project. Spillways at the Inglis Lock Bypass Channel and Inglis Dam are used to maintain an optimum pool elevation of 28 ft. mean sea level (msl) at Lake Rousseau.

The Inglis Lock, which is currently inactive, separates Lake Rousseau from the western end of the CFBC. The lock's former function was to raise and lower water levels so that vessels could travel between Lake Rousseau and the Gulf of Mexico. (Reference 2.3-006) During operation the lock released approximately 43.2 million L (11.4 million gal.) of freshwater into the Gulf of Mexico each time it was operated. Operation of the lock was discontinued in 1999 due to mechanical malfunctions. There are currently no plans to repair the lock.

2.3.1 HYDROLOGY

This subsection describes the surface water and groundwater aquifer resources that are present in the vicinity of the LNP site. These resources were evaluated to determine the potential effects that plant construction and operation may have on surface water and groundwater flow and quality.

The following hydrologic systems were considered in this evaluation:

- Freshwater streams
- Lakes and impoundments
- CFBC

(0.01 ft^3/day), respectively, no significant seasonal variation in these values was observed in the bedrock aquifer.

2.3.2 WATER USE

LNP water use, surface water use, groundwater use, and future water use are described in the following subsections.

2.3.2.1 Plant Water Use

LNP 1 and LNP 2 will collect cooling tower makeup water at the LNP makeup water pumphouse within the CFBC. The intake structure will be located approximately 11.1 km (6.9 mi.) east from the Gulf of Mexico on the berm that forms the north side of the canal and within 0.8 km (0.5 mi.) of the Inglis Lock (Figure 2.3-31). After being used, cooling tower blowdown water will be pumped through a pipeline that runs south to and along the northern berm of the CFBC. It will then run south to the CREC and will ultimately be discharged into the CREC discharge canal. There will be no discharge of water from the cooling towers to Waccasassa River basin.

The proposed pipelines (both blowdown and makeup) will be located in the lower part of the LNP site within the Withlacoochee River basin (Figure 2.3-31). However, the Withlacoochee River will not be influenced by the LNP as the makeup pipe will be directly connected to the Gulf of Mexico through the CFBC and the blowdown pipe will be connected to the Gulf through the CREC discharge canal.

Water for general plant operation will be taken from groundwater wells located off-site. Cooling tower makeup water at LNP 1 and LNP 2 will be withdrawn from the CFBC. Plant water use is described in further detail in ER Chapter 3.

2.3.2.2 Surface Water Use

There are no known communities that withdraw water from the Withlacoochee River or Lake Rousseau for public or private water supply. Groundwater is the primary source of water for public supply near the LNP site. However, surface water withdrawal does occur for non-drinking water purposes within Citrus, Levy, and Marion counties, which are located within a 16.1-km (10-mi.) radius of the proposed LNP site. Non-potable surface water uses include the following (Table 2.3-14) (Reference 2.3-049):

- Irrigation – 13.89 million liters per day (mld) (3.67 [million gallons per day [mgd]) of freshwater.
- Livestock – 0.45 mld (0.12 mgd) of freshwater.
- Mining – 8.52 mld (2.25 mgd) of freshwater.

2.7 METEOROLOGY AND AIR QUALITY

2.7.1 GENERAL CLIMATE

This subsection describes the general climate of the region surrounding the LNP. A climatological summary of normal and extreme values of relevant meteorological parameters is presented for the first-order NWS stations or Automated Surface Observing System (ASOS) stations located in Gainesville, Jacksonville, Orlando, Tallahassee, and Tampa, Florida. Figure 2.7-1 shows the locations of these meteorological observation stations with respect to the LNP site. Additional information regarding regional climatology was derived from various documents, which are referenced in the text below.

2.7.1.1 General Description

The LNP site is located near the geographical west central portion of Florida in the gulf coast region. Five first-order meteorological observation stations are located within the general area surrounding the LNP site. The locations of these stations, which are all in Florida, and their distances from the LNP site are presented in Table 2.7-1. The Gainesville station is approximately 76 km (47 mi.) to the north-northeast of the LNP site; the Jacksonville station is 181 km (112 mi.) to the northeast; the Orlando station is 146 km (91 mi.) to the east-southeast; the Tallahassee station is 222 km (138 mi.) to the northwest; and the Tampa station is 125 km (78 mi.) to the south of the site. These fully instrumented meteorological stations are "first-order" meteorological observing stations, continuously recording a complete range of meteorological parameters. The observations are recorded continuously, either by automated instruments or by human observer, for the 24-hour period from midnight to midnight. The LNP site is located in Florida's North Central state climate division of the National Climatic Data Center (NCDC). (Reference 2.7-026)

Climatological data for the general area surrounding the LNP site were obtained from several sources containing statistical summaries of historical meteorological data for these meteorological observation stations The references used to characterize the climatology include the following:

- Gale Research Company, *Climates of the States*, Third Edition (Reference 2.7-001).
- Gale Research Company, *Weather of U.S. Cities*, Fourth Edition (Reference 2.7-002).
- "Local Climatological Data, Annual Summary with Comparative Data" for Gainesville, Jacksonville, Orlando, Tallahassee, and Tampa, Florida, as published by the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (References 2.7-003, 2.7-004, 2.7-005, 2.7-006, and 2.7-007).

Hourly wind speed and direction measurements at the LNP site for the 2-year POR were used to prepare monthly and annual average joint frequency distributions of wind speed and direction by Pasquill Stability Category (refer to ER Subsection 2.7.4.1.6) for the 10-m (33-ft.) and 60-m (197-ft.) levels of the onsite meteorological tower. The wind speed categories presented in the joint frequency distributions correspond to the 11 wind speed categories recommended in Regulatory Guide 1.23, Revision 1.

The lower-level (10-m [33-ft.]) wind direction and wind speed are summarized by individual Pasquill stability category (A through G) and for the "All Stability" category in Tables 2.7-9, 2.7-10, 2.7-11, 2.7-12, 2.7-13, 2.7-14, 2.7-15, and 2.7-16 for the 2-year POR.. Additionally, the lower-level wind direction and wind speed are summarized monthly for the POR for the "All Stability" category in Tables 2.7-17, 2.7-18, 2.7-19, 2.7-20, 2.7-21, 2.7-22, 2.7-23, 2.7-24, 2.7-25, 2.7-26, 2.7-27, and 2.7-28. For this same period, graphical illustrations of the wind roses of wind speed and direction for the lower-level tower measurements are shown on Figure 2.7-3 (all stabilities, 1-year POR) and on Figures 2.7-4, 2.7-5, 2.7-6, 2.7-7, 2.7-8, 2.7-9, 2.7-10, 2.7-11, 2.7-12, 2.7-13, 2.7-14, and 2.7-15 (all stabilities by month). It is noted that the information in Tables 2.7-9 through 2.7-28 indicates a high frequency of "calm" winds at the 10-meter level (i.e., 18.8 percent of the total observations in Table 2.7-16). A review of the meteorological data indicates that, during the 2-year period of record, nearly all of the observed winds at the 10-meter level were observed to be in the range of "greater than 0" to less than 0.4 meters per second (m/s) (0.9 mph). Wind directions associated with these measurements do not reflect the characteristics of calm wind conditions in that the directions are not highly variable or abruptly changing, as would be expected during true calm (stagnant) conditions. The very low wind speeds observed at the 10-meter level are believed to be attributable to the height of the surrounding forest canopy and its corresponding frictional influence on wind speeds at the 10-meter elevation.

The upper-level (60-m [197-ft.]) wind direction and wind speed data are summarized by individual Pasquill stability category (A through G) and for the "All Stability" category in Tables 2.7-29, 2.7-30, 2.7-31, 2.7-32, 2.7-33, 2.7-34, 2.7-35, and 2.7-36 for the POR. Additionally, the upper-level wind direction and wind speed are summarized monthly for the POR for the "All Stability" category in Tables 2.7-37, 2.7-38, 2.7-39, 2.7-40, 2.7-41, 2.7-42, 2.7-43, 2.7-44, 2.7-45, 2.7-46, 2.7-47, and 2.7-48.

Graphical wind roses of wind speed and direction from the nearby Tampa, Gainesville, and Tallahassee airports are also provided for comparison with the on-site wind measurements described above. Figures 2.7-16, 2.7-17, and 2.7-18 illustrate these wind roses for the 5-year period from January 1, 2001, through December 31, 2005. It is noted that the wind roses for the Tampa and Gainesville observing stations are most similar to the LNP on-site annual wind rose (Figure 2.7-3) in that there is a notable east-west bias in the results, which is most likely attributable to the diurnal influence of sea breeze effects. These effects are much more distinct in the on-site data where a strong east-west wind direction is evident in the observations. The Tallahassee wind rose is seen to exhibit more of a north-south bias in the results, which is also believed to be attributable to sea breeze influences, which is consistent with the proximity of the station to the east-west shoreline in that part of the state.

2.7.4.1.2 Ambient Temperatures

Ambient temperature from the on-site monitoring system is measured at 10-m (33-ft.), and differential temperature (used in determining wind stability classification) is measured between the 10-m (33-ft.) and 60-m (197-ft.) levels of the tower. The maximum temperature recorded by the system for the first year of onsite data was 34.6°C (94.3°F), and the minimum temperature was -3.9°C (25.0°F). A summary of the on-site temperature information by month and for the 1-year POR is presented in Table 2.7-49. Based on the maximum and minimum temperature observations in the table, the diurnal temperature range of the on-site temperatures during this period is approximately 20 to 22 degrees in the fall, winter, and spring seasons and approximately 14 to 17 degrees in the summer and early fall seasons. The on-site temperature measurements are consistent with the long-term regional observations from Tampa, Gainesville, Orlando, Tallahassee, and Jacksonville, which are also summarized in Table 2.7-49.

2.7.4.1.3 Atmospheric Moisture

2.7.4.1.3.1 Relative Humidity

Maximum relative humidity usually occurs during the early morning hours, and minimum relative humidity is typically observed in the mid-afternoon. For the annual cycle, the lowest relative humidities occur in mid-spring, with the summer months typically exhibiting the highest relative humidities. Table 2.7-50 summarizes relative humidity observations from the Tampa, Gainesville, and Orlando, Tallahassee, and Jacksonville meteorological observing stations.

2.7.4.1.3.2 Dew-Point Temperature

Dew-point temperature is used as a measure of the absolute humidity in the air. It is the temperature to which air must be cooled to reach saturation/condensation, assuming pressure and water vapor content remain constant. The on-site composite monthly and annual dew-point measurements for the first year of onsite data are compared with regional long-term observations from the Tampa, Gainesville, Orlando, Tallahassee, and Jacksonville stations in Table 2.7-51. The observed on-site dew-point temperatures are consistent and generally bounded by the long-term regional observations of dew-point temperatures.

2.7.4.1.3.3 Wet Bulb Temperature

Table 2.7-52 provides a summary of statistically significant dry and wet bulb temperatures in the region surrounding the LNP site, as obtained from the Jacksonville, Tallahassee, and Tampa meteorological observing stations. These data were obtained from the 30-year (1961-1990) Solar and Meteorological Surface Observation Network (SAMSON) database (Reference 2.7-024) and from the 24-year (1973-1996) NOAA Engineering Weather Data (EWD) database (Reference 2.7-019).

2.7.4.1.4 Precipitation

The total precipitation observed at the LNP meteorological monitoring station during the first year of onsite monitoring 109.09 cm (42.95 in.). Table 2.7-53 compares average monthly and annual precipitation measurements at the Tampa, Gainesville, Orlando, Tallahassee, and Jacksonville meteorological observation stations with the monthly and annual precipitation measurements from the LNP on-site meteorological monitoring station. The region displays some variance in total monthly and annual precipitation between stations from month-to-month and year-to-year, and the wettest period of the year is typically the summer, with approximately twice the monthly totals in those months as compared to winter months. The one year of on-site precipitation data presented here are considered to be consistent with generally bounded by the long-term regional observations from the Tampa, Gainesville, Orlando, Tallahassee, and Jacksonville meteorological observing stations when compared with long-term periods of record at those locations (Table 2.7-53). Based on a review of the regional precipitation data, it appears to be reasonably representative of the site area; and there is no reason to expect that on-site measurements of precipitation would be significantly different.

2.7.4.1.5 Fog

Fog is an aggregate of minute water droplets suspended in the atmosphere near the surface of the earth. According to international definition, fog reduces visibility to less than 1.0 km (0.62 mi.). According to United States observing practice, ground fog is a fog that hides less than 60 percent of the sky and does not extend to the base of any clouds that may lie above it. Ice fog is fog composed of suspended particles of ice; it usually only occurs in high latitudes in calm, clear weather at temperatures below -28.9°C (-20°F) and increases in frequency as temperature decreases. (Reference 2.7-025)

Table 2.7-54 summarizes the occurrence of fog at the Tampa, Gainesville, Orlando, Tallahassee, and Jacksonville meteorological observation stations. Heavy fog (that is, visibility less than or equal to 0.4 km [0.25 mi.]) has been observed at Tampa, Gainesville, Orlando, Tallahassee, and Jacksonville an average of 15.3, 46.5, 18.0, 49.8, and 39.3 days per year, respectively (Table 2.7-54). The greatest number of fog days typically occurs during the months of December through February. However, fog can be a very localized phenomenon, and the information provided in Table 2.7-54 is used as a regional estimate for fog occurrence. Based on a review of regional fog observations, they appear to be reasonably representative of the site area; and there is no reason to expect that on-site observations of naturally occurring fog would be significantly different. Given that the air quality of Florida is considered to be good, smog (generally considered to be a combination of fog and air pollution episodes) is not expected to occur in the region at any time.

2.7.4.1.6 Atmospheric Stability

A joint frequency distribution of wind speed, wind direction, and atmospheric stability is used in conjunction with a dispersion model to estimate the average rate of dispersion of routine and potential accidental radioactive releases. For the LNP site, joint frequency distributions have been generated from on-site data using the vertical temperature gradient and the variability of the horizontal wind to estimate atmospheric stability, as recommended in NRC Regulatory Guide 1.23, Revision 1. As previously noted, joint frequency distributions of wind speed, wind direction, and atmospheric stability measured at the LNP site for the period from February 1, 2007, to January 31, 2009, are provided in a series of 40 tables, beginning with Table 2.7-9 and ending with Table 2.7-48.

Based on the two years of meteorological data collected on the LNP site, temporal variations within the individual stability categories are relatively small. Almost 50 percent of all hours fall into either neutral (D) or slightly stable (E) stability categories. More that 25 percent of all hours fall into the stable (F) and extremely stable (G) stability categories. Extremely unstable (A), moderately unstable (B), and slightly unstable (C) categories combined occurred approximately 25 percent of the total hours. These distributions of stability category are generally consistent with what would be expected for this region and the high predominance of A through E stability is considered to be conducive to very good atmospheric dispersion conditions during the majority of the hours of the day.

2.7.4.1.7 Topographical Description of the Surrounding Area

The LNP site and surrounding region is relatively flat, with no significant terrain features that will otherwise be expected to adversely or unusually impact natural dispersion downwind of the plant. Figures 2.7-19, 2.7-20, 2.7-21, and 2.7-22 show cross-sectional plots of elevation versus distance from the LNP center for each of 16 directional sectors. Figure 2.7-23 shows the existing topographic features within an 8-km (5-mi.) radius of the LNP. The area surrounding the LNP site is relatively flat, and no significant terrain modifications are expected during and after construction of the LNP that would affect local meteorological measurements an the on-site monitoring station. Figure 2.7-24 shows topographic features within an 80-km (50-mi.) radius of the LNP site, which is noted to be generally flat in all directions.

2.7.4.2 Local Meteorological Conditions for Design and Operating Bases

Design and operating bases, such as tornado parameters, temperature, and precipitation extremes are statistics that, by definition and necessity, are based on long-term regional records. Although data collected by the LNP on-site meteorological monitoring system is representative of site conditions, only 2 years of on-site data are available. Therefore, long-term regional data are considered most appropriate for use in establishing conservative estimates of climatological extremes. Therefore, the design and operating basis conditions were based on regional meteorological data, as previously described in ER Subsection 2.7.1.

2.7.5 ON-SITE METEOROLOGICAL MEASUREMENTS PROGRAM

The LNP on-site meteorological measurement program began in February 2007 with the installation of a 60.4-m (198-ft.) guyed, open-latticed meteorological tower. The tower has been used to monitor meteorological parameters at two levels above ground level and has operated continuously since it was first installed. Table 2.7-55 shows the current elevations of the operational sensors for all monitored parameters for both the lower and upper monitoring levels. Figure 2.7-2 shows a topographical map of the area and the location of the meteorological tower with respect to the LNP site, LNP 1, and LNP 2. The area surrounding the tower is generally covered with low-level vegetation (less than approximately 0.9 m [3 ft.] in height and indigenous to the central region of Florida) within several hundred feet of the tower in all directions. In the immediate vicinity of the tower base and within the security fence, gravel has been used as a means of controlling weeds. The presence of this gravel is not extensive and is not expected to have an influence on the parameters measured on the tower. The location of the LNP meteorological tower is ideally situated for use in support of the LNP COLA. Therefore, the monitoring results obtained from the tower will be used to characterize the on-site meteorological conditions for the LNP site. The topography of the area, as discussed in ER Subsection 2.7.4.1.7, is essentially flat with no significant terrain variations that would influence or otherwise affect dispersion. Topographical cross-sections of the region are provided on Figures 2.7-19, 2.7-20, 2.7-21, and 2.7-22, which show the topographical changes by direction from the center of the site out to a distance of 80 km (50 mi.) of the LNP site.

Two years of continuous and consecutive meteorological data from the on-site tower for the period from February 1, 2007, through January 31, 2009, are submitted with this COLA in the electronic format recommended in Appendix A of Regulatory Guide 1.23, Revision 1. These data are also used for the determination of short- and long-term diffusion estimates, as described in ER Subsections 2.7.6 and 2.7.7, respectively.

Additional information on tower instrumentation, including wind, temperature, precipitation, and solar system, as well as maintenance, data reduction, and measurement accuracy can be found in ER Section 6.4.

2.7.6 SHORT-TERM DIFFUSION ESTIMATES

2.7.6.1 Objective

Conservative estimates of the local atmospheric dilution factors (Chi/Q) for LNP 1 and LNP 2 were made using an atmospheric dispersion model and on-site meteorological data for the period from February 1, 2007, through January 31, The subsequent addition of the helper cooling towers to trim CREC discharge temperatures has resulted in recent visually apparent improvements in the abundance of sea grasses and likely the community of aquatic organisms normally inhabiting sea grass beds. A recent study of sea grass abundance and speciation has been conducted by a subcontractor to PEF, and the results of the study are discussed in ER Subsection 2.4.2.5.1. Additional surveys of aquatic life in the vicinity of the CREC discharge canal are planned for 2008 because the data used in the original 1985 316(a) and (b) demonstration document have not been updated. Based on available ecological information in the 1985 316(a) and 316(b) (Reference 5.3-001) and the relatively small size and lower temperature characteristics of the LNP blowdown plume, the impacts of the LNP addition are anticipated to be SMALL. No measurable adverse impacts on aquatic biota, including populations of important species present in the CREC discharge canal and the nearshore Gulf sea grass habitats are likely to result from the addition of the smaller thermal component of the LNP blowdown. Additional aquatic field surveys for the sea grass habitats within the influence of the CREC thermal plume, the sea grass study results, and the impacts of the combined LNP/CREC discharge canal are provided as supplemental information in response to an NRC request for additional information.

5.3.3 ATMOSPHERIC HEAT DISSIPATION SYSTEM

Mechanical draft cooling towers will be used to provide a heat sink during normal operation of LNP 1 and LNP 2. The AP1000 reactor does not rely on site service water as a safety grade ultimate heat sink (UHS) and meteorological design parameters for the cooling tower during normal operation have been established. This subsection contains a brief description of the potential impacts of the normal operation heat sink system for LNP 1 and LNP 2 on the environment in the area surrounding the LNP site.

5.3.3.1 Heat Dissipation to the Atmosphere

5.3.3.1.1 Length and Frequency of Elevated Plumes

The mechanical draft cooling towers that will be used to dissipate waste heat from LNP 1 and LNP 2 to the atmosphere are not expected to have a significant influence on the local environment. While there may be some near-field changes in temperature or humidity (that is, in the immediate vicinity of the towers), the cooling tower plumes should not significantly affect conditions at ground level at any off-site location.

Under full power, it is expected that the LNP cooling towers will evaporate up to 106,142.9 liters per minute (lpm) (28,040 gpm), depending on weather conditions. Under most meteorological conditions, the discharge will condense upon leaving the tower, and the length of the visible plume will depend on the temperature and humidity of the atmosphere. Colder and more humid weather is conducive to longer plumes. On very humid days, when the longest plumes are expected, there may be a naturally occurring overcast. On such occasions, it is more difficult to distinguish the cooling tower plume from the overcast cloud layer. Most of the time, the visible plume will extend only a short distance from the tower and then disappear by evaporation.

USEPA's CALPUFF dispersion model was used to evaluate cooling tower plume behavior and to estimate the frequency of occurrence and length of visible cooling tower plumes (Reference 5.3-002). The analysis of cooling tower plume behavior was performed under the assumption of full load operation, with maximum heat dissipation to the atmosphere. The maximum potential system heat rejection rate to the cooling towers is 7.63E09 Btu/hr per unit, which was assumed to be a bounding value for purposes of the analysis. The physical and operating characteristics of the cooling towers for each of the two banks of towers (that is, one bank of towers for each generating unit, LNP 1 and LNP 2) are as follows:

Number of cells	44
Orientation of cells	2x22
Length	362.8 m (1190 ft.)
Width	292.6 m (97 ft.)
Height	17.1 m (56 ft.)
Fan diameter	10.0 m (32.8 ft.) (per cell)
Circulating water flow rate	2,010,187 lpm (531,100 gpm)
Drift rate	0.0005 percent
Cycles of Concentration	1.5 (normal operation
Cycles of Concentration	2.0 (short-term excursions)
Heat rejection rate	7.63E09 Btu/hr

The analysis of cooling tower plume behavior was performed using 1 year of hourly surface meteorological data (2003) from the Gainesville, Florida, observing station. The results of the analysis indicate that visible plumes from the LNP cooling towers will remain very close to the cooling towers, primarily on-site and within approximately 100 m (328 ft.) of the cooling towers under most meteorological conditions. Visible vapor plumes greater than 1000 m (3280 ft.) in length (the approximate distance to the nearest property boundary) are predicted to occur less than approximately 2 percent of the time (less than 1 percent during daylight hours). The vertical rise of visible vapor plumes is predicted to be less than 200 m (656 ft.) above the cooling towers more than 98 percent of the time (99 percent during daylight hours). Based on this analysis, the expected frequency of occurrence of visible cooling tower plumes that will leave the property or that will be visible from off-site locations is expected to be very small. The nearest public road (US-19) is approximately 1400 m (0.9 mi.) to the west of the nearest cooling tower bank, and there are no predicted occurrences of fogging or icing at distances of more than 1000 m (3280 ft.) from the cooling towers. Additional detail on the results of the analysis of cooling tower plume behavior is provided in ER Subsection 5.8.1.3.

The nearest airport is the Crystal River Airport, which is a small municipal Airport located approximately 22.5 km (14 mi.) south of the LNP site. The operation of the cooling towers for LNP 1 and LNP 2 is neither expected to affect operations at this or any other airport, nor is the operation of the towers expected to result in an air traffic safety hazard at any location.

The design of the cooling towers minimizes tower visibility and improves plume dissipation. The additional water and heat released to the atmosphere by the cooling tower plumes is expected to have a SMALL impact on the local environment, and no mitigation is required.

5.3.3.1.2 Ground-Level Fogging and Icing

An analysis of cooling tower fogging and icing was also performed using USEPA's CALPUFF model as described in ER Subsection 5.3.3.1.1. The results indicated that there were no predicted occurrences of ground level fogging or icing beyond 1000 m (3280 ft.) of the cooling towers (that is, the approximate distance to the nearest property boundary). Since the nearest roadway (US-19) is located approximately 1400 m (0.9 mi.) (at its closest point) from the cooling towers, no instances of ground level fogging or icing are expected on any roadway as a result of the operation of the LNP cooling towers.

The impacts attributable to fogging and icing as a result of the operation of the LNP cooling towers are expected to be SMALL and no mitigation is required.

5.3.3.1.3 Solids Deposition

A very small fraction of the water circulating through the LNP 1 and LNP 2 cooling towers will be carried into the cooling tower plumes as small water droplets. These water droplets, referred to as "cooling tower drift" (typically defined as kilograms [kg] of water per second leaving the tower top divided by the kg of water per second circulating through the tower heat exchange section) would not exceed 0.0005 percent for the LNP cooling towers. Because modern cooling towers have almost no drift losses, this is not considered to be a critical design parameter. Site wind velocities and direction have been considered in designing the mechanical draft cooling towers and their orientation on the site to minimize any recirculation of air and vapor exiting the towers and to provide adequate cooling capacity should any recirculation occur.

Water droplets emitted from the cooling towers (as cooling tower "drift") will contain the same concentration of dissolved and suspended solids as the water within the cooling tower basin that is circulated through the towers. The dissolved and suspended solid concentrations in the cooling tower basins will be controlled through use of the makeup and blowdown water lines from the CFBC. Because the cooling water that will be pumped from the CFBC will be from the estuarine portions of the nearshore Gulf, the total dissolved solids of the makeup water is expected to be in the range of 25,000 parts per million (ppm) during normal operating conditions.

The estimated amount of dissolved solids that could potentially escape from the cooling towers in drift from the LNP cooling towers (for both LNP 1 and LNP 2 operating simultaneously) is estimated to be 115.7 pounds per hour (lb/hr) during normal operation and 154.26 (lb/hr) for short-term excursions (as total particulate). This amount of material could be released and dispersed over the area surrounding the LNP site once both units become fully operational. A description of the results of an analysis of cooling tower plume drift and deposition is provided in Subsection 5.3.3.2.1.

Given the relatively large distances from the cooling towers to the LNP site boundaries, it is expected that the deposition solids from the cooling towers at off-site locations will be SMALL and no mitigation is required.

5.3.3.1.4 Cloud Shadowing and Additional Precipitation

Although there will be visible plumes during some periods of operation of the proposed LNP site, adverse effects attributable to cloud shadowing or additional precipitation are not expected to be significant. Given the large distance to the LNP site boundary and the low profile of the mechanical draft cooling towers, the cooling tower plumes are not expected to be visible except on rare occasions from off-site locations. The impacts of cloud shadowing or additional precipitation are, therefore, expected to be SMALL and no mitigation is required.

5.3.3.1.5 Interaction with Existing Pollution Sources

No synergistic effects of cooling tower plumes mixing with plant radiological (see ER Section 5.4) or any other releases (see ER Subsection 5.5.1.3) are expected to occur. Any gaseous effluents released from the plant during operation would be at a different elevation or at a location well removed from the cooling towers. Any such releases would also be at or near ambient temperature, and no significant plume rise from those releases would occur. The potential for the mixing of the plumes is expected to be minimal and at different locations from where any water droplets in the cooling tower plume would still be present.

Interactions with other sources of air pollution are expected to be SMALL and no mitigation is required.

5.3.3.1.6 Ground-Level Humidity Increase

No discernible increase in atmospheric humidity at off-site locations is expected as a result of the operation of the LNP. No mitigation is required.

5.3.3.2 Terrestrial Ecosystems

The heat dissipation system proposed for the LNP site has only a very small potential to have any discernible impact on local terrestrial plants and animals. The operation of the LNP cooling towers will result in relatively small amounts of salt and particle drift from the tower and very limited occurrences of visible vapor plumes at off-site locations. No occurrences of fogging or icing are expected at any off-site locations. The potential for local precipitation modification is considered to be almost nonexistent. While there will be an increase in noise in the immediate vicinity of the cooling towers and the cooling water intake system, noise impacts are expected to be minimal, with mobile organisms avoiding high noise environments. Refer to ER Subsection 5.1.1.1 and the Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Plants prepared by the U.S. Nuclear Regulatory Commission (NRC) for further discussion on impacts.

The operation of the LNP cooling towers is not expected to have a significant or adverse impact on any terrestrial species from the presence of vapor plumes, the small amount of cooling tower drift and solids deposition, or plume fogging or icing. The impacts are expected to be SMALL, and no mitigation is required.

5.3.3.2.1 Salt Drift

Cooling tower drift, as discussed above, normally contains small amounts of solids that can ultimately deposit at ground level. A deposition analysis was performed to assess the rate of deposition to the surface in the area surrounding the plant site. The analysis was performed using USEPA's AERMOD dispersion model (Reference 5.3-003) and 5 years (2001 through 2005) of hourly meteorological data (Gainesville surface and Jacksonville upper air observations). The analysis resulted in a maximum predicted off-site deposition rate (during normal plant operation) of 6.81 kilogram per hectare per month (kg/ha/mo) (6.13 pounds per acre per month [lb/ac/mo]) of total solids at a location due west of the cooling towers at the nearest property boundary. Even assuming that all of the solids contained in the cooling tower drift are salts, this rate is below the threshold limit of 10 kg/ha/mo (9 lb/ac/mo) as provided in NUREG-1555, which is a threshold above which an adverse impact on vegetation could occur. The predicted off-site deposition impacts were also predicted to decrease significantly with increasing distance from the plant, with the maximum predicted deposition rate decreasing to approximately one-third of the maximum off-site value with an increasing distance of 1000 m (3280 ft.) from the site boundary. The maximum predicted on-site deposition (during normal plant operation) is 10.75 kg/ha/mo (9.68 lb/ac/mo).

It is noted that a comprehensive salt drift deposition study was conducted at the nearby CREC to evaluate the physical impacts of salt deposition from that facility's natural and mechanical draft cooling towers on vegetation surrounding the CREC. This long-term study was conducted from 1981 through 1995 as a condition of the facility's NPDES and Prevention of Significant Deterioration (PSD) permits. The results of the study demonstrated that there were no significant impacts to vegetation in the area surrounding the plant resulting from cooling tower operation and in 1995 FDEP was petitioned to approve termination of the study. In March of 1996, FDEP concluded that there were no significant impacts to vegetation due to salt drift from the plant and authorized facility to discontinue the study.

Impacts on vegetation attributable to salt drift emissions from the proposed cooling tower plumes at the LNP site are expected to be SMALL, and increases in soil salinity are anticipated to be minimal. No mitigation is required.

5.3.3.2.2 Vapor Plumes and Icing

As discussed in ER Subsection 5.3.3.1.1, there will be visible plumes resulting from the operation of the LNP cooling towers. As discussed in ER Subsection 5.3.3.1.2, there could also be icing impacts in the immediate vicinity of the cooling tower, but none are expected at any off-site locations.

The impact of cooling tower plumes on terrestrial ecosystems is expected to be SMALL, and no mitigation is required.

5.3.3.2.3 Precipitation Modifications

As discussed in ER Subsection 5.3.3.1.4, no significant increase in local precipitation is expected to occur as a result of cooling tower operation at the LNP site. Any additional precipitation will be small in comparison with the average rainfall in the region, which has been shown to range from 114 centimeters (cm) (45 in.) to 160 cm (63 in.) (refer to Table 2.7-2).

The operation of the LNP cooling towers is not expected to result in a significant increase in precipitation, its impacts are anticipated to be SMALL, and no mitigation is required.

5.3.4 IMPACTS ON MEMBERS OF THE PUBLIC

This subsection describes the potential human health impacts associated with the cooling system proposed for the new LNP units, specifically, potential impacts on human health from thermophilic microorganisms from the aerosolization of waterborne pathogens, and the potential impacts of noise generated by the cooling towers on humans residing outside the property boundary. Because the LNP closed-cycle cooling system will use mechanical draft cooling towers, most of the thermal discharge, and most of the thermophilic organisms, if any, will be released in the lower reaches of the local atmosphere and are not expected to move beyond the site boundary.

5.3.4.1 Thermophilic Microorganism Impacts

Microorganisms associated with cooling towers and thermal discharges can impair human health. These organisms are called thermophilic organisms, because their presence and numbers can be increased by the addition of heat to their habitats. Thermophilic organisms with the potential to affect human health include *Salmonella sp.*, *Shigella sp.*, *Legionella sp.*, *Naegleria sp.* (particularly *Naegleria fowleri*) and *Acanthamoeba sp.*

Salmonella and *Shigella* are enteric (digestive system) pathogens and must be ingested to produce symptoms. Other microorganisms normally present in surface water include the bacteria *Legionella sp.*, which is manifested as Legionnaires' disease, so named for the first documented cases at a Legionnaires' convention in Philadelphia some years ago and traced in improperly cleaned air conditioning systems, and the free-living amoebae of the