6.0 EFFECTS OF PLANT OPERATION

6.1 Effects of the Operation of the Heat Dissipation System

Since there will be no point source discharge of industrial wastewater, or stormwater associated with industrial activities, to surface waters of the U.S., the Project does not require a 316(a) or 316(b) Demonstration under the Clean Water Act (CWA) (see Appendix 10.2.1). Furthermore, as discussed below, there will be no adverse impacts to surface water resources from operation of the heat dissipation system.

6.1.1 Temperature Effect on Receiving Body of Water

The circulating water system for Units 6 & 7 will use closed-cycle, wet cooling systems with mechanical draft cooling towers for heat dissipation. Reclaimed water will be provided from the MDWASD South District Wastewater Treatment Plant for makeup water to the circulating water system. When reclaimed water is not available in sufficient quantity or quality, makeup water will be obtained from radial collector wells. The radial collector wells will withdraw saltwater through laterals installed approximately 40 ft below the bottom of Biscayne Bay. The wells will be recharged over a large area, at low velocities, by saltwater from Biscayne Bay.

The service water system for Units 6 & 7 will use closed-cycle, wet cooling systems with mechanical draft cooling towers for heat dissipation. The makeup water source for the service water system is potable water from MDWASD.

Cooling tower blowdown and other wastewater streams will be collected in a common blowdown sump and injected, using deep injection wells, to the Boulder Zone. The deep injection wells will meet the requirements established by the FDEP Underground Injection Control (UIC) program permit. Consequently, there will be no heated effluent discharged to surface waters and no thermal mixing zones are requested. Furthermore, there will be no adverse thermal effects on groundwater resources from injection of wastewater effluent to the Boulder Zone through the deep injection wells.

Biscayne Bay is a large, relatively shallow estuary or tidal lagoon that has limited freshwater inflow and is well-connected to the Atlantic Ocean. In addition, Miami has wind speeds that average about nine miles per hour with the prevailing direction from the southeast (see Subsection 3.5.7). Given all these factors, Biscayne Bay should be vertically well-mixed in most locations most of the time.

Therefore, the recharge from Biscayne Bay that is induced by the radial collector wells will have no adverse impact on the water temperatures in Biscayne Bay.

6.1.2 Effects on Aquatic Life

No adverse effects to aquatic life are expected from the operation of the radial collector wells. As discussed in Subsection 6.1.3, the recharge velocity through the bottom of Biscayne Bay in the area of the radial collector wells is estimated to be less than 0.00001 foot per second (ft/sec). This extremely low velocity will not result in any adverse impacts to aquatic life near the radial collector wells or anywhere else in Biscayne Bay. As discussed in Subsection 6.1.1, there will be no changes to surface water temperature resulting from the heat dissipation system for Units 6 & 7. Therefore, there will be no thermal effects on aquatic life.

6.1.3 Biological Effects of Modified Circulation

The use of reclaimed water will not impact the natural circulation of any surface water body. Therefore, the potential for biological effects from modified circulation can exist only when the radial collector wells are operating. The most significant potential impact to biota from operating the radial collector wells would be a change in the salinity regime of the bay. As discussed below, the analysis of the radial collector wells shows that the potential effects of the withdrawal on the circulation and natural salinity within Biscayne Bay will not have an adverse impact on aquatic systems. The predicted highly localized salinity changes are well within the natural ranges experienced by aquatic life in Biscayne Bay. Furthermore, the predicted withdrawal velocity at the sediment/water interface is extremely small, and it will not result in any impingement or entrainment effects.

6.1.3.1 Salinity Impact Analysis

The salinity of Biscayne Bay in the area of Turkey Point is predominately mixoeuhaline [30 to 40 ppt] with excursions into polyhaline (18 to 30 ppt) conditions following wet periods when there is significant freshwater inflow from water management canals draining inland areas. Based on data presented by Langevin (Ground Water, Vol. 41, No. 6, November–December 2003, pages 758–771, Figure 8), freshwater inflow to Biscayne Bay (groundwater plus surface water) averages approximately four million cubic meters per day (140 million ft^3/day). According to Langevin, submarine groundwater discharge to Biscayne Bay is only about 10 percent of the surface water discharge, and most of the groundwater discharge is in the northern half of Biscayne Bay, north of Structure S-123 (a SFWMD spillway). During dry periods, freshwater inflow is less than 1.5 million cubic meters per day (< 53 million ft^3/day). During wet periods, the freshwater inflow can exceed 8 to 10 million cubic meters per day (280 to 350 million ft^3/day). According to NOAA, the mean tide range at Turkey Point is 1.65 ft

A mixing chamber model (also referred to as a control volume analysis), was used to evaluate the potential impacts of the radial collector wells on the salinity regime of Biscayne Bay. The model is based on continuity of flow (including tidal flow), conservation of mass (i.e., conservation of solute or dissolved solids), steady-state conditions and uniform salinity concentrations within the specified control volume or mixing chamber. Using the data discussed above, the model was first calibrated to several salinity conditions by adjusting the model tidal exchange coefficient. Then, the model was run with the radial collector wells operating and the change in salinity induced by the radial collector well withdrawal was determined. The model was run for two specified control volumes (i.e., two scenarios): Scenario 1 used a control volume based on a surface area of one square mile. Scenario 2 used a control volume based on a surface area of four square miles. The model control volumes are shown in Figure 6.1.3-1 to illustrate the areas considered in this analysis relative to the Turkey Point peninsula where the radial collector wells will be located. While the area of the control volume is important to the calculation, the exact shape of the control volume is not important.

The average salinity in Biscayne Bay near the Turkey Point peninsula is approximately 34 ppt. During wet periods, the salinity in the bay is typically below average; during dry periods, the salinity in the bay is typically above average. The mixing chamber modeling results show that near the radial collector wells the water withdrawal will have a slight moderating effect on the salinity regime in the bay. During the wet periods, the salinity near the radial collector wells will not be quite as low when the wells are operating. During the dry periods, the salinity near the radial collector wells will not be as high when the wells are operating. When the bay is near its average salinity, the radial collector wells will have no measurable effect. This moderating effect will be small near the wells and undetectable one mile from the center of pumping, or in any other part of Biscayne Bay.

To illustrate this conclusion, salinity data from Biscayne Bay (Station BB41) was used to establish a salinity time history and probability distribution in the area of Turkey Point. Station BB41 is the closest station to the Turkey Point power plant with a long period of record (212 sampling events over 24 years, from 3/20/1979 to 3/5/2003). The station is located approximately three to four miles northeast of the power plant. The data set was obtained from the SFWMD DBHYDRO database. Figure 6.1.3-2 shows the salinity time history and Figure 6.1.3-3 shows the salinity cumulative probability distribution. The black lines show the historical salinity in Biscayne Bay (i.e., salinity without the radial collector wells). The blue lines (Scenario 1 from the mixing chamber model) show the average salinity within approximately one-half mile of the center of the collection area, with the radial collector wells operating at maximum capacity. The green lines (Scenario 2) show the average salinity within approximately one mile of the center of the collection area with the radial collector wells operating at maximum capacity. At one mile, there is no measurable impact from operating the radial collector wells. This is illustrated by the fact that the green line is almost completely covered by the black line in both figures. Near the average salinity (34 ppt), both lines are covered by the black line. This shows that the average salinity is not significantly changed by operation of the radial collector wells.

6.1.3.2 Induced Velocity at the Seabed

The groundwater recharge from Biscayne Bay, which is induced by the radial collector well withdrawals, should have no impact on impingement or entrainment of aquatic organisms. Based on the conceptual radial well design and the groundwater modeling of the radial collector wells, the flow will be recharged through at least 20,000,000 square feet of the bay bottom. Therefore, the recharge velocity at the bottom will be less than 0.00001 ft/sec. To put this in perspective, a one-foot wind wave on Biscayne Bay in five to six feet of water can induce a velocity of approximately one foot per second near the bottom.

6.1.3.3 Wetland Impacts from Radial Collector Wells

No adverse impacts to wetlands are predicted from the operation of the radial collector wells. Within the potential area of influence of the radial collector wells, the mangrove wetlands are found seaward of the high water shoreline. As a result, they are inundated from the bay about twice a day. Therefore, potentiometric elevation reductions (i.e., drawdowns) within the surficial aquifer caused by operation of the radial collector wells will not adversely affect wetlands.

6.1.4 Effects of Off-Stream Cooling

The potential impacts of off-stream cooling using the circulating water cooling towers were addressed by performing plume dispersion analyses that predicted impacts with respect to:

- Plume length;
- Plume height;

- Plume fogging;
- Plume icing; and
- Salt (from TDS) deposition.

Two air quality dispersion models were used in these analyses to address the effects of off-stream cooling for the Project. These models are the California Puff (CALPUFF) model and the American Meteorological Society and EPA Regulatory Model (AERMOD) dispersion model.

The CALPUFF model (version 5.8) was used to determine the fogging and icing potential due to the cooling towers. The CALPUFF model can be configured to analyze the fogging and icing impacts due to emissions from sources, such as the cooling towers, with the use of a pre-processor program called the Cooling Tower Emissions Processor (CTEMISS) and post-processor programs.

The AERMOD dispersion model (version 07026) was used to determine potential mineral deposition due to the cooling towers.

Both air dispersion models were also used to predict ambient pollutant concentrations for the Project and are described in more detail in Subsection 6.6 and Appendix 10.2.5. These dispersion models are approved by EPA for determining ambient air pollutant concentrations and have capabilities to assess fogging impacts (CALPUFF) and solids deposition (AERMOD).

The following sections present the methods and assumptions used in these models to address the effects of off-stream cooling due to the cooling towers.

6.1.4.1 Cooling Tower Visibility

The visible plume from a cooling tower is a result of the mixing of the saturated exhausts from the cooling tower with the ambient air, and the resultant mixture is beyond the atmosphere's ability to accommodate the entrained moisture as a gas. At this point, the moisture in the mixture condenses and forms a visible water vapor plume. The ability for air to accommodate water as a gas depends on the temperature and barometric pressure. For example, at an ambient temperature of 90°F, the air is capable of accommodating almost six times more water vapor (as mass) than at 40°F. With the circulating water cooling towers proposed for Units 6 & 7, plumes are typically more visible and at greater plume lengths during the winter months than during the summer.

The CTEMISS program was used to create a variable emission rate file for CALPUFF for water vapor within the plume from the cooling towers. The CTEMISS program reads fixed inputs, such as emissions characteristics (exit velocity, exit temperature, and water emission rate) and building data. Meteorological data in the format used by the Industrial Source Complex Short-term (ISCST) model are used. CALPUFF models the dispersion of the water contained in the plume and provides cloud information in a specialized format for further analysis. CALPUFF output is provided to the FOG.DAT file and can be run in either 'plume mode' or 'receptor mode.'

Five years of surface meteorological data from MIA for 2001 through 2005 were used in the CTEMISS program. The surface and mixing height data were first processed using EPA's PCRAMMET processor to create ISCST model-compatible meteorological data, which are read by the CTEMISS program. The meteorological data for MIA are the same data approved by FDEP for determining air pollutant concentrations using these models.

The stack data and meteorological data used to determine potential fogging and icing impacts are identical to those used in the air dispersion modeling and presented in Subsection 6.6.

The emission rate file created by the CTEMISS program was used and the CALPUFF model was run in both plume and receptor modes. The CALPUFF model created a FOG.DAT file, which was then input to the post-processor programs, POSTPM and SUMPOST, which operate on the fog plume-mode output to characterize visible plume height and length statistics. The post-processor program POSTRM operates on the fog receptor-mode output to characterize the frequency of possible fogging and icing events at specific locations.

In the plume mode, information on the plume heights and plume lengths are generated for each hour. The program provides output that excludes hours when fog, clouds, and/or precipitation are occurring. In the receptor mode, discrete receptors are located in a receptor grid covering the Plant Site and adjacent areas.

The CALPUFF model's plume mode results are presented in Table 6.1.4-1 for all hours and daylight hours, except those when fog, heavy cloud conditions, and/or precipitation are occurring. In such meteorological conditions, visible vapor plumes are obscured by natural weather conditions. This table presents the information seasonally and annually. The primary factors in the visible appearance of the plume are the height and length of the plume.

Visible vapor plumes are predicted to occur about 1,723 hours per year (hr/yr) or about 20 percent of the year. Visible vapor plumes are predicted to occur during the winter nearly twice as much (718 hours) as the spring (387 hours) and fall (388 hours). Only about 13 percent (230 hours) of the total hours with visible vapor plumes occur during the summer. During daylight hours, visible vapor plumes are predicted to occur for 584 hr/yr or only about seven percent of the time. Visible vapor plumes during daylight hours are predicted to occur at a higher frequency during the winter (213 hours) than other seasons.

Visible vapor plumes from the circulating water cooling towers are predicted to remain close to each of the towers during the daylight, when the plumes would be most visible. The results for daylight hours indicate that, for the majority of the time, plume heights will be less than 400 meters and plume lengths will be less than 300 meters. As shown in Table 6.1.4-1 for daylight hours, plume heights greater than 1,000 meters are predicted to occur only one hour per year, while plume lengths in excess of 5,000 meters are predicted to occur only 40 hours per year.

The model predicts that no surface fogging or icing events will occur. Neither ground-level fogging nor any other plume effect is predicted to occur on the nearest roadways to the Site and within the BNP.

6.1.4.2 Cooling Tower Deposition

Deposition from the circulating water cooling towers will depend upon the quality of water used as makeup to replace the water evaporated through cooling and the cycles of concentration within the circulating water system. Two sources of makeup water are proposed as makeup to the circulating water cooling towers. One source will be reclaimed water from the MDWASD South District Wastewater Treatment Plant, conveyed via pipeline to an FPL reclaimed water treatment facility on the Turkey Point plant property. The FPL reclaimed water treatment facility will further treat the reclaimed water for use in the cooling system. The estimated TDS for treated reclaimed water in the circulating water is assumed to be 4,000 ppmw. The second source for makeup water will consist of radial collector wells that are recharged with saltwater from Biscayne Bay. Salinities of the water from the radial collector wells will vary depending upon the season. Although a TDS concentration in the circulating water may be as high as 65,000 ppmw for short periods as described in Subsection 4.4, the long-term average concentration will be lower. Therefore, a TDS concentration in the circulating water of 50,000 ppmw and five years of meteorological data was used to conservatively represent deposition from cooling tower drift.

The estimated drift emission spectrum for the Units 6 & 7 cooling towers is presented in Table 6.1.4-2. The predicted deposition was based on the TDS in the circulating water of 50,000 ppm using water from the radial collector wells. This represents a conservative TDS in the circulating water and envelops the potential cooling tower deposition impacts. Reclaimed water will have lower TDS concentrations and result in much lower quantities of cooling tower drift. The TDS concentration using treated reclaimed water would be about ten times lower than when using the radial collector wells as a makeup water source. Since the rate of cooling tower drift is directly proportional to the TDS concentration in the circulating water, the deposition using water from the radial collector wells would be many times higher than the maximum predicted deposition using treated reclaimed water.

The maximum monthly deposition predicted from the cooling towers to locations at varying distances is presented in Table 6.1.4-3**.** The table shows the monthly deposition over the five-year period for which the analysis was performed. The average predicted deposition of an area within a radius of five km from the circulating water cooling towers and the maximum predicted salt deposition over several distances are presented in Table 6.1.4-3**.** The spatial distribution of the predicted monthly average salt deposition is presented in Figure 6.1.4-1.

The monthly deposition rate from the cooling towers averaged over an area within five km of the cooling towers is approximately five kilograms per hectare per month (kg/ha/month). The maximum predicted monthly deposition rate of 272 kg/ha/month occurs on-Site at the perimeter of the makeup water reservoir that surrounds the cooling towers. Beyond the reservoir, the deposition rates are predicted to decrease rapidly. At a distance of 500 meters from the towers, the maximum predicted monthly deposition rate is 80 kg/ha/month and occurs to the southwest of the cooling towers over the existing industrial wastewater facility. At a distance of 1,000 meters, the maximum monthly deposition rate decreases to 25 kg/ha/month. At the nearest Turkey Point plant property boundary south of the Site, the maximum deposition rate is approximately 65 kg/ha/month. The deposition rate decreases to 20 kg/ha/month at about 600 meters south of the Site.

Southern Florida has a subtropical climate influenced by the trade winds coming from the Atlantic Ocean. As a result, there is a natural background of salt deposition. Several studies have been conducted to determine deposition, including the Florida Acid Deposition Study (FADS) that conducted studies in the mid-1980s and the Florida Atmospheric Mercury Study (FAMS) that conducted studies in the mid-1990s. FADS measured major anions and cations in dry and wet deposition, while FAMS measured the major anions and cations in wet deposition. According to data collected as part of FADS (1986), which measured deposition over many locations in Florida, background mineral deposition in southern Florida ranges from approximately four to six kg/ha/month. The maximum predicted deposition within three km of the circulating water cooling towers, as shown in Table 6.1.4-3, is about equal to the background deposition.

Studies of coastal vegetation in other parts of the country have shown that natural deposition levels experienced in highly exposed beach-dune areas range from 1,680 to 4,500 kg/ha/yr (140 to 375 kg/ha/month) areas (Van der Valk, 1974; Fletcher, 1975; Profitt, 1977). In the less-exposed areas supporting maritime forest and coastal hammock vegetation, levels of 150 to 400 kg/ha/yr (12.5 to33.3 kg/ha/month) have been measured (Art, 1971; Van der Valk, 1974; Fletcher, 1975; Profitt, 1977). BTI data (1954) indicate that the natural loads for these dune and forest communities may actually be as high as 500 to 1,000 grams per square meter per year ($g/m^2/yr$) (417 to 833 kg/ha/month), respectively. The BTI data also indicate that normal leaf chloride concentration in exposed leaves of the salt-tolerant marsh-elder (*Iva imbricata*) may reach 75,000 micrograms per gram dry weight (µg/gdw), while threshold toxicity levels approach 200,000 µg/gdw. Normal values in live oak (*Quercus virginiana*) and yaupon holly (*Ilex vomitoria*) reach 16,000 and 50,000, with toxic levels at about 150,000 µg/gdw.

Potential impacts to vegetation may occur from deposition of salt from cooling tower drift. Vegetation may be affected by absorption of salts that accumulate in the soil as well as foliar deposition. Accumulation in soil will occur if the annual deposition rate of salt exceeds the rate at which salt is leached from the soil by rainfall. It is difficult to predict which plant species would be most affected by soil salinity, as tolerance to salt spray does not necessarily parallel known plant tolerances to soil salinity, but the tolerance to salt is governed by the rate of foliar absorption (Grattan et al., 1981). However, the vegetation surrounding the Site is dominated by coastal mangroves, specifically the salt-tolerant red mangrove (*Rhizophora mangle*), which has developed physiological characteristics to allow the plants to survive in highly saline soils and areas of salt spray. *Rhizophora* plants can sustain salinities up to two times concentrated seawater (Mallery and Teas, 1984).

The two major deleterious effects of salinity on plants are reduced water uptake attributed to high salt content in soil and a toxic effect of sodium and chloride ions, which can inhibit enzyme activity, interfere with protein synthesis, and alter respiration rates (McKee, 1996). Mangroves exhibit strategies for tolerance of salinity stress, including exclusion of salts by the plant roots, excretion of salts from salt glands in the leaves, dilution of salts by increased water content in leaf tissues, elimination of salt-saturated organs, compartmentalization of salts in the vacuole (which removes toxic ions from metabolically active portions of the cell), and synthesis of organic solutes to balance inorganic ions in the vacuoles (McKee, 1996). Due to the mangroves' ability to tolerate elevated salinity, they are often found in monocultures in areas that are uninhabitable by freshwater and/or terrestrial vegetation.

Based on the above, no adverse impacts to the existing salt-tolerant vegetative communities adjacent to the circulating water cooling towers from salt drift are expected.

The cooling canals and other nearby canals and wetlands have been included within the designated critical habitat for the American crocodile. The water in the cooling canals is hypersaline, with salinity concentrations between 1.5 and 2 times the salinity of Biscayne Bay. This level of salinity does not adversely impact adult crocodiles but could adversely impact hatchling and juvenile crocodiles if no freshwater refugia were present. Hatchlings and juvenile crocodiles have underdeveloped osmoregulatory capabilities and need fresh to brackish water at least once per week to maintain normal growth rates. FPL's crocodile management program collects hatchling crocodiles and transfers them to freshwater refugia constructed by FPL, many on the tops of the existing cooling canal system berms (see also Threatened and Endangered Species Evaluation and Management Plan in Appendix 10.7.1.3). These refugia are primarily located in the central and southern portions of the existing industrial wastewater facility where the maximum predicted deposition from the circulating water cooling towers is at or near background deposition rates when saltwater is used as makeup to the circulating cooling system (see Figure 6.1.4-1). In addition, the maximum predicted deposition rate in the industrial wastewater treatment facility within one km of the circulating water cooling towers ranges from 40 to 80 kg/ha/month (see Figure 6.1.4-1). On an annual basis, this range in deposition rates would increase salinity ranging from about 0.03 to 0.06 ppt. This range in salinity concentration is about three orders of magnitude lower than the salinity in the existing industrial wastewater facility.

There will be no adverse potential impact of salt drift on the American crocodiles within the existing industrial wastewater facility. A population of crocodiles occurs at hypersaline Lake Enriquillo in the Dominican Republic, where salinity varies between 33 and 100 ppt (Buck et al., 2005), with the higher salinities being much greater than the salinity with the Turkey Point industrial wastewater facility. Salt contributions from cooling tower deposition in other areas of the existing industrial wastewater facility are much lower as evidenced in Figure 6.1.4-1. Salt deposited within the existing industrial wastewater facility will be circulated within the system and subsequently combined with much higher salinity water. Crocodile nesting occurs on well-drained berms approximately 25 to 30 meters wide located between canals. As indicated by the deposition analysis, the maximum deposition will not impact nesting conditions on the berms and will not result in abandonment of any of the important nesting areas currently providing nesting habitat. The berms contain constructed freshwater ponds that provide important freshwater refugia for hatchling crocodiles. Frequent summer rains form a brackish water lens on the surface of the cooling canals, and the freshwater ponds constructed on berms between canals also provide a perennial source of fresh water. The predicted deposition will not measurably increase salinity in cooling canals and will not affect the conditions within these freshwater refugia areas.

6.1.5 Measurement Program

Since the radial collector wells will be a secondary cooling water source for Units 6 & 7, the monitoring frequency of that system will be dependent upon system operation. During operation, the volume of water pumped from the radial collector well caissons and the water elevation in the operating caissons will be recorded. The radial collector well water will also be monitored for temperature, conductivity (salinity) and TDS. During operation, the surface water and groundwater monitoring locations established during pre-application monitoring will also be monitored. Surface water elevation will be measured within the return canal of the industrial wastewater facility and in the area of the Turkey Point barge slip. Field measurements of water elevation, conductivity (salinity) and temperature will be collected. Groundwater will be monitored at monitoring wells adjacent to the collector wells and along the shoreline to collect field measurements of water elevation, conductivity (salinity) and temperature.

Because there are no anticipated adverse ecological impacts from operation of the Units 6 & 7 heat dissipation system, no biological monitoring is proposed.

6.2 Effects of Chemical and Biocide Discharges

6.2.1 Industrial Wastewater Discharges

Wastewaters associated with Units 6 & 7 were identified in Subsection 4.6 and delineated in Table 4.6.0-1. Table 4.6.0-1 presents wastestreams, their characterization, and disposal method. All non-hazardous industrial wastewater, including process wastewaters and cooling tower blowdown, will be combined and discharged through the deep injection wells into the Boulder Zone of the lower Floridan Aquifer. Stormwater runoff from the Site will be released to the existing industrial wastewater facility. The rate of stormwater runoff from the Site will be approximately the same as it is today. Consequently, there will be no change in water quality within the industrial wastewater facility from the operation of Units 6 & 7, and no change to the cooling canal habitat utilized by the American crocodile.

Since there will be no industrial wastewater released to surface waters and Site stormwater runoff will be released to the existing industrial wastewater facility, there will be no impact to surface water quality from the operation of Units 6 & 7.

6.2.2 Deep Injection Wells Impact Analysis

6.2.2.1 Introduction

This section provides a preliminary analysis of the potential for impacts from the deep injection wells, pending results from the UIC exploratory well, for which FPL has submitted an application to FDEP. The results of this preliminary analysis provide reasonable assurance that injection of wastewater into the Boulder Zone will not affect underground sources of drinking water (USDW).

All non-hazardous industrial wastewater streams (other than stormwater) that are not recycled, including process wastewaters and cooling tower blowdown, will be discharged via the deep injection wells. These wastestreams will be combined and discharged through the deep injection wells into the Boulder Zone of the lower Floridan Aquifer. The Units 6 & 7 deep injection wells are being developed under permits issued by FDEP for the federally delegated UIC Program. FPL has submitted an application for authorization to construct an exploratory well to determine site-specific stratigraphy, water quality profiles, potentiometric pressures, and important aquifer parameters. The Units 6 & 7 deep injection wells will be designed so that there is no impact to any USDW. The exploratory well permit application is provided in Appendix 10.2.8.

As discussed in Subsection 3.5, the circulating water system and the process water cooling system for Units 6 & 7 will use closed-cycle, wet cooling systems with circulating water cooling towers for heat dissipation. Reclaimed water will be provided from the MDWASD South District Wastewater Treatment Plant for makeup water to the circulating water system. When reclaimed water is not available in sufficient quantity or quality, makeup water will be obtained from radial collector wells.

The radial collector wells will withdraw saltwater, which will be slowly recharged from Biscayne Bay.

The two cooling water sources discussed above produce different quantities of wastewater, with different water quality characteristics. The deep injection well flow rates for the two water sources are provided in Tables 4.5-1 and 4.5-2, and the expected wastewater constituent concentrations are shown in Tables 4.6-2 and 4.6-3. The maximum flow to the deep injection wells for two units using 100 percent reclaimed water is 12,914 gpm (18.6 MGD). The maximum flow to the deep injection wells for two units using 100 percent saltwater is 58,922 gpm (84.8 MGD). Based on the Project requirements, there will be up to ten primary deep injection wells and two backup wells. Each well will be designed for a peak injection capacity of 18.6 MGD. However, it is anticipated that the deep injection wells will be operated at an injection rate of approximately ten MGD/well.

For the purpose of this analysis, the most important characteristics of the effluent are temperature and TDS, because these two parameters determine fluid density. The effluent temperature will vary seasonally. The maximum and minimum expected wastewater temperatures are 91 and 65ºF, respectively. The expected wastewater TDS when using reclaimed water is 2,721 mg/L (see Table 4.6-2). The wastewater TDS when using saltwater from the radial collector wells is 57,030 mg/L (see Table 4.6-3). Based on these values, the density of the effluent is estimated to range from 996.8 kg/m^3 (100-percent reclaimed water in the summer) to 1,042.2 kg/m^3 (100-percent saltwater in the winter). The ambient temperature and TDS concentration in the Boulder Zone, and for most of the confining unit below the USDW, are about 50ºF and 37,000 mg/L (see Subsection 3.3.2). Therefore, the density of the Boulder Zone fluid is estimated to be 1,028.5 kg/m^3. Consequently, the injection wells will operate under a wide range of buoyancy scenarios.

When the effluent density is greater than the injection zone fluid density, the plume will sink to the bottom of the injection zone, stratify, and move laterally along the bottom. Under this scenario, the probability of affecting a USDW is extremely unlikely because, at a given injection rate, pressures at the top of the injection zone will be lower than for any other scenario. In addition, if the effluent encounters a vertical pathway, it will tend to move downward away from any USDW. When the wastewater effluent and the injection zone fluid densities are about the same, the effluent will fill the injection zone and move laterally away from the well in a uniform manner. On the other hand, when the effluent density is less than the injection zone fluid density, the plume will be buoyant, stratify and move laterally along the top of the injection zone. This represents the bounding operational scenario because, at a given injection rate, pressures at the top of the injection zone will be maximum. The preliminary analysis presented below evaluates this scenario.

6.2.2.2 Geohydrologic Setting

In the area of the Site, the base of the USDW (defined by water with a TDS concentration less than 10,000 mg/L) is approximately 1,450 ft below land surface. This level is below the base of the Upper Floridan Aquifer and above the top of the Avon Park Permeable Zone. The top of the Boulder Zone (i.e., the injection zone) is anticipated to be approximately 2,900 ft below land surface. The Middle Confining Unit, which separates the USDW from the injection zone, is anticipated to be approximately 800 to 1,000 ft thick. Based on reported data from southeast Florida, the vertical hydraulic conductivity of this unit is anticipated to be between 2.0×10^{-5} ft/day and 2.0×10^{-2} ft/day (CH2MHill, 1988; CDM, 1987). A reasonable and conservative estimate, which was obtained by taking the geometric mean of values reported in the literature, is 2.3×10^{-3} ft/day. This equates to a leakance of 2.9×10^{-6} ft/day/ft (2.3×10^{-3} ft/day/800 ft). The thickness of the Boulder Zone in the area around the Site is estimated to be 200 ft (see Appendix 10.2.8); and the transmissivity is reported to be between 3.2×10^{6} ft^2/day and 24.6×10^{6} ft^2/day (Miller, 1978). The geology and geohydrology in the area of the Site are discussed in more detail in Subsections 3.3.1 and 3.3.2.

6.2.2.3 Approach

The first step in evaluating the potential impacts of injection on the USDW is to estimate the maximum formation pressure increase, at the maximum injection flow rate. The maximum formation pressure increase (approximately equivalent to the bottom hole pressure) is the pressure increase at the top of the Boulder Zone (i.e., the injection zone) at the injection wells. It is not the same as the injection wellhead pressure, which is measured near land surface. To determine the maximum formation pressure, the injection process is modeled as steady-state flow from a well into a leaky confined aquifer, with modifications to transmissivity to account for density stratified flow.

In step two, the maximum formation pressure increase is used to calculate the maximum vertical flow rate through the confining unit (i.e., the steady-state vertical flow rate, at the well, at the maximum injection rate). This flow rate is then used to calculate the maximum vertical displacement in the confining unit.

6.2.2.4 Injection Zone Pressure

The formula for pressure increase, under steady flow conditions near the wells (i.e., r / λ < 0.02), is given by Bear (*Hydraulics Of Groundwater*, 1979, pp. 313-315):

$$s(r) = \left[\frac{Q_w}{2\pi T}\right] K_0\left(\frac{r}{\lambda}\right) \qquad (1)$$

Where: K_0 is s modified Bessel function of the second kind order zero

$$\lambda = \sqrt{T/L} \qquad (1a)$$

s = the pressure increase (ft-H_2O)

r = the radius from the well (ft)

Q_w = the injection rate (ft^3/day)

T = transmissivity of the injection zone (ft^2/day)

L = leakance of the confining layer (ft/day/ft)

If the injection fluid is less dense than the formation fluid, the flow will stratify and the injection zone will be confined to the upper part of the Boulder Zone. Applying the Ghyben-Herzberg approximation (Bear, 1979, p. 384), the injection zone thickness (h_I) is given by:

$$\begin{Bmatrix} h_I = \delta * s(r) & \delta * s(r) \le B \\ h_I = B & \delta * s(r) > B \end{Bmatrix} \qquad (2a \text{ and } 2b)$$

$$Where: \quad \delta = \left[\gamma_{BZ} \big/ [\gamma_{BZ} - \gamma_I]\right] \qquad \gamma_I < \gamma_{BZ}$$

γ_{BZ} = *the specific weight of the Boulder Zone fluid*,

γ_I = *the specific weight of the injection fluid*,

B = *the maximum injection zone thickness (i.e., thickness of Boulder Zone).*

For this analysis, the maximum injection zone thickness (B) is the thickness of the Boulder Zone, which is estimated to be 200 ft. The injection zone transmissivity (T) is given by:

$$T = T_{BZ} * \left[h_I / B \right] \qquad (3)$$

$$Where: \quad T_{BZ} = the\ transmissivity\ of\ the\ Boulder\ Zone.$$

Substituting equations (2a), (2b) and (3) into equations (1) and (1a) gives the following equations:

$$\left.\begin{aligned} s(r) &= \sqrt{\left[\frac{Q_w\ B}{2\pi\ T_{BZ}\ \delta}\right] K_0\left(\frac{r}{\lambda}\right)} \\ h_I(r) &= \sqrt{\left[\frac{Q_w\ B\ \delta}{2\pi T_{BZ}}\right] K_0\left(\frac{r}{\lambda}\right)} \end{aligned}\right\} \quad h_I(r) = \delta * s(r) \leq B \qquad (4a\ and\ 4b)$$

$$\lambda(r) = \sqrt{\frac{T_{BZ}\ h_I(r)}{B\ L}} \qquad (4c)$$

Equations (4a), (4b), and (4c) are derived using the following procedure. First, substitute equation (2a) into equation (3) and then substitute the resulting equation for T into equation (1). After rearranging terms, this will give equation (4a). Next, substitute equation (2a) into equation (4a) and rearrange terms. This will produce equation (4b). Finally, substitute equation (3) into equation (1a) to derive equation (4c). These equations give the pressure increase, the injection thickness and the leakage factor as functions of the radius from the well, the injection rate, aquifer parameters, and fluid density differences. The injection zone pressure and injection zone thickness will be a maximum at the injection well ($r = r_w$), at the maximum injection rate ($Q_w = Q_w(\max)$). Substituting these variables into equations (4) give the following:

$$\left.\begin{aligned} s(\max) &= s(r_w) = \sqrt{\left[\frac{Q_w(\max)\ B}{2\pi\ T_{BZ}\ \ \delta}\right] K_0\left(\frac{r_w}{\lambda}\right)} \\ h_I(\max) &= h_I(r_w) = \sqrt{\left[\frac{Q_w(\max) B\ \delta}{2\pi T_{BZ}}\right] K_0\left(\frac{r_w}{\lambda}\right)} \end{aligned}\right\} h_I(r_w) = \delta * s(r_w) \leq B \qquad (5a\ and\ 5b)$$

$$\lambda(\max) = \lambda(r_w) = \sqrt{\frac{T_{BZ}\ h_I(r_w)}{B\ L}} \qquad (5c)$$

The above equations are implicit and are most easily solved numerically. They can be solved quickly using the following procedure and the Solver tool or the Goal Seek tool in a Microsoft™ Excel spreadsheet. First, make an initial guess at the value for $h_I(r_w)$. A good starting point is half the maximum injection zone thickness (B/2). Substitute this value into equation (5c), along with the other aquifer parameters, and calculate the leakage factor (λ). Substitute λ into equation (5b) and calculate an improved estimate of $h_I(r_w)$. The calculation error is the difference between the initial guess and the calculated value. Use the Solver or Goal Seek tools to make the error zero. If the final value for $h_I(r_w)$ is greater than B, make $h_I(r_w)$ equal to B and recalculate λ and s(max) using equations (5c) and (5a), respectively.

For the following conditions (Q=18.6 MGD, T=3.2×10^6 ft^2/day, L= 2.9×10^{-6} ft/day/ft, B=200 ft), the solution gives the following results at the injection well (r_w=1.0 ft):

Stratified Injection Zone Thickness = 105 ft
Maximum Formation Pressure = 3.2 ft-H_2O.

The stratified injection zone thickness and the maximum formation injection pressure are relatively insensitive to the leakance. For example, increasing the leakance by an order of magnitude, from L= 2.9×10^{-6} to L= 2.9×10^{-5}, gives the following results:

Stratified Injection Zone Thickness = 100 ft,
Maximum Formation Injection Pressure = 3.1 ft-H_2O.

6.2.2.5 Maximum Vertical Flow Rate and Vertical Displacement

The maximum vertical flow rate (i.e., vertical specific discharge or leakage) through the confining layer, which is induced by the injection well pressure increase, is given by the following formula based on Darcy's law (Bear, 1979, page 36):

$$q_V[ft/day] = \frac{K'(\phi_{ext} - \phi)}{B'} = L[ft/day/ft] * s(r_w)[ft] \qquad (6)$$

Where: ϕ_{ext} = *the head in the source aquifer,*
ϕ = *the head in the pumped aquifer,*
B' = *the thickness of the confining layer, and*
K' = *the vertical hydraulic conductivity of the confining layer.*

For a leakance value of 2.9×10^{-6} ft/day/ft and a maximum injection pressure of 3.2 ft, the maximum vertical flow rate is 9.3×10^{-6} ft/day, or 3.4×10^{-3} ft/year. If the leakance value is increased by an order of magnitude, the injection pressure drops to 3.1 ft-H_2O and the maximum vertical flow rate increases to 9.0×10^{-5} ft/day, or 3.3×10^{-2} ft/year.

The vertical velocity through the confining layer (V) is given by the following equation (Bear, 1979, page 63):

$$V[ft/day] = q_V[ft/day]/n_e \qquad (7)$$

$$Where: \quad n_e = the\ effective\ porosity\ of\ the\ confining\ unit.$$

Since the confining layer is composed of low-permeability fine-materials, the effective porosity (n_e) should be comparable to the specific yield for clay and silt (Bear, 1979, pp. 88 and 99). Therefore, to be reasonably conservative, this analysis uses an effective porosity of 10 percent. Under these conditions, the vertical velocity through the confining layer would be between 0.034 ft/year and 0.33 ft/yr. Consequently, if the injection wells were to operate for 100 years, the water in the confining unit, near the wells, would be displaced between 3.4 ft and 33 ft, or between 0.4 percent and 4 percent of the confining unit thickness. This analysis provides reasonable assurance that wastewater injected into the Boulder Zone will not affect any underground sources of drinking water.

6.2.3 Cooling Tower Blowdown

Cooling tower blowdown makes up the majority of wastewater (averaging about 78 percent or more), and it will be combined with other non-hazardous industrial wastewater streams prior to injection through the deep injection wells (refer to Tables 4.5.-1 and 4.5-2).

6.2.4 Measurement Programs

An aquifer monitoring program, including dual-zone monitoring wells, will be included as part of the Units 6 & 7 deep injection wells.

6.3 Impacts on Water Supplies

In general, the Project has three water demand requirements:

1. Makeup water to replace cooling tower evaporation and blowdown;
2. Process and service water; and
3. Potable water for use by employees.

A water-use diagram for Units 6 & 7 is presented in Subsection 4.5 of this SCA.

The sources for cooling tower makeup water associated with the circulating water system will be reclaimed water from MDWASD South District Wastewater Treatment Plant and saltwater obtained from the radial collector wells. Reclaimed water used by Units 6 & 7 will meet all of the relevant requirements of Chapter 62-610, F.A.C., including the requirements for cooling water applications found in Chapter 62-610.668, F.A.C. Potable water supplied by MDWASD will be used as process water and makeup to the service water system. Potable water for employees will be supplied by MDWASD.

6.3.1 Surface Water

Surface water resources in the area of the Site are discussed in Subsection 3.3.4 and Appendix 10.7. The reclaimed water used by Units 6 & 7 will meet all of the relevant requirements of Chapter 62-610, F.A.C., including the requirements for cooling water applications found in Rule 62-610.668, F.A.C. The radial collector wells will withdraw groundwater from a saltwater aquifer, which will be recharged from Biscayne Bay. The quality of water in Biscayne Bay overlying the radial collector wells is that of saltwater. Given the quality and abundance of saltwater, the use of the radial collector wells will not affect surface water supplies. Furthermore, as discussed in Subsection 6.1, the amount withdrawn will not significantly impact surface waters in Biscayne Bay. All industrial wastewater will be routed to the deep injection wells, and Site stormwater will be routed to the existing industrial wastewater facility. Consequently, there will be no industrial wastewater or stormwater associated with industrial activities discharged to surface waters of the state or to waters of the U.S. Therefore, no impacts to surface water supplies from the operation of Units 6 & 7 are expected.

6.3.2 Groundwater

Groundwater resources in the vicinity of the Site are described in Subsection 3.3.2 of the SCA and in Appendix 10.7. The radial collector wells will withdraw groundwater from a saltwater aquifer, which will be recharged by saltwater from Biscayne Bay at low velocities over a large area. All industrial wastewater streams will be routed to the deep injection wells. Therefore, no adverse impacts to USDW, other groundwater supplies, or the sole source Biscayne Aquifer are predicted.

6.3.3 Drinking Water

Potable water from MDWASD will be used for process, service, and potable water supplies, which require high-quality water. The amount used, which will average about 1.35 MGD, is less than 2.3 percent of the total water demand using reclaimed water or saltwater. While new pipelines will be required (see Section D9.0), this amount can be accommodated by the MDWASD potable system and no adverse impact to the drinking water supply is expected. There will be no discharges to drinking water sources from Units 6 & 7. All industrial wastewater will be routed to the deep injection wells and injected into the Boulder Zone below the confining layer beneath the lowermost aquifer containing a USDW. There are no potable supply wells within a one-half mile radius of the deep injection wells. Therefore, no impacts to drinking water supplies are expected from the Units 6 & 7, as discussed in Subsection 6.2.1.

6.3.4 Leachate and Runoff

Operation of Units 6 & 7 will not generate leachate. Units 6 & 7 have been designed to eliminate direct discharge to surface waters of the state or to waters of the U.S. All stormwater associated with industrial activities will be recycled or directed to an oil/water separator, and then routed to the existing permitted industrial wastewater facility. Non-contact stormwater runoff will be released to the existing industrial wastewater facility or treated as required for applicable regulations and released to the local drainage. The stormwater system is designed to meet applicable standards of FDEP, SFWMD, and Miami-Dade County (see Appendix 10.6 for stormwater design). Therefore, no impacts to water supplies are expected due to runoff or leachate.

The FPL reclaimed water treatment facility will store all materials in tanks or lined containment. Solid wastes will be temporarily stored under roof. Therefore, there will be no leachate generated from this facility. Stormwater design for this facility is discussed in Subsection 3.8 and Appendix 10.6.

6.3.5 Measurement Programs

Withdrawals from the radial collector wells will be measured and reported to the SFWMD as required by consumptive use permitting rules and regulations. An aquifer monitoring program, as required by the rules and regulations of the FDEP UIC program, will be conducted (see also Subsections 6.1.5 and 6.2.4).

6.4 Solid/Hazardous Waste Disposal Impacts

All non-hazardous and hazardous wastes associated with the Project will be managed according to applicable regulations. Subsection 4.7 describes the potential solid and hazardous wastes associated with the operation of the Project. Solid wastes their characterization, and disposal methods are presented in Table 4.6.0-1. Wastes will be handled according to the waste handling guidelines presented in Table 4.7.0-1.

6.4.1 Solid Waste

There will be no on-site disposal of solid wastes associated with operation of the Project. The solid wastes that will be generated from Units 6 & 7 include municipal solid wastes, office and industrial materials (paper, cardboard, wood, filters, metal, etc.), cleaning debris (trash accumulation), and water treatment solids. As explained in Subsection 4.7, after accumulation, all solid wastes generated during Units 6 & 7 operations will be disposed of in off-site licensed landfills or by other approved methods. To the extent practicable, paper, wood, scrap metal, paper, and other recyclable materials will be recycled off-site at an approved recycling facility. There are no adverse impacts expected from solid waste generated by the operation of Units 6 & 7.

The FPL reclaimed water treatment facility will store all materials in tanks or lined containment. Solid wastes will be temporarily stored under roof and disposed of off-site in an approved facility.

6.4.2 Hazardous Wastes

The handling of hazardous wastes for Units 6 & 7 is described in detail in Subsection 4.7. The Turkey Point Plant has one EPA Identification Number for all units. Together, the Turkey Point Plant typically generates less than 1,000 kg of hazardous waste per month. The facility holds a SQG status. The Project will not contribute significantly to the hazardous waste generation at the site; hence, the SQG status is not expected to change. FPL will continue to contract with an approved disposal company to transport and dispose of small quantities of hazardous waste at licensed facilities in a manner that complies with environmental regulations. Therefore, no adverse impacts are anticipated from hazardous wastes generated from the operation of Units 6 & 7.

6.5 Sanitary and Other Waste Discharges

Sanitary wastes will be routed to a package treatment unit and the treated sanitary effluent routed to the blowdown sump and then to the deep injection wells. The amount of treated sanitary effluent is estimated to average 48 gpm with a maximum of 95 gpm, which will be less than one percent of the overall flow from the blowdown sump to the deep injection wells (refer to Subsection 4.5). Subsection 6.2 provides an assessment of the potential impacts from the deep injection wells to groundwater. There will be no surface water discharge of other wastestreams associated with the Project. Wastestreams, their characterization, and disposal methods are presented in Table 4.6.0-1.

6.6 Air Quality Impacts

6.6.1 Impact Assessment

An air quality impact analysis meeting the requirements of FDEP's PSD rules and EPA/FDEP modeling guidance was performed. EPA/FDEP requirements, modeling methodology, and results are presented in the Air Construction Permit Application in Appendix 10.2.5. The air quality impact assessment is required for the PM_{10} emissions from the Project, since the emissions exceed the significant emission rates. This analysis must demonstrate that the air quality impacts of PM_{10} do not exceed the significant impact levels or, alternatively, a cumulative impact analysis is performed to demonstrate compliance with AAQS and PSD Increments. In addition, an air quality modeling analysis is not required for SO_2, NO_2, or CO, since these air pollutants do not exceed the PSD significant emission rates. However, an air quality impact assessment was performed for these pollutants as a supplement to the Air Construction Permit Application contained in Appendix 10.2.5.

The air quality impact assessment for SO_2, NO_2, and CO is a comparison of the Project's impacts for these pollutants with the AAQS and applicable PSD Class I and II Increments.

The air quality model used to calculate air quality impacts for the Project was based on the model's ability to simulate impacts in areas surrounding the Site, as well as at the PSD Class I area of the ENP, located approximately 20 km from the Site. The EPA-approved and FDEP-recommended AERMOD dispersion model was used to address air quality impacts within 50 km of the Project. AERMOD was approved as part of the Guideline on Air Quality Models in 40 CFR Part 52; Appendix W as the preferred general purpose dispersion model (70 FR 68218-68260; November 9, 2005). The AERMOD model calculates hourly concentrations based on hourly meteorological data. The AERMOD model is valid for most applications, since it contains the latest scientific algorithms for simulating plume behavior in all types of terrain. The predicted concentrations are compared to the applicable AAQS and PSD Class II Increments. Because the nearest parts of the ENP are located within 50 km (31 miles) of the Site, the AERMOD model was used to perform the significant impact analysis at the ENP PSD Class I area.

Meteorological data used in the AERMOD model to determine air quality impacts consisted of a concurrent five-year period of hourly surface weather observations from the NWS office located at MIA and upper air sounding data collected at the Florida International University (FIU) in Miami. The five-year period of the meteorological data was from 2001 through 2005. The NWS office at MIA is located approximately 40 km (25 miles) north of the Site and is the closest primary weather station to the study area considered by FDEP to have meteorological data appropriate for the air quality impact analysis of the Project.

A comparison of the average land use parameters at MIA and the Site was performed using the EPA AERSURFACE program. AERSURFACE reads land use files developed by the U.S. Geological Survey and provides average land use values for albedo, Bowen ratio, and surface roughness within a specified radius. The comparison determined similarities between the land use parameters at MIA and the Site indicating that these data are representative and appropriate for the modeling analysis.

The Units 6 & 7 sources that were evaluated in the modeling analysis included:

- 6 circulating water cooling towers;
- 2 service water system cooling towers;

- 4 standby diesel generators;
- 4 ancillary diesel generators; and
- 2 diesel fire pump engines.

The cooling towers operate continuously, while the generators and fire pump engines are only operated for routine testing and maintenance. Each circulating water cooling tower has 12 cells while each service water cooling tower has two cells. The annual emissions for the generators and engines were based on 96 hours of operation per year or eight hours per month. These generators and engines would normally only be operated four hours per month. To predict annual average and 24-hour SO_2 impacts, 24-hour PM_{10} impacts, and 8-hour CO impacts, it was conservatively assumed that half of the eight monthly operating hours for these machines (i.e., four hours) would occur simultaneously during a 24-hour period. For predicting 3-hour SO_2 and 1-hour CO impacts, the maximum short-term (i.e., lb/hr) emissions were used. The calculated TPY emissions of these sources were used for predicting annual average PM_{10} and NO_2 impacts.

All significant building structures were identified on the plot plan. The building structures were processed in the EPA Building Profile Input Program (BPIP-PRIME, Version 04274) to determine direction-specific building parameters for each 10-degree azimuth direction for each source included in the air modeling analysis.

A Cartesian receptor grid was used to predict maximum concentrations in the vicinity of the Site. The receptor grid included receptors located on and beyond the FPL Turkey Point plant property boundary at the following receptor spacing: along the property boundary – 50 meters; beyond the property boundary to 2 km – 100 meters; and from 2 to 5 km – 250 meters. The Project’s impacts at the PSD Class I area of the ENP were predicted with an array of 901 discrete receptors and elevations covering the entire ENP that were obtained from the NPS Class I extraction program.

The maximum PM_{10}, SO_2, NO_2, and CO concentrations predicted for Units 6 & 7 in the vicinity of the Site are presented in Table 6.6.1-1. The maximum concentrations for each pollutant are compared to the AAQS, PSD Class II Increments, and PSD Class II significant impact levels. When compared to the AAQS and PSD Class II Increments, the maximum predicted concentrations from the emission units associated with Units 6 & 7 are much less than these standards. The modeling results also indicate that the maximum concentrations from the Project are predicted to be less than the significant impact levels for all pollutants except CO for the 1-hour averaging period. The significant impact levels are threshold concentrations used to further evaluate pollutants triggering PSD review such as PM_{10}. PSD modeling is not required for SO_2, NO_2, and CO, but was performed as a supplement to Appendix 10.2.5. For CO, the maximum predicted one-hour impact of 3,912.5 µg/m^3, while above the PSD significant impact level, is much less than the AAQS of 40,000 µg/m^3 for one-hour averaging time.

The maximum PM_{10}, SO_2, and NO_2 concentrations predicted for Units 6 & 7 at the ENP are presented in Table 6.6.1-2. These maximum concentrations are compared to the PSD Class I Increments and PSD Class I significant impact levels. The modeling results demonstrate that the maximum concentrations from Units 6 & 7 are predicted to be less than the significant impact levels for PM_{10}.

The air modeling analysis demonstrates that the air emissions from the addition of Units 6 & 7 will not have a significant effect on air quality and will comply with all applicable AAQS and allowable PSD increments.

6.6.2 Monitoring Programs

Measurements of meteorology, ambient air quality, or visibility are not required for Units 6 & 7 based on FDEP PSD Rules (see Section 3.0 of Appendix 10.2.6). Proposed compliance conditions are contained in the Air Construction/PSD Application (See Appendix 10.2.6). Continuous emissions monitoring or stack monitoring is not applicable to the emission units associated with Units 6 & 7.

6.7 Noise

The noise predictions for Units 6 & 7 were developed using the CadnaA computer model, a computerized software program for calculation, presentation, assessment, and prediction of environmental noise (DataKustik, 2008).

CadnaA is an environmental noise propagation computer program that was developed to assist with noise propagation calculations for major noise sources and projects. Noise sources are entered as octave band sound power levels. Locations of the noise sources, buildings, and receptors are input directly on the base map and can be edited throughout the modeling process. All noise sources are assumed to be a point, line, area, or vertical area source, and can be specified by the user. Sound propagation is calculated by accounting for hemispherical spreading and three other user-identified attenuation options: atmospheric attenuation, path-specific attenuation, and barrier attenuation.

CadnaA path-specific attenuation can be specified to account for the effects of soil, vegetation, foliage, and wind shadow. Directional source characteristics and reflection can be simulated using path-specific attenuation. Barrier attenuation is calculated by assuming a barrier perpendicular to the source-receptor path and lateral diffraction. Overall A-weighted SPLs are calculated.

The noise impacts of Units 6 & 7 were evaluated using the SPLs for the various types of equipment associated with the Site. The SPLs for the cooling towers represent far-field SPLs that the vendor is willing to guarantee. For other noise sources, the SPLs used in the analysis were typical of conservative noise levels from similar equipment. The location of each noise source was based on its location in the computerized plot plan (see Figure 4.2-2). The computerized drawing was imported into the CadnaA model for the noise analysis. The heights of the major buildings were also input into CadnaA, developing a three-dimensional representation. Sources were input as point, area, and vertical area sources with appropriate dimensions.

The design of Units 6 & 7 includes components that mitigate noise from being emitted to the surrounding environment. The majority of the noise sources associated with Units 6 & 7, such as the steam generators, electric generators, compressors, and cooling water pumps, are located within buildings that mitigate sounds emitted by equipment. The noise from electric transformers is partially shielded by walls that also mitigate noise. The standby and ancillary diesel generators and diesel fire pumps operate only four hours per month for testing and maintenance. The noise from cooling towers is mitigated by their inherent design. Modular fill distributes cooling water equally throughout the tower minimizing areas in the tower where large quantities of falling water can increase noise. Splash guards on the air inlets mitigate sounds generated by the falling water. Finally, the mechanical fans have stacks that direct noise vertically. The far-field SPL for the cooling tower used in the noise modeling analysis was 65 dBA at 400 ft.

The sound power levels used in the analysis are presented in Table 6.7.0-1. There were 98 point sources, eight area sources, and 140 vertical area sources input to CadnaA. Noise sources such as the cooling tower fans and transformers were input as point sources. The sources listed in Table 6.7.0-1 are descriptive of the sources modeled, which include the buildings' roofs and walls. Sources inside buildings were input as area sources that are horizontal. The vertical area noise sources represent sides of buildings and structures such as the cooling tower inlets from which interior noise can be emitted. The atmospheric attenuation was set at the CadnaA default value, which is ten degrees Celsius (ºC) (50°F) and 70-percent relative humidity. For southern Florida, the average temperature is much higher than the default value for attenuation. As a result, using a lower ambient temperature would produce conservative results. The ground attenuation for the area was set to represent mixed adsorption to reflect a mixture of paved surfaces, water, and vegetation. No vegetation or other buildings that can act as barriers were input in to the model.

Figures 6.7.0-1 and 6.7.0-2 present the predicted noise levels for Units 6 & 7. Figure 6.7.0-1 shows noise contours in the proximity of Units 6 & 7. Figure 6.7.0-2 shows noise contours in relationship to the noise monitoring locations. Table 6.7.0-2 presents predicted SPLs for the operation of Units 6 & 7 at each noise monitoring location. The closest current permanent private residence to the Site is located about four miles northwest of the Units 6 & 7 Site. The maximum predicted noise levels shown in Figure 6.7.0-1 do not include background, which can be variable depending upon the activities in the area. The background noise levels are presented in Subsection 3.3.8 and Appendix 10.7.3. The background noise levels used in the analysis included both transient average SPLs (i.e., L_{eq}) that represent the average SPL for all noise sources, and the L_{90}, which represents the sound level, exceeded 90 percent of the time during the monitoring period. The latter excludes the majority of the transient noise sources, such as traffic, that can influence the L_{eq} or the average SPL. When there are a number of transient sounds observed during a monitoring period, the difference between the L_{90} and the predicted contribution is a more representative comparison of the noise impact from a continuously operating noise source such as a power plant. The background noise levels for the Project were obtained over a two-day period that included both daytime and nighttime measurements. The background noise levels used in the analysis represented the average sound energy of the two daytime and nighttime measurements. Table 6.7.0-2 also presents the daytime and nighttime background L_{90} and L_{eq} used in the analysis.

Because noise from Units 6 & 7 will be additive to the noise generated by Units 1 through 5, the background noise levels while Units 1 through 5 were operating were added to the SPLs predicted from Units 6 & 7. Table 6.7.0-3 presents the predicted SPLs for the operation of Units 6 & 7 at the monitoring locations and the predicted SPLs combined with background noise levels. Table 6.7.0-3 also shows the SPLs difference in dBA between the predicted SPLs with background and the observed background SPLs. The predicted SPL at the nearest permanent private residence (Site 8) is 31.9 dBA. During the daytime, the calculated SPLs would range from 38.9 to 64.4 dBA with background L_{90} and L_{eq} SPLs. The difference between the predicted SPLs with background L_{90} and L_{eq} SPLs and observed background SPLs are calculated to range between 1.0 dBA (from L_{90} background) and 0.0 dBA (from L_{eq} background). This difference is the contribution from the operation of Units 6 & 7 to the observed background noise levels. During the nighttime, the calculated SPLs would range from 46.8 to 54.1 dBA with background L_{90} and L_{eq} SPLs. The difference between the predicted SPLs with background L_{90} and L_{eq} SPLs and observed background SPLs are calculated to range between 0.1 dBA (from L_{90} background) and 0.0 dBA (from L_{eq} background).

The predicted SPL due to the operation of Units 6 & 7 at the Homestead Bayfront Park (Site 7) is predicted to be 35.4 dBA. During the daytime, the calculated SPLs would range from 40.1 to 49.6 dBA with background L_{90} and L_{eq} SPLs. The difference between the predicted SPL with background L_{90} and L_{eq} SPLs and observed background SPLs are calculated to range between 1.8 dBA (from L_{90} background) and 0.2 dBA (from L_{eq} background). During the nighttime, the calculated SPLs would range from 41.5 to 47.5 dBA with background L_{90} and L_{eq} SPLs. The difference between the predicted SPL with background L_{90} and L_{eq} SPLs and observed background SPLs are calculated to range between 1.2 dBA (from L_{90} background) and 0.3 dBA (from L_{eq} background).

The difference between the predicted noise impacts with background L_{90} and L_{eq}, and background L_{90} and L_{eq} at monitoring locations beyond the FPL Turkey Point Plant Property is 1.8 dBA or less during the daytime and 1.2 dBA or less during the nighttime. A 1.8-dBA difference in SPLs is generally not noticeable by human hearing. In addition, the typical uncertainty in environmental noise observations due to temporal changes in noise sources is 3 dBA.

There are no State of Florida noise regulations that are applicable for the construction and operation of the proposed Project. There is only a "nuisance" noise ordinance for Miami-Dade County. Section 21-28, "Noises; unnecessary and excessive prohibited" states: "It shall be unlawful for any person to make, continue, or cause to be made or continued any unreasonably loud, excessive, unnecessary or unusual noise" (Code of Miami-Dade County, Part III Code of Ordinances, Article IV Miscellaneous).

The two closest municipalities to the Units 6 & 7 Site are the City of Homestead and Florida City. The City of Homestead has a nuisance ordinance while Florida City has an ordinance that establishes quantitative limits. The Homestead and Florida City noise ordinances are not applicable to the Project but are used for illustrative purposes. The City of Homestead ordinance [Section 19-23(a)] states: "No person shall by any method or device make, continue or cause to be made or continued any noise disturbance within the city." The City of Homestead noise ordinance is similar to that established by Miami-Dade County.

Florida City has a quantitative noise ordinance that specifies maximum noise levels for receiving land uses. The Florida City noise ordinance is illustrative of quantitative noise regulations and similar to other noise ordinances established by municipalities (e.g., City of Miami, Chapter 36). This regulation is codified in the Florida City Code of Ordinances, Part II, Chapter 30 Environment, Article II, Noise. The ordinance limits the maximum noise from the source to Residential and Multi-family zoning districts from adjoining property to 60 dBA during the daytime (7 A.M. to 10 P.M.) and 55 dBA during the nighttime (10 P.M. to 7 A.M.). For Commercial, Institutional, Community Facilities, Government, Recreational and Public Facilities zoning districts, noise from an adjoining property is limited to 65 dBA during the daytime and 60 dBA during the nighttime from the source of the sound or noise. For Light Industrial zoning districts, noise from an adjoining property is limited to 70 dBA during the daytime and 65 dBA during the nighttime from the source of the sound or noise. The noise limitation for Heavy Industrial zoning districts is 75 dBA.

The Florida City noise ordinance is not applicable to Units 6 & 7, but provides an illustrative example of quantitative noise standards that are typical of municipalities. Such comparisons are useful in putting the predicted quantitative noise impacts in perspective with qualitative noise ordinances such as that adopted by Miami-Dade County. As shown in Table 6.7.0-3, the predicted SPLs with background L_{eq} at the Homestead Bayfront Park are 49.6 dBA during the daytime and 47.5 dBA during the nighttime. These levels are much lower than the Florida City noise ordinance for Recreational and Public Facilities of 65 dBA during the daytime and 60 dBA during the nighttime. Moreover, the contribution of Units 6 & 7 to the background L_{eq} is less than 0.3 dBA to the overall predicted SPLs.

At the nearest permanent private residence, the predicted noise impacts with background L_{eq} are 64.4 dBA during the daytime and 54.1 dBA during the nighttime. As shown in Table 6.7.0-3, the operation of Units 6 & 7 is not predicted to contribute to the background (i.e., a difference of 0.0 dBA between predicted impacts and background). As previously discussed, the L_{eq} includes all noise sources including transient sounds such as traffic that influence observations. The L_{90} can exclude such sources since this parameter represents the sound level exceeded 90 percent of the time during the monitoring period. The predicted SPLs with background L_{90} are 38.9 dBA during the daytime and 46.8 dBA during the nighttime, with predicted contributions to the overall SPL from Units 6 & 7 of less than 1.0 dBA during the daytime and a contribution of 0.1 dBA during the nighttime. Although the Florida City noise ordinance is not applicable to the operation of Units 6 & 7, a comparison of the predicted impacts including background with the quantitative noise standards suggests that the noise impacts of operation are very low compared to typical municipal numerical standards.

Based on the results of the noise impact analysis and the comparison to municipal numerical standards, the predicted noise levels from the operation of Units 6 & 7 will not produce any unreasonably loud, excessive, unnecessary or unusual noise and will comply with the applicable Miami-Dade County noise ordinance.

The Site currently experiences noise associated with operation of the existing plant facilities; and wildlife that occurs in the vicinity of the Site, such as wading birds, is acclimated to such activities. The operational noise from Units 6 & 7 will be similar in magnitude and character to the existing units. No noise-sensitive wildlife is known to occur near the Site or vicinity. Since wildlife in the area has been acclimated to noise associated with the existing Turkey Point Plant, no adverse affect on wildlife from noise resulting from the operation of Units 6 & 7 is anticipated.

Intermittent noise sources during routine startup, testing and maintenance, and emergency conditions may include steam venting. Such activities would not normally occur simultaneously and would last for a short duration. The noise impacts of these conditions would not be expected to cause a nuisance.

6.8 Changes to Non-Aquatic Species Populations

6.8.1 Impacts

6.8.1.1 Flora

Potential impacts to onsite and regional vegetation due to plant operation are anticipated to be negligible. Coastal mangrove communities in the vicinity of the Site are acclimated to saltwater conditions; therefore, no significant impact to vegetative communities is expected as a result of cooling tower drift (see Subsection 6.1.4.2). Any potential impacts to non-aquatic species will be due to Plant construction rather than Plant operation and, therefore, are discussed in Subsection 5.2.

6.8.1.2 Fauna

The existing cooling canals and industrial wastewater facility are utilized by birds, mammals, reptiles, and amphibians. No adverse impacts are expected to fauna within the existing industrial wastewater facility as a result of the Project. Impacts upon salinity within the industrial wastewater facility associated with cooling tower drift (Subsection 6.1.4.2) are expected to be negligible. The average predicted deposition was based on the TDS in the circulating water of 50,000 ppm when using water from the radial collector wells; if using treated reclaimed water, the TDS is approximately ten times lower. Therefore, the predicted deposition from cooling tower drift is conservative when treated reclaimed water is used as makeup (see Subsection 6.1.4).

Operation of Units 6 &7 will not utilize the existing industrial wastewater facility for cooling water, and therefore, apart from minimal salt deposition, will not impact salinity or temperature within the cooling canals. No change in faunal populations is anticipated as a result of operation of Units 6 & 7. Adherence with the guidelines of the Turkey Point Threatened and Endangered Evaluation and Management Plan (Appendix 10.7.2.3) will reduce and/or eliminate potential impacts to crocodiles and other listed species.

As mentioned in Subsections 3.3.6 and 5.4, the Site is adjacent to existing units, which consist of two oil/gas-fired units, one natural gas combined-cycle plant, and two nuclear units. Thus, the wildlife species present in the area are generally those that tolerate human activity. No populations of recreational or commercially important species will be significantly affected by operation of Units 6 & 7.

6.8.2 Monitoring

Because no significant impacts to non-aquatic species populations are anticipated, no monitoring program is proposed during operation of Units 6 & 7, with the exception of the ongoing crocodile monitoring within the existing industrial wastewater facility, as described in Appendix 10.7.2.3.

6.9 Other Plant Operations Effects

6.9.1 Operational Traffic

A transportation impact analysis evaluating the potential impacts of the operation of the Turkey Point Plant including Units 6 & 7 was performed and is contained in Appendix 10.7.4. The operational traffic impact analysis examined the traffic conditions for two scenarios: normal operation and normal operation with nuclear unit refueling and maintenance outages. The roadway improvements recommended for safe and efficient construction of this Project are not required for operations; however, it is recommended that some of the roadway improvements should be maintained. FPL will work with the appropriate agencies and stakeholders to determine and create the optimal disposition of the improved public rights-of-way.

Currently, the Turkey Point Plant has a maximum of approximately 1,467 employees, including operation, maintenance, and engineering personnel. The new employees associated with Units 6 & 7 are estimated at 806. The total estimated employees at the Turkey Point Plant are estimated to be 2,273 once Turkey Point Unit 7 becomes operational in 2020.

For short durations each year (typically about four to six weeks), additional personnel are required for nuclear unit refueling and maintenance outages. During nuclear unit refueling outages, 2,000 additional workers were conservatively estimated in the traffic analysis to be traveling to the Turkey Point Plant, for a total of about 4,273. Additional personnel associated with extended outages for Units 6 & 7 are estimated to be about 1,000.

The traffic analysis determined that the additional trips generated by Units 6 & 7 (under normal operation and nuclear unit refueling/maintenance outages) with the existing traffic conditions will continue to meet Miami-Dade County's Traffic Concurrency Standards. The future traffic conditions (under both scenarios) will not exceed the available capacity of the transportation network located in the vicinity of the Site, where sufficient capacity is available to absorb the potential traffic impacts generated by Units 6 & 7.

With the retention of the improvements that were identified to support the peak construction period (see Subsection 5.6), the roadways are projected to operate in a safer and more efficient manner during both normal operation and outages of Units 6 & 7. Specifically, it is recommended to retain the following improvements.

6.9.1.1 Roadways

FPL proposes to retain the access provided by the following segments to ensure the safe, adequate and efficient transport of workers to and from the Turkey Point Plant:

- SW 137th Avenue/Tallahassee Road south of SW 344th Street/Palm Drive;
- SW 359th Avenue as a transmission access road and private drive; and
- SW 117th Avenue south of SW 344th Street/Palm Drive.

6.9.1.2 Intersections

FPL proposes to retain the function provided by the intersection of SW 328th Street/North Canal Drive and SW 117th Avenue –

- All-way stopped control and no need for signalization or police control. (Note: Traffic signals will be installed to accommodate the peak construction period and may still be operational, the signals should operate under "flashing" mode during normal operation).
- One separate northbound left-turn lane and no need for dual lefts (Note: One of the dual left-turn lanes should be striped-out).
- Maintain one eastbound right-turn lane. (Note: The eastbound center lane should be designated as a through-only lane and the shared right-turn arrow required for peak construction activities should be eliminated.

FPL proposes to retain the function provided by the intersection of SW 344th Street/Palm Drive and SW 117th Avenue –

- All-way stopped control and no need for signalization or police control (Note: Traffic signals will be installed to accommodate the peak construction period and may still be operational, the signals should operate under "flashing" mode during normal operation);
- Maintain one eastbound left-turn lane;
- Maintain one westbound right-turn lane; and
- Maintain one southbound left-turn lane.

During scheduled outages for Units 6 & 7, the traffic impact analysis identified that for the intersections of SW 328th Street/North Canal Drive and 117th Avenue, and SW 344th Street/Palm Drive and SW 117th Avenue, a traffic control officer should be provided to assist in adequate operation of the intersections if traffic signals were not installed for the peak construction period. If traffic signals were installed and operational, the signals should be activated to "normal" mode during the periods of outages.

FPL proposes to retain the function provided by the intersection of SW 359th Street and SW 117th Avenue –

- All-way stopped control and no need for signalization or police control (Note: Traffic signals will be installed to accommodate the peak construction period and may still be operational, the signals should operate under "flashing" mode during normal operation);
- Maintain one eastbound left-turn lane;
- Maintain one westbound right-turn lane; and
- Maintain one southbound left-turn lane.

6.9.2 Lighting

Outdoor lighting will be necessary to satisfy NRC and OSHA requirements for security, worker and plant safety, including lighted walkways, parking areas and various equipment areas. Unconstrained lighting can cause light pollution and light trespass (see Subsection 3.3.9). Light pollution or sky glow is the term used to describe sky brightness caused by scattering of light in the atmosphere. Light trespass is the term used to describe light that strays from its intended purpose and becomes an annoyance.

Light pollution and light trespass will be addressed when designing the outdoor lighting systems. Guidelines specifically addressing potential lighting issues are available from the Illuminating Engineering Society of North America (IESNA). These guidelines will be incorporated into the outdoor lighting design to the extent possible while meeting NRC and OSHA requirements. Typical practices to be incorporated are: minimize upward light from luminaries; minimize upward light in general so that light reaches its intended target; turn off lighting not needed for safety and security between 11:00 P.M. and sunrise; and contain light within its intended target area by suitable choice of luminaries for light distribution, by selection of mounting height and physical location, and by minimizing glare in the horizontal or vertical directions.

The results of the outdoor light monitoring indicated that, while light from the existing Turkey Point Plant is visible as sky glow, it is localized. Sky glow was observed from the major urban areas such as Homestead and Miami. The use of the IESNA guidelines to the extent possible, while meeting NRC and OSHA security and safety requirements, will result in low lighting impacts from Units 6 & 7.

6.10 Archaeological Sites

No sites of historic or archaeological significance will be impacted due to operation of Units 6 & 7 and associated non-linear facilities. No sites listed or eligible for listing in the *National Register of Historic Places* are located in close proximity to the existing Site. No direct or indirect impacts are anticipated from the operation of the new units.

The operation of Units 6 & 7 may potentially involve earth-moving activities during maintenance. The Unanticipated Finds Plan implemented during construction will be modified for operations and maintenance activities and included in the operational procedures for Units 6 & 7.

As discussed in Subsection 5.6, the air emissions from the operation of Units 6 & 7 will meet the AAQS and PSD Increments. The AAQS include secondary standards that protect public welfare from the effects of air emissions. Public welfare includes the potential air quality effects to structures and soils.

As described in Subsection 5.7, the potential noise impacts for the operation of Units 6 & 7 will primarily be confined to the Turkey Point plant property, and predicted noise levels will be less than levels accepted by municipalities for residential and institutional uses (i.e., schools). As a result, no direct or indirect noise impacts on archaeological or historic resources are anticipated from any operational aspect of Units 6 & 7.

6.11 Resources Committed

This section identifies and describes the irreversible and irretrievable commitments of state or local resources due to operation of Units 6 & 7.

6.11.1 Land Use

When Units 6 & 7 cease operations and the plant is decommissioned in accordance with NRC requirements, the land that supports the power plant facilities could be returned to support other industrial or non-industrial uses. If the need for the transmission lines, substations, and access roads cease, the land occupied by these facilities could also be returned to support other industrial or non-industrial uses. Below grade structures such as the reclaimed water and potable water pipelines have little to no impact on land use. ~~The FPL-owned fill source would become a water management area and hence serve as a beneficial long-term resource.~~

Water Use

Units 6 & 7 require makeup water for the closed-cycle cooling system, service water system, demineralized water system, and potable water system. All of the cooling water (reclaimed and saltwater) will be consumed through cooling tower evaporation, system blowdown, or disposal via subsurface injection. The beneficial use of reclaimed water will reduce the amount of other water resources irretrievably committed. Additionally, potable water would be consumed during the operation of Units 6 & 7. Because the use of this resource is entirely consumptive, it would not be available for other uses.

6.11.2 Ecology (Terrestrial and Aquatic)

Once construction of the Project is complete, flora and fauna would recover during operation of Units 6 & 7 in areas that are not directly affected by construction. Suitable habitats for the affected species are available adjacent to the Site and in the region.

As the mitigation plan offsets the loss of wetland functions associated with construction through restoration, enhancement, and preservation of habitat, no significant adverse effects on habitat or individual species is expected to occur.

6.11.4 Air Quality

The primary air emissions for the Project are PM and PM_{10} from the circulating water system and service water system cooling towers. For other air emissions such as NO_x, CO_2, and SO_2, emissions will occur in minor amounts.

Units 6 & 7 will consume PSD Increments for several pollutants (NO_x, PM_{10}, and SO_2). However, the magnitude of increment consumption is very low compared to the PSD Class I and Class II Increments and the maximum impacts of the Project are less than the EPA significant impact levels.

6.11.5 Material Resources

Construction of Units 6 & 7 requires large quantities of building materials that would be considered commitments of resources unless they are recycled when the plant is decommissioned. Construction materials used for Units 6 & 7 would not be atypical of other types of power plants such as hydroelectric and coal-fired plants, or of many large industrial facilities (e.g., manufacturing plants) that are constructed throughout the U.S. The major construction materials that would be required and the estimated quantities needed for construction of two units are summarized as follows:

- 154,400 cubic yards of concrete;
- 20,000 tons of rebar;
- 12,800 tons of steel;
- 1,620,000 linear ft of cable;
- 460,000 linear ft of small bore pipe (less than three inches);
- 136,000 linear ft of large bore pipe; and
- Small quantities of aluminum, boron, titanium, tungsten, uranium, and other natural resources.

TABLE 6.1.4-1
PREDICTED VISIBLE WATER VAPOR PLUME HEIGHT AND LENGTH FOR TURKEY POINT UNITS 6 & 7 CIRCULATING WATER COOLING TOWERS

Conditions		Winter hours/year	Winter %	Spring hours/year	Spring %	Summer hours/year	Summer %	Fall hours/year	Fall %	Annual [a] hours/year	Annual [a] %
ALL HOURS ALL HOURS EXCEPT EXISTING FOG/CALM [a,b,c]		718	41.7%	387	22.5%	230	13.3%	388	22.5%	1723	100.0%
Plume Height (m)											
>0	50	0	0.06%	0	0.05%	1	0.61%	3	0.67%	5	0.27%
>50	200	364	50.72%	222	57.39%	113	49.39%	204	52.50%	903	52.44%
>200	400	328	45.63%	153	39.61%	106	46.25%	168	43.32%	755	43.84%
>400	600	15	2.14%	8	1.96%	6	2.53%	9	2.37%	38	2.21%
>600	1000	10	1.34%	4	0.98%	3	1.13%	4	1.13%	20	1.18%
>1000	3000	1	0.11%	0	0.00%	0	0.09%	0	0.00%	1	0.06%
Plume Length (m)											
>0	100	166	23.1%	111.2	28.75%	65.8	28.66%	104.4	26.92%	447	25.96%
>100	300	220	30.6%	119.6	30.92%	67.4	29.36%	104.8	27.02%	511	29.69%
>300	500	35	4.8%	16.2	4.19%	9.4	4.09%	14.8	3.82%	75	4.35%
>500	1000	46	6.5%	25	6.46%	17.4	7.58%	38.6	9.95%	127	7.40%
>1000	3000	84	11.6%	43.6	11.27%	28.4	12.37%	47.6	12.27%	203	11.80%
>3000	5000	52.4	7.29%	22.4	5.79%	16.6	7.23%	26.2	6.76%	118	6.83%
>5000		116	16.15%	49	12.62%	25	10.71%	51	13.25%	241	13.98%
DAYLIGHT HOURS		213	36.5%	137	23.4%	99	17.0%	134	23.0%	584	100.0%
Plume Height (m)											
>0	50	0	0.09%	0	0.15%	0	0.40%	2	1.64%	3	0.51%
>50	200	119	55.77%	84	61.26%	57	57.34%	74	55.36%	334	57.23%
>200	400	79	36.90%	46	33.48%	34	34.61%	47	35.12%	206	35.30%
>400	600	9	4.13%	5	3.36%	6	5.63%	7	5.06%	26	4.42%
>600	1000	6	2.91%	2	1.75%	2	1.81%	4	2.83%	14	2.43%
>1000	3000	0	0.19%	0	0.00%	0	0.20%	0	0.00%	1	0.10%
Plume Length (m)											
>0	100	61	28.8%	41.4	30.26%	30.8	30.99%	37.6	27.98%	171	29.34%
>100	300	77	36.3%	55	40.20%	42	42.25%	46.4	34.52%	221	37.83%
>300	500	13	5.9%	7.8	5.70%	5.6	5.63%	7.4	5.51%	33	5.72%
>500	1000	15	7.2%	11.6	8.48%	9.6	9.66%	16	11.90%	53	9.01%
>1000	3000	19	8.8%	9.8	7.16%	7.6	7.65%	13	9.67%	49	8.43%
>3000	5000	7.4	3.47%	3.6	2.63%	1.8	1.81%	4	2.98%	17	2.88%
>5000		20	9.39%	8	5.56%	2	2.01%	10	7.44%	40	6.79%

[a] Annual average of the 5-year period from 2001 to 2005.

[b] Also removed are hours with both a predicted plume height and plume length of zero.

[c] Percentage listed under season and annual is the percent of total visible plumes.

TABLE 6.1.4-2
ESTIMATED DRIFT EMISSION SPECTRUM FOR TURKEY POINT UNITS 6 & 7 CIRCULATING WATER COOLING TOWERS

Particle Size Range (micrometers)	Total in Size Range (percent)
0 - 10	0.4
10 - 15	2.6
15 - 20	19.2
20 - 25	25.1
25 - 35	31.0
35 - 65	15.2
65 - 170	6.5

Source: "Calculating Realistic PM Emissions from Cooling Towers", Frisbie and Gordon, 2001.

TABLE 6.1.4-3

MONTHLY MINERAL CIRCULATING WATER DEPOSITION PREDICTED FOR TURKEY POINT UNITS 6 & 7 COOLING TOWERS

Period		Deposition		Location	
		g/m^2/month	kg/ha/month	Distance (m)	Direction (degree)
2001-2005	Average	0.5	5	Area within 5 km	
	Maximum	27.2	272	361	214
		8.0	80	500	233
		2.5	25	1,000	270
		0.9	9	2,000	270
		0.4	4	3,000	270

TABLE 6.6.1-1
MAXIMUM PREDICTED CONCENTRATIONS OF TURKEY POINT UNITS 6 & 7 PROJECT COMPARED TO AAQS, PSD CLASS II INCREMENTS, AND PSD CLASS II SIGNIFICANT IMPACT LEVELS

Pollutant / Averaging Time	Concentration[a] (μg/m^3)	Ambient Air Quality Standards (ug/m^3) Florida	Miami-Dade County	PSD Class II Increments (μg/m^3)	EPA Significant Impact Level (μg/m^3)
PM_{10}					
Annual	0.119	50	NA	17	1
24-Hour, High	4.934	150	NA	30	5
SO_2					
Annual	0.003	60	25	20	1
24-Hour	0.054	260	110	91	5
3-Hour	1.448	1,300	350	512	25
NO_2[b]					
Annual	0.273	100	NA	25	1
CO					
8-Hour	250.3	10,000	NA	NA	500
1-Hour	3,912.5	40,000	NA	NA	2,000

Note: NA = not applicable.

[a] Based on the AERMOD model and surface and upper air meteorological data from Miami for 2001 to 2005.
[b] NO_x to NO_2 conversion factor of 75% applied based on recommendations in EPA's Guideline on Air Quality Models.

TABLE 6.6.1-2
MAXIMUM PREDICTED CONCENTRATIONS OF TURKEY POINT UNITS 6 & 7 PROJECT COMPARED TO PSD INCREMENTS IN SIGNIFICANT IMPACT LEVELS IN ENP

Pollutant / Averaging Time	Concentration[a] ($\mu g/m^3$)	PSD Class I Increments ($\mu g/m^3$)	EPA Class I Significant Impact Level ($\mu g/m^3$)
PSD Pollutants			
PM_{10}			
Annual	0.0018	4	0.2
24-Hour, High	0.0833	8	0.3
Non-PSD Pollutants			
SO_2			
Annual	0.00002	2	0.1
24-Hour, High	0.0005	5	0.2
3-Hour, High	0.01854	25	1.0
NO_2[b]			
Annual	0.0017	2.5	0.1

[a] Based on the AERMOD model and surface and upper air meteorological data from Miami for 2001 to 2005.

[b] NO_x to NO_2 conversion factor of 75% applied based on recommendations in EPA's Guidelines on Air Quality Models.

TABLE 6.7.0-1
SOUND POWER LEVELS FOR NOISE SOURCES
ASSOCIATED WITH TURKEY POINT UNITS 6 & 7

Noise Sources Used in Modeling	Interior Noise Source	Source Type	Number of Sources	Source Height (m)	Overall Sound Power Level (dBA)
Unit 6 Annex Building Roof	Yes	Area	1	26.02	98.4
Unit 6 Annex Building Walls	Yes	Vert. Area	20	26.01	95.3
Unit 6 Ancillary Generator Stacks	No	Point	2	27.56	100.8
Unit 7 Annex Building Roof	Yes	Area	1	26.02	98.4
Unit 7 Annex Building Walls	Yes	Vert. Area	20	26.01	95.3
Unit 7 Ancillary Generator Stacks	No	Point	2	27.56	100.8
Unit 6 Transformers	No	Point	8	7.62	80.7
Unit 7 Transformers	No	Point	8	7.62	80.7
Clear Sky Substation Transformers	No	Point	2	7.62	80.7
Unit 6 Cooling Tower Fans	No	Point	36	16.03	105.2
Unit 7 Cooling Tower Fans	No	Point	36	16.03	105.2
Unit 6 Cooling Tower Inlets	No	Vert. Area	24	7.32	115.5
Unit 7 Cooling Tower Inlets	No	Vert. Area	24	7.32	115.5
Unit 6 Standby Generator Building Roof	Yes	Area	1	6.41	118.5
Unit 6 Standby Generator Building Walls	Yes	Vert. Area	4	6.4	99.9
Unit 6 Standby Generator Stacks	No	Point	2	8.55	114
Unit 7 Standby Generators Buidling Roof	Yes	Area	1	6.41	118.5
Unit 7 Standby Generator Building Walls	Yes	Vert. Area	4	6.4	99.9
Unit 7 Standby Generator Stacks	No	Point	2	8.55	114
Unit 6 Cooling Water Pump Roof	Yes	Area	1	9.15	95.1
Unit 6 Cooling Water Pump Walls	Yes	Vert. Area	4	9.14	75.2
Unit 7 Cooling Water Pump Roof	Yes	Area	1	9.15	95.1
Unit 7 Cooling Water Pump Walls	Yes	Vert. Area	4	9.14	75.2
Unit 6 Turbine Building Roof	Yes	Area	1	44.82	86.4
Unit 6 Turbine Building Walls	Yes	Vert. Area	18	44.81	86.4
Unit 7 Turbine Building Roof	Yes	Area	1	44.82	86.4
Unit 7 Turbine Building Walls	Yes	Vert. Area	18	44.81	86.4

TABLE 6.7.0-2
PREDICTED SOUND PRESSURE LEVELS (SPLs) FOR THE OPERATION OF UNITS 6 & 7 AND OBSERVED BACKGROUND SPLs

Site	Location	TP 6&7 SPLs (dBA)	Background (dBA)			
			Daytime L_{90}	Daytime L_{eq}	Nighttime L_{90}	Nighttime L_{eq}
S1	Homestead Racetrack	30.3	34.7	53.9	46.7	54.5
S2	FPL T-line NW TP 5	45.6	58.8	60.6	59.3	60.6
S3	FPL T-line W TP 5	46	66.1	67.2	65.7	66.9
S4	FPL TP Main Entrance	40.4	43.1	60.2	48.1	57.4
S5	FPL Northern Boundary	40.7	42.1	44.1	46.9	47.9
S6	FPL Daycare Center	39.4	42.5	48.6	46.2	49.0
S7	Homestead Bayfront Park	35.4	38.3	49.4	40.2	47.2
S8	Nearest Permanent Private Residence	31.9	37.9	64.4	46.7	54.1

Legend: TP = Turkey Point; TP 5 = Turkey Point Unit 5.

TABLE 6.7.0-3
PREDICTED SOUND PRESSURE LEVELS FOR THE OPERATION OF UNITS 6 & 7 COMBINED WITH OBSERVED BACKGROUND SPLs AND PREDICTED DIFFERENCE

Site	Location	TP 6&7 SPLs (dBA)	TP 6&7 Impact with Background (dBA)				Difference TP 6&7 and Background (dBA)			
			Daytime L_{90}	Daytime L_{eq}	Nighttime L_{90}	Nighttime L_{eq}	Daytime L_{90}	Daytime L_{eq}	Nighttime L_{90}	Nighttime L_{eq}
S1	Homestead Racetrack	30.3	36.0	53.9	46.8	54.5	1.4	0.0	0.1	0.0
S2	FPL T-line NW TP 5	45.6	59.0	60.7	59.5	60.7	0.2	0.1	0.2	0.1
S3	FPL T-line W TP 5	46.0	66.2	67.2	65.7	66.9	0.0	0.0	0.0	0.0
S4	FPL TP Main Entrance	40.4	45.0	60.3	48.7	57.4	1.9	0.0	0.7	0.1
S5	FPL Northern Boundary	40.7	44.5	45.7	47.8	48.7	2.4	1.6	0.9	0.8
S6	FPL Daycare Center	39.4	44.2	49.1	47.0	49.5	1.7	0.5	0.8	0.5
S7	Homestead Bayfront Park	35.4	40.1	49.6	41.5	47.5	1.8	0.2	1.2	0.3
S8	Nearest Permanent Private Residence	31.9	38.9	64.4	46.8	54.1	1.0	0.0	0.1	0.0

Legend: TP = Turkey Point; TP 5 = Turkey Point Unit 5.

LEGEND

- Center of Collection Area
- Scenario 1 = 1 Square Mile
- Scenario 2 = 4 Square Miles

NOTES

Scenario 1
- The change in the average salinity is 0.36 percent.
- The mean absolute percent difference in the salinity is 1.47 percent.

Scenario 2
- The change in the average salinity is 0.09 percent.
- The mean absolute percent difference in the salinity is 0.37 percent

REFERENCES

PROJECT

TURKEY POINT UNITS 6 & 7 PROJECT

TITLE

CONTROL VOLUMES FOR SALINITY ANALYSIS

FPL

FILE No. 08387584E004

REV. 0

PLOT DATE 6/11/2009

FIGURE

6.1.3-1

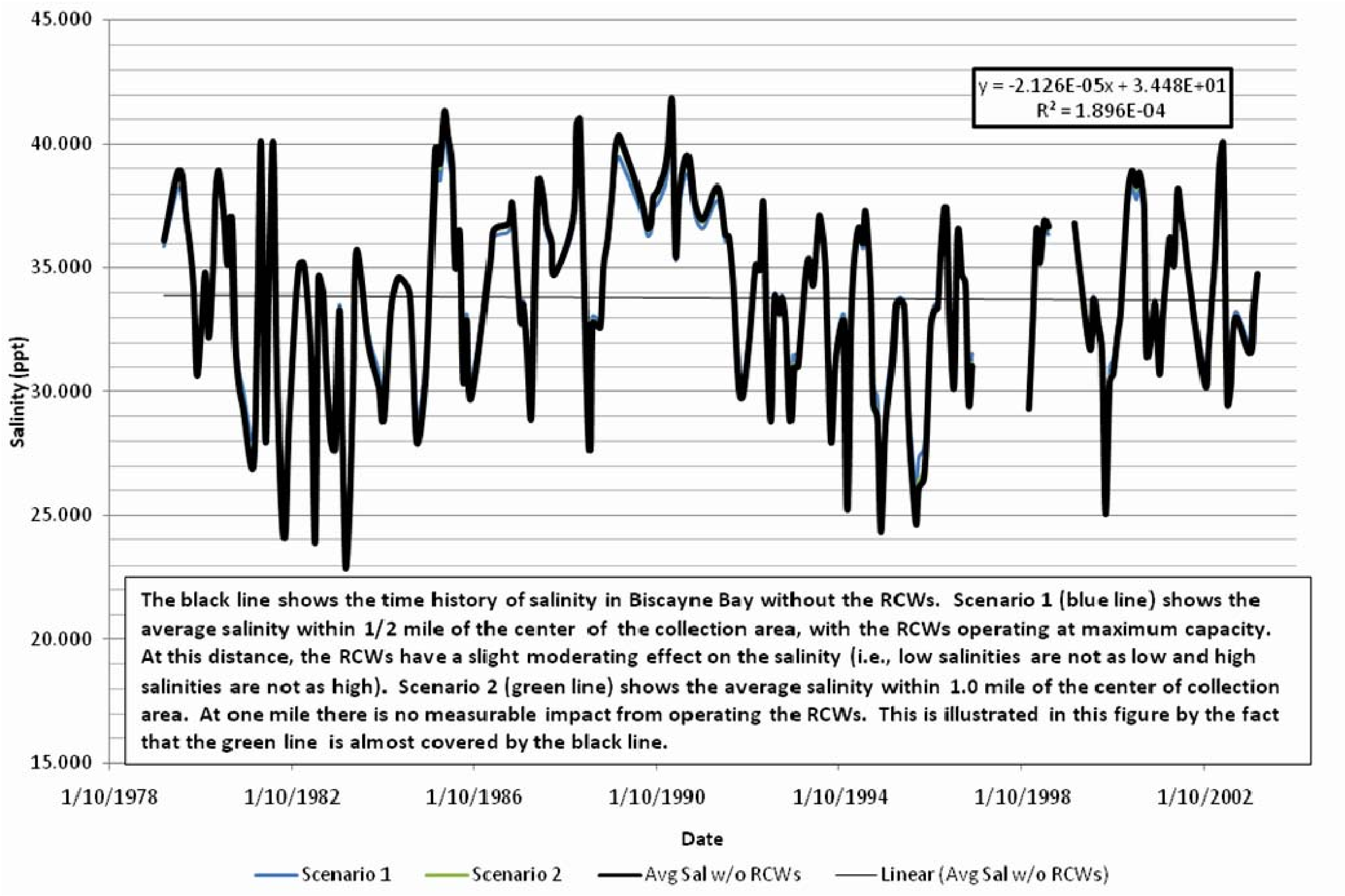


Figure 6.1.3-2
Time History of Salinity in Biscayne Bay With and Without Radial Collector Wells

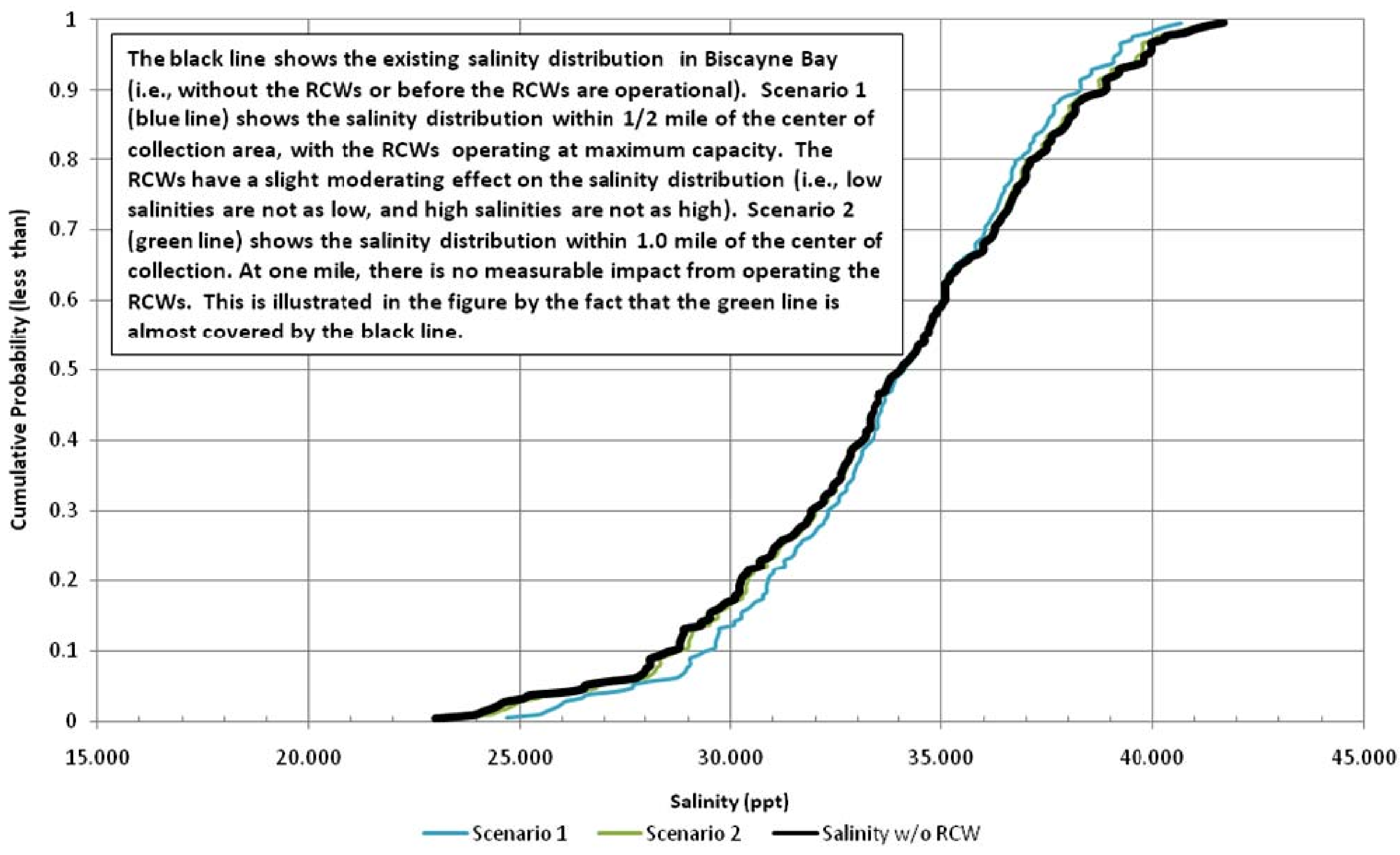
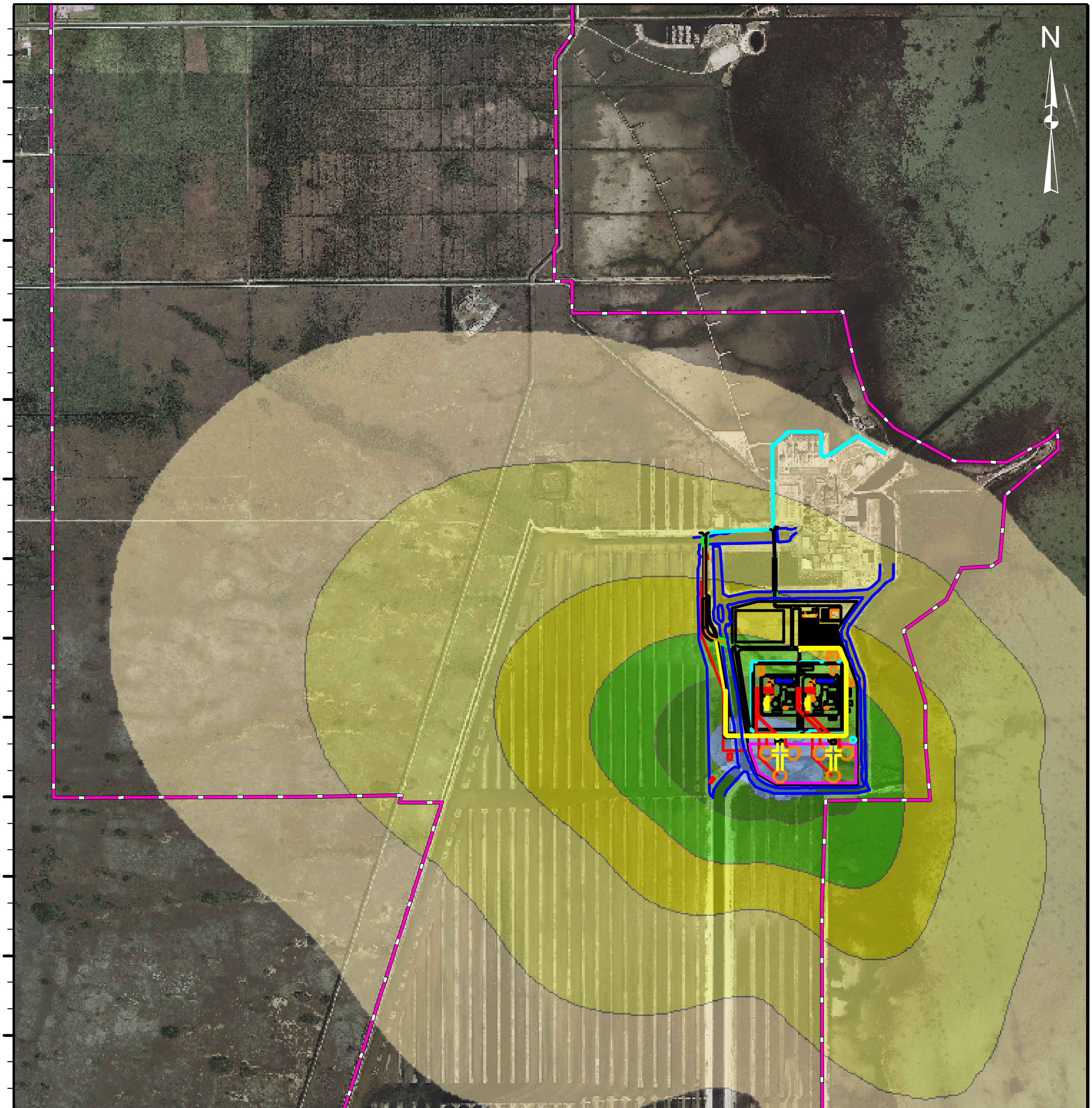


Figure 6.1.3-3
Salinity Distribution in Biscayne Bay With and Without Radial Collector Wells

Rev. 0

FPL



2,950 0 2,950
Feet

LEGEND

Turkey Point Plant Property

Monthly Deposition (kg/ha/month)

- 2-4
- 4-10
- 10-20
- 20-40
- 40-80
- > 80

REFERENCES

1. Imagery, Miami-Dade County 2007.
2. Monthly Deposition, Miami-International Airport, 2001-2005.

PROJECT

TURKEY POINT UNITS 6 & 7 PROJECT

TITLE

AVERAGE MONTHLY SALT DEPOSITION FROM CIRCULATING WATER COOLING TOWERS

FPL

FILE No. 08387584E001

REV. 0

PLOT DATE 6/11/2009

FIGURE

6.1.4-1

LEGEND

- Turkey Point Units 6 & 7 Plant Area
- Turkey Point Units 6 & 7 Site

Noise Sources

- CT Fan
- ClearSky Transformer
- TP Unit 6 Ancillary Generator
- TP Unit 6 Standby Generator
- TP Unit 7 Ancillary Generator
- TP Unit 7 Standby Generator
- Transformer

Noise Impact Contours

- > 45 dB
- > 50 dB
- > 55 dB
- > 60 dB
- > 65 dB
- > 70 dB
- > 75 dB
- > 80 dB
- > 85 dB

REFERENCES

1. Imagery, Miami-Dade County, 2007.

PROJECT

TURKEY POINT UNITS 6 & 7
PROJECT

TITLE

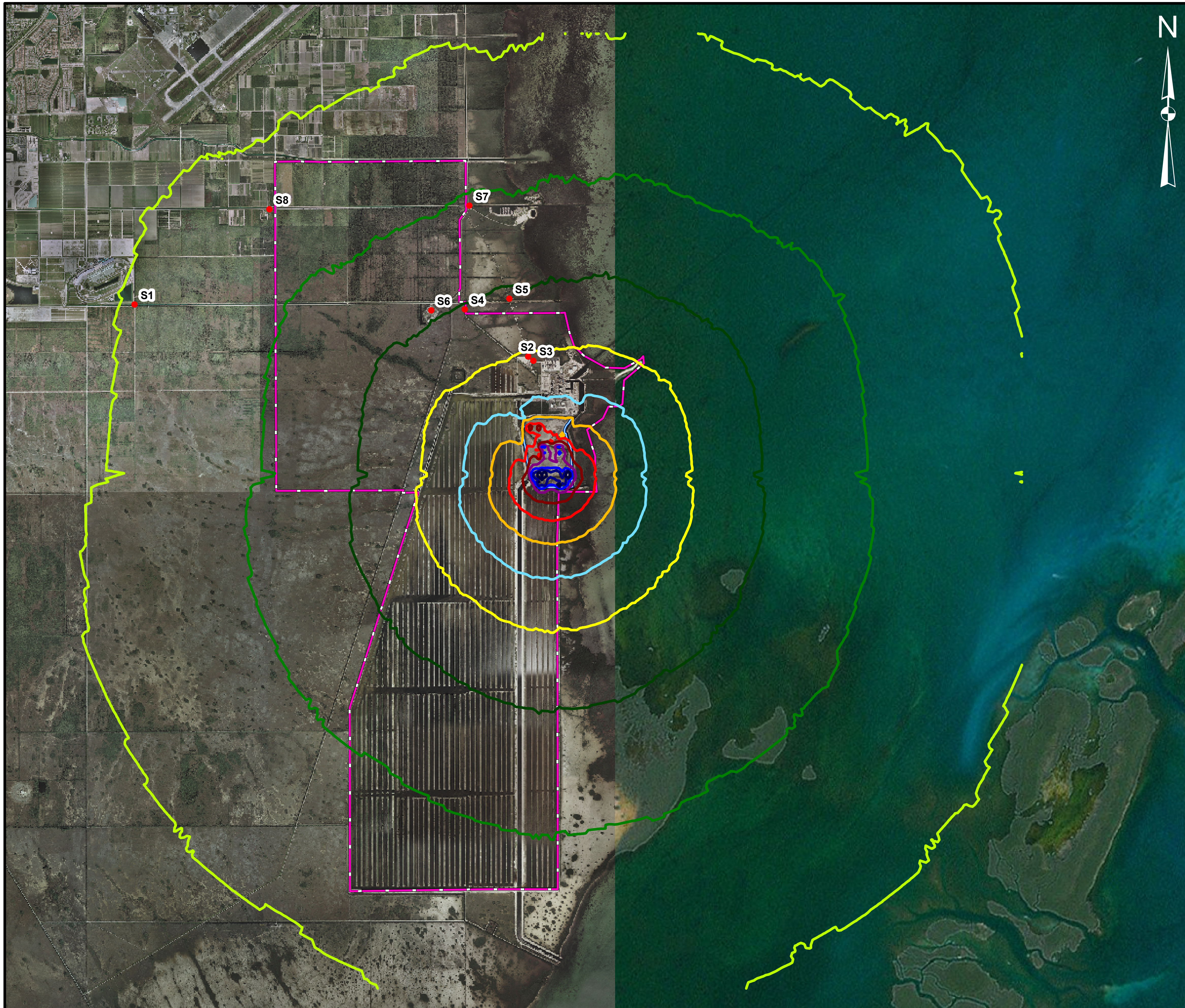
NOISE CONTOURS
IN THE VICINITY OF THE SITE

FPL

FILE No. 08387584E002
REV. 0
PLOT DATE 6/11/2009

FIGURE

6.7.0-1



LEGEND

- Turkey Point Units 6 & 7 Plant Area
- Turkey Point Plant Property
- Noise Monitoring Locations

Noise Impact Contours

- > 30 dB
- > 35 dB
- > 40 dB
- > 45 dB
- > 50 dB
- > 55 dB
- > 60 dB
- > 65 dB
- > 70 dB
- > 75 dB
- > 80 dB
- > 85 dB

REFERENCES

1. Imagery, ESRI / Miami-Dade County, 2006 / 2007.

5,500 2,750 0 5,500
Feet

PROJECT

TURKEY POINT UNITS 6 & 7
PROJECT

TITLE

NOISE CONTOURS AND
NOISE MONITORING LOCATIONS

FPL.

FILE No. 08387584E003

REV. 0

PLOT DATE 6/11/2009

FIGURE

6.7.0-2