FPL-001

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	Docket No. 50-250-LA
Florida Power & Light Company	)	50-251-LA
	)	
(Turkey Point Units 3 and 4)	)	ASLBP No. 15-935-02-LA-BD01

INITIAL WRITTEN TESTIMONY OF FLORIDA POWER & LIGHT COMPANY WITNESSES STEVE SCROGGS, JIM BOLLETER, AND PETE ANDERSEN ON CONTENTION 1

November 10, 2015

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LIST OF ACRONYMS

AO	Administrative Order
APT	Aquifer Performance Test
CCS	Cooling Canal System
EA	Environmental Assessment
E&E	Ecology and Environment, Inc.
FDEP	Florida Department of Environmental Protection
FPL	Florida Power & Light Company
LAR	License Amendment Request
MGD	Million Gallons per Day
NOV	Notice of Violation
pCi/L	picoCuries per Liter
ppt	Parts per Thousand
psu	Practical Salinity Units
SAV	Submerged Aquatic Vegetation
SER	Safety Evaluation Report
SCA	Site Certification Application
SFWMD	South Florida Water Management District
TS	Technical Specification
TDS	Total Dissolved Solids
UFA	Upper Floridan Aquifer
UHS	Ultimate Heat Sink

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I. EXPERT WITNESSES

A. Steve Scroggs

Q1. Please state your full name.

A1. Steven D. Scroggs (SS)

Q2. By whom are you employed and what is your position?

A2. (SS) I am employed by Florida Power & Light Company ("FPL") as Senior Director, Project Development. I am responsible for undertaking development and management roles related to project development. In 2014, I was assigned to oversee and direct the efforts to reduce salinity in the Cooling Canal System ("CCS") of the Turkey Point Industrial Wastewater Facility.

Q3. Please summarize your professional qualifications.

A3. (SS) I graduated from the University of Missouri – Columbia in 1984 with a Bachelor of Science Degree in Mechanical Engineering. From 1984 until 1994, I served in the United States Navy as a Nuclear Submarine Officer. My training and experience resulted in certification as a nuclear engineering officer and submarine officer. I served on two fast attack submarines, including service during the First Gulf War. From 1994 to 1996, I was a research associate at Pennsylvania State University, where I earned a Master of Science Degree in Mechanical Engineering.

From 1996 to 2001, I provided engineering consulting and management services to the regulated and unregulated power generation industry through a number of positions. This work included representation of owners as an independent engineer for power plant projects and to improve project operations and economic performance. In 2002 I joined Calpine Corporation and oversaw the performance acceptance testing of new construction projects.

In 2003, I joined FPL as Manager, Resource Assessment and Planning and directed the long range generation planning efforts for the company, including the oversight of Requests for Proposals for Turkey Point Unit 5 and West County Energy Center Units 1 and 2. I also lead the multi-disciplinary team responsible for obtaining the licenses, certifications, and approvals necessary to construct and operate the Turkey Point Units 6 & 7 Project. A copy of my qualifications statement is attached to Exhibit FPL-002.

Q4. What is the purpose of your testimony?

A4. (SS) The purpose of my testimony is to address the issues raised in CASE's Contention with particular focus on FPL's efforts to mitigate salinity and otherwise manage the cooling canals.

Q5. What documents have you reviewed to prepare your testimony?

A5. (SS) I am familiar with FPL's license amendment request ("LAR") submitted to the NRC, which is the subject of this proceeding, including FPL's initial submittal to the NRC, as well as the NRC Staff review documents, including the Environmental Assessment ("EA") and the final Safety Evaluation Report ("SER"). I am also familiar with FPL's other permit applications to multiple environmental regulators in the state of Florida to request approval for consumptive use of water from various sources. To prepare this testimony I also reviewed the filings made to date by CASE on this issue, as well as the Atomic Safety and Licensing Board ("ASLB") decision (LBP-15-13) admitting the contention for hearing.

B. Jim Bolleter

Q6. Please state your full name.

A6. Jim M. Bolleter (JB)

Q7. By whom are you employed and what is your position?

A7. (JB) I am employed by Ecology and Environment, Inc. ("E&E") as Operations Manager.

Q8. Please summarize your professional qualifications.

A8. (JB) I obtained my Bachelors of Science in Ocean Engineering from Texas A&M University in 1983 and a Master of Science Degree in Civil Engineering from Texas A&M in 1985. While in school I worked on the Strategic Petroleum Reserve Project tracking a salt water plume from brine disposal in the Gulf of Mexico. Upon graduation, I worked for Baskerville Donovan, an engineering firm, for eight years and have been with E&E since 1993. I am a registered professional engineer in Florida and nine other states and Puerto Rico. As operations manager of E&E's West Palm Beach office, I lead and manage environmental scientists, engineers, and planners. I have over 30 years of experience in a wide variety of environmental, coastal and water resource projects, including: watershed and waterfront planning and design; water and wastewater system studies and design; environmental impact assessment; water quality and wetland restoration; environmental monitoring, permitting, and compliance; and contamination site assessment and remediation. I have managed multiple multidisciplinary environmental projects with construction costs in excess of $100 million and successfully managed numerous projects in the water resource, ecosystem restoration, power, alternative energy, oil and gas, hazardous waste, and land development market sectors. I currently oversee the Uprate Monitoring Program for FPL. A copy of my qualifications statement is attached to Exhibit FPL-003.

Q9. What is the purpose of your testimony?

A9. (JB) The purpose of my testimony is to address the issues raised in CASE's Contention regarding the impact of the NRC's license amendment, specifically with respect to saltwater intrusion and the findings of FPL's Uprate Monitoring Program, which tracks saltwater intrusion in the vicinity of the cooling canals.

Q10. What documents have you reviewed to prepare your testimony?

A10. (JB) I am familiar with FPL's LAR, which is the subject of this proceeding, including FPL's initial submittal to the NRC, as well as the NRC Staff review documents, including the EA and the final SER. I am also generally familiar with

FPL's other permit applications to multiple environmental regulators in the state of Florida to request approval for consumptive use of water from various sources. To prepare this testimony I also reviewed the filings made to date by the CASE on this issue, as well as the Atomic Safety and Licensing Board decision (LBP-15-13) admitting the contention for hearing.

C. Pete Andersen

Q11. Please state your full name.

A11. Peter F. Andersen (PA)

Q12. By whom are you employed and what is your position?

A12. (PA) I am employed by Tetra Tech, Inc., an environmental consulting firm, where I am a Principal Engineer and Operations Manager at the Alpharetta, GA office.

Q13. Please summarize your professional qualifications.

A13. (PA) I obtained my Bachelors of Civil Engineering (BCE) from Auburn University in 1977 and a Master of Science Degree in Civil Engineering from Auburn University in 1980. Following graduation with my BCE, I was employed by the Alabama Water Resources Research Institute as a field engineer. I aided in the design, construction, operation, and data analysis for an aquifer thermal energy storage and recovery project. Following graduation with my Master's Degree, I was employed as an instructor in the Civil Engineering Department at Auburn University. I taught undergraduate courses, including computer programming, hydraulics, and hydrology. I then worked for the South Florida Water Management District ("SFWMD") in the Water Use Department. There, I was involved with permitting of water use for agricultural and municipal entities and establishment of saltwater intrusion monitoring programs.

In 1982, I accepted a position with GeoTrans, Inc. in Reston Virginia. I have worked continuously for GeoTrans and (later Tetra Tech, following Tetra Tech's acquisition of GeoTrans) since then, advancing in positions of progressively greater responsibility. My duties have included development and testing of groundwater and solute transport models, application of these models to characterize natural systems and evaluate conceptual designs of engineered systems, report preparation and presentation to clients, and teaching. An example project included evaluation of the causes of and potential mitigation measures for saltwater intrusion at a public supply wellfield in south Florida. The analysis was performed using a sophisticated numerical model of density dependent groundwater flow and solute transport. The analysis was of significant complexity, enabling publication in a professional journal. Also during this period, I worked with other company engineers and scientists to prepare conceptual designs of groundwater remediation systems, involving low-permeability covers, slurry cut-off walls, drains, and extraction wells.

In 1994 I moved to Atlanta, Georgia to open a new branch office for the company. As a Principal Engineer and Operations Manager, my duties include project management, technical analysis and design, as well as administrative tasks such as business development and office management. My technical duties include project management, conceptual designs of remedial engineering systems for hazardous waste sites, analysis of subsurface systems using numerical models, evaluation of water supply potential and prediction of impacts of water supply development, and teaching of short courses. I have been involved with water resource problems in Florida throughout my career and have provided services to a broad range of clients, including the water management districts, counties, agricultural interests, utilities, and industry. I have presented testimony based on engineering calculations at several administrative hearings for water supply development in Florida.

I have taught approximately 65 short-courses to working professionals at the International Ground Water Modeling Center, the U.S. Army Corps of Engineers Hydrologic Engineering Center, Florida Water Management Districts, and other commercial entities. I am a Professional Engineer in the State of Florida, as well as in Georgia, Alabama, and Virginia. I am a member of the Association of Ground Water Scientists and Engineers. I have authored or co-authored 51 technical papers, either as peer reviewed journal articles or conference proceedings. Nearly all of these technical papers deal with groundwater hydrology and modeling. Two notable peer-reviewed publications involved modeling of saltwater intrusion in the Biscayne Aquifer near Hallandale Florida and a post-audit of a groundwater model I used to design a contaminant extraction/injection system. I authored "A Manual of Instructional Problems for the USGS MODFLOW Model," a training manual sponsored by the Environmental Protection Agency. A copy of my qualifications statement is attached to Exhibit FPL-004.

Q14. What knowledge do you have of the CCS and related hydrology at Turkey Point?

A14. (PA) I have been involved as a consultant to FPL for approximately 11 years, with much of that work involving the Turkey Point Plant in south Florida. My specific areas of expertise are in groundwater hydrology, water resource engineering, groundwater modeling, and groundwater/surface water relationships. My first exposure to Turkey Point was in 2004 when I performed the groundwater modeling of the proposed extraction of 14 million gallons per day ("MGD") of Floridan Aquifer water for cooling purposes for the Site Certification of Unit 5. I was qualified as an expert and testified in the administrative hearing. I became involved in the Site Certification Application ("SCA") and Combined License ("COLA") applications for Units 6 and 7 in 2008. My role was to assist and review the groundwater modeling being performed by the prime contractor, Bechtel Corporation. I performed independent analyses to corroborate their findings and offered suggestions on groundwater modeling techniques. I have been active in assisting FPL in the state and federal review processes and testified in the SCA hearing. In addition, I managed a project that involved developing a comprehensive water and salt balance of the CCS. This balance used data from the Uprate Monitoring Program and quantified inflows to and outflows from the CCS.

Q15. What is the purpose of your testimony?

A15. (PA) The purpose of my testimony is to address the issues raised in CASE's Contention regarding the impact of the NRC's license amendment, specifically with respect to the impact on temperature and the impact of the license amendment on salinity in the CCS, the quality of the water FPL is using and plans to use to mitigate CCS conditions, and the impact of both of these measures on saltwater intrusion.

Q16. What documents have you reviewed to prepare your testimony?

A16. (PA) I am familiar with FPL's LAR which is the subject of this proceeding, including FPL's initial submittal to the NRC, as well as the NRC Staff review documents, including the EA and the final SER. I am also generally familiar with FPL's other permit applications to multiple environmental regulators in the state of Florida to request approval for consumptive use of water from various sources. To prepare this testimony I also reviewed the filings made to date by the CASE on this issue, as well as the Atomic Safety and Licensing Board decision (LBP-15-13) admitting the contention for hearing.

II. BACKGROUND

Q17. What is your understanding of CASE's Contention?

A17. (All) CASE's Contention alleges that "the NRC's environmental assessment, in support of its finding of no significant impact related to the 2014 Turkey Point Units 3 and 4 license amendments, does not adequately address the impact of increased temperature and salinity in the CCS on saltwater intrusion arising from (1) migration out of the CCS; and (2) the withdrawal of fresh water from surrounding aquifers to mitigate conditions within the CCS." As we understand it, the contention alleges that, related to the increase in the CCS maximum temperature authorized by the amendment, there will be a concurrent increase in evaporation from the CCS and thus increased salinity in the CCS. This increased salinity, CASE argues, will exacerbate saltwater intrusion in the vicinity of the CCS. Further, the contention alleges that the increase in CCS salinity will cause FPL to withdraw additional water from local sources, which will also exacerbate saltwater intrusion.

Q18. Can you briefly summarize your approach to responding to the issues raised in CASE's Contention?

A18. (All) Our testimony supports the EA's overall conclusion that the ultimate heat sink license amendment will have no significant environmental impact. We will first show that FPL is not withdrawing freshwater from aquifers for CCS mitigation purposes at Turkey Point, nor has FPL pursued authorizations to do so. FPL has carefully developed a coordinated plan to restore CCS salinity by use of degraded groundwater sources and available excess surface water, fully in keeping with all state, regional and local regulations. There is no reason to believe that FPL's use of local water will exacerbate saltwater intrusion in any meaningful way. Next, we will discuss that, based on predictive modeling, marginal increases in CCS temperatures for short time periods, like those that we expect would be associated with the amendment, would not be expected to lead to significant CCS salinity increases. Additionally, we will explain that, based on the actions taken by FPL and the water sources FPL has been allowed to use, since the amendment CCS temperatures have actually averaged lower than the previous year. Finally, we will discuss that, based on recent environmental monitoring, the increasing trend in CCS temperatures over the previous few years has not had a significant impact on the surrounding aquifers.

III. THE TURKEY POINT PLANT AND SURROUNDING ENVIRONMENT

A. The Turkey Point Plant and Cooling Canal System

Q19. Where is the Turkey Point Plant located?

A19. (SS) The Turkey Point Plant is approximately 25 miles south of downtown Miami and approximately 10 miles east of Homestead, FL, bordered by Biscayne Bay to the east.

Q20. Could you please describe FPL's existing electrical generating units at the Turkey Point Plant?

A20. (SS) Exhibit FPL-005 is a figure identifying the layout of the existing generating facilities at Turkey Point. Exhibit FPL-006 provides an aerial photograph of the site. The Turkey Point Plant site consists of five units built over the past 50 years. Units 1 and 2 were built in the 1960s and are traditional steam units burning fuel oil and natural gas. Unit 2 is no longer operational and is being decommissioned. In the 1970s FPL constructed and began operation of Units 3 and 4, the first two nuclear generation units in Florida. Unit 5 began operation in 2007 and is a natural gas combined cycle generating unit.

Q21. What is the purpose of the CCS?

A21. (SS) The CCS was constructed in compliance with a consent order from the Department of Justice in 1971, instructing FPL to construct a cooling canal system that is closed to interaction with other surface waters that would provide cooling water to the units (1-4). This design eliminated the discharge of warm water to Biscayne Bay or Card Sound and any potential impacts to sea grasses.

From an operational perspective, the CCS provides the basic steam cycle heat removal capacity for Units 1, 3, and 4 (since the retirement of Unit 2) and serves to receive cooling tower blowdown from Unit 5. From a safety perspective, the CCS also serves as the Ultimate Heat Sink ("UHS") for Units 3 & 4 in the NRC's Design Basis Accident analysis.

Q22. Can you briefly describe how the CCS functions?

A22. (SS) Exhibit FPL-007 shows the Turkey Point Plant Property and a diagram of the flow of the CCS on the property. The plant's Circulating Water pumps provide for the steady counter-clockwise flow of the CCS water beginning at the northern end discharge canal. From this point the water flows five miles to the south through a series of shallow canals, collecting at the southern end, and is directed eastward. The water then flows north through seven intake canals, around an island, and into the plant intakes. The full CCS circuit from outlet to intake takes approximately 48 hours. When the water enters the plant, heat is transferred to the CCS water by flow through the plant condensers and heat exchangers that are a part of the steam cycle used to produce electricity. The CCS water flows through heat exchanger tubes and is isolated from the reactor coolant by multiple barriers. CCS water outlet temperature from the plant is approximately 10 to 14ºF above the intake temperature. The CCS water cools through convective heat transfer as it moves down the discharge canals and up the intake canals.

Q23. Are there regulatory requirements related to CCS temperature that are included in the NRC operating license?

A23. (SS) Yes. As the UHS, the CCS provides assurance that in the event of an accident within the Design Basis of Unit 3 or Unit 4, there will be sufficient cooling capacity to cool the reactor and components. The Design Basis, an integral part of the NRC Operating License, requires that the CCS intake temperature remains at or below a specific temperature while the plant is operating. If the temperature exceeds this limit, FPL must reduce power, or shut down the plant. The focus of the requested amendment was to increase this temperature limit from 100°F to 104°F. A copy of FPL's license amendment request is provided as Exhibit FPL-008.

Q24. Could you please describe the salinity of the water within the CCS?

A24. (PA, SS) Historically, the salinity in the CCS has varied seasonally, high at the end of the dry season (May) and low at the end of the rainy season (November). Over the past twenty years salinity has varied from the 30s to the high 60s psu.[1] The salinity in the CCS varies with rainfall, heat load and other meteorological and operating factors, but is approximately 1.5 to 2 times the salinity in Biscayne Bay. Recently, in 2014 and 2015, the salinity of the CCS has risen from near 60 psu, which is 1.7 times the salinity in Biscayne Bay, to a high in June of 2015 of 94.7 psu, which is 2.7 times the salinity in Biscayne Bay.

(SS) As discussed below, FPL's recent salinity management activities have brought CCS salinity down to the low 50s psu in the fall of 2015.

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[1] Salinity is expressed in practical salinity units (psu), parts per thousand (ppt), or mgL. Seawater is approximately 35 psu, 35 ppt, 35 gL, or 35,000 mgL.

Q25. Why do the waters within the CCS have a higher salinity level than the nearby portions of Biscayne Bay?

A25. (SS, PA) Heat from the power plants that is released to the CCS is dissipated to the atmosphere primarily through evaporation. The process of evaporation removes only water and not the solids that are dissolved in the water. Therefore the water that is evaporated leaves behind the constituents, primarily sodium and chloride, which account for its salinity. The water that leaves the CCS through evaporation is replaced primarily by rainfall, with a smaller portion provided by groundwater inflow from under Biscayne Bay, which has a salinity that is approximately equal to that of sea water. The process of evaporating salt water gives the cooling canals a salinity that is higher than the Bay.

Q26. Why has salinity in the CCS increased in recent years?

A26. (SS) Salinity in the CCS is a result of a number of factors, including ambient weather conditions that affect evaporation (e.g., temperature, precipitation, relative humidity, cloud cover, wind speed/direction) and CCS water quality parameters that affect heat transfer and heat capacity (e.g., algae concentration, total suspended solids). These factors determine the rate at which heat is absorbed and released from the CCS and the associated evaporation rate. The rate of evaporation (or water leaving the system) must be balanced with water additions, such as rainfall and groundwater exchange. Historically, the rate of evaporation has been roughly balanced with an equivalent volume of additions. Salinity varies seasonally, decreasing in the rainy season and increasing in the dry season. When there have been several below average precipitation years in sequence, average annual salinity is elevated.

In 2013 and the first half of 2014 the South Miami-Dade region experienced below average rainfall, and consequently, above average evaporation. This ambient weather phenomenon contributed to above normal salinity in the CCS. The above normal salinity aided the growth and persistence of a blue-green algae bloom; a type of algae that thrives in warm, hypersaline environments. The combined effect of low precipitation, high evaporation, and degraded water quality due to the algal bloom (e.g., high turbidity, high total suspended solids) resulted in an imbalance in historic salinity levels.

When salinity increases due to a lack of sufficient water to replace evaporation, water quality degradation can occur, further exacerbating the heat transfer capability and elevating temperatures. This elevation of temperatures increases evaporation and therefore increases salinity, creating a negatively reinforcing cycle. Given the timing of the completion of the uprate and the recent degradation in CCS water quality some have drawn the incorrect conclusion that the additional power generated as a result of the uprate has caused the CCS problems. However, closer inspection reveals that the compounding factors described above are the source of the issue. Exhibit FPL–009, "Comparison of Pre- and Post-Uprate CCS Thermal Load," provides an accounting of thermal input to the CCS before and after the uprate. This document shows that the net heat input into the CCS has actually been reduced by approximately 4% since the uprate of Units 3 and 4 because of the retirement of Unit 2.

B. Recent Activities and Current Status of the Cooling Canal System

Q27. What actions has FPL taken recently to address water quality?

A27. (SS) The principal action to manage water quality was to provide additional water sources to mitigate the salinity increase during the dry season and begin the process of reducing salinity. State water policy requires that industrial users first look to sources with water quality below that of fresh water, or "degraded sources." This would include brackish or saltwater-intruded aquifers. There were several sources of degraded groundwater available. As discussed more fully below, in 2014 FPL obtained approval to redirect up to 5 MGD from an existing (brackish) Floridan aquifer source permitted to provide make up water for the Turkey Point Unit 5 forced draft cooling tower. The Florida Department of Environmental Protection ("FDEP")'s Site Certification Amendment Order authorizing this reallocation is provided as Exhibit FPL-010. Use of this small volume source was discontinued in the summer of 2015 when larger volume sources were brought into service.

Further, several test wells have been installed in various locations into the shallow saline Biscayne Aquifer (salinity of marine water) in support of the Turkey Point Units 6 & 7 Combined License Application and state Site Certification, including one well (PW-1) on the Turkey Point peninsula. This peninsular well provided 10 MGD of approximately 35 psu marine water, beginning in 2014. In 2015, subsequent to the NRC's EA, the peninsular marine well field was expanded to provide two new wells producing a total volume of approximately 45 MGD for all three wells. In September 2015, as CCS salinity began to fall in response to seasonal rainfall and L-31 E storm water, FPL stopped adding this water source to the CCS to limit the addition of salt that is associated with this source.

Also subsequent to the NRC's EA, FPL received an Emergency Order from the SFWMD to obtain excess storm water from the nearby L-31E canal. In the fall of 2014, FPL was able to draw an average of approximately 44 MGD for a 21 day drawdown period. Withdrawals from this source were controlled by permit conditions that ensured that an environmental reservation of water for Biscayne Bay was always achieved in concert with any flow to FPL's CCS. FPL also received similar authority in 2015, but due to an extreme drought in Southeast Florida in the summer of 2015, water from this source was not available until August 28, 2015. Withdrawals from the L-31E canal have averaged approximately 43 MGD in September and October of 2015. This source is available only in the rainy season. Therefore, after November 30 it will not be available until the summer of 2016. A consumptive use permit issued by the SFWMD authorizes similar withdrawals in the summer of 2016, and expires in November 2016. This permit is currently under an administrative challenge.

FPL plans to use these sources in the short term for CCS management until the longer term source, 14 MGD from the UFA is available upon issuance of the Site Certification Modification.

Q28. Are any of the water sources used by FPL in the CCS a source of drinking water?

A28. (SS) No. None of the sources are used for drinking water.

Q29. Are any of the water sources used by FPL in the CCS classified as "freshwater"?

A29. (SS) Yes. The excess storm water from the L-31E canal contains agricultural and suburban runoff, but can be classified as a freshwater source due to the limited chloride content of the water. However, the SFWMD has approved the use of this excess storm water.

Q30. What actions has FPL taken to address the heat exchange capability of the CCS?

A30. (SS) Over many years, rainfall and storm events create erosion on the many berms that define the cooling canals. This sediment is carried in the flow and is re-deposited in low flow regions within the CCS. The result of this sedimentation process causes shifts in CCS flow creating an imbalanced flow distribution, and makes many of the western canals shallower than design, reducing their heat exchange capabilities. FPL initiated a dredging program to recover canals that had been heavily silted and conducted changes to the flow distribution to restore better flow. In response to the blue-green algae blooms, FPL also added copper sulfate to the CCS to determine if algae growth could be managed through such means.

Q31. What has been the result of these actions?

A31. (SS) FPL was able to maintain continuous operations during the summer of 2015 with a maximum intake temperature of 98.5°F, compared to a maximum intake temperature of 102.5°F in 2014. Salinity was managed during the drought conditions by use of the marine wells, and has been reduced from a peak of 95 psu to the low 50's as of this filing. Algae concentrations were largely unaffected by the copper sulfate additions, but have diminished with recent rainfall and L-31E canal volumes and are trending lower as of the date of this filing. On average, CCS temperatures are approximately 2.5 to 3ºF lower in 2015 as compared to the same time period in 2014. This is shown in Exhibit FPL-011, a 60-day trend of the UHS Technical Specification monitoring location temperatures for the same time period in 2014 and 2015. Exhibit FPL-012 shows the CCS temperature at the Intake Cooling Water inlet, since the summer of 2014. As shown in this exhibit, the temperature has not exceeded 100ºF since August of 2014.

C. The Local Aquifers at Turkey Point

Q32. Please describe the hydrogeology surrounding Turkey Point.

A32. (PA) The regional hydrostratigraphic framework of Florida contains three major components: (1) the surficial aquifer system (Biscayne Aquifer), (2) an intermediate confining bed, and (3) the Floridan aquifer system. The Biscayne Aquifer is one of the most productive aquifers in the world, due to its high hydraulic conductivity (permeability) and storage capacity. It extends from land surface to approximately 150 feet below land surface at the Turkey Point site. Due to the presence of Biscayne Bay and the Atlantic Ocean, the aquifer is saline offshore and near the coast. The saltwater extends inland for several miles up and down the coast, with the greatest intrusion proportional to depth. Exhibit FPL-013, a figure excerpted from FPL's 2012 Comprehensive Pre-Uprate Monitoring Report, shows the approximate location of the freshwater-saltwater interface in the area, as delineated by the U.S. Geologic Survey. The figure indicates that the saltwater interface at the base of the aquifer is approximately 6 to 8 miles inland of the Turkey Point area. Drinking water for much of southeast Florida is obtained from wells sunk into the Biscayne aquifer at some distance onshore.

The Floridan Aquifer System is a large and regionally extensive system that underlies most of Florida, as well as part of several southeastern states. The upper part of the aquifer (referred to as the Upper Floridan Aquifer or "UFA") consists of a thick (approximately 850 feet at the site) sequence of limestones that are capable of providing large quantities of water. Near Turkey Point, the top of this aquifer is approximately 1000 feet beneath land surface. The aquifer is overlain by a sequence of limestone, dolomite, siltstone, claystone, sand, and clay that form a semi-confining layer known as the Hawthorn Group that separates, both geographically and hydraulically the UFA from the Biscayne Aquifer. Although the UFA is a major source of potable groundwater in much of Florida, water withdrawn from it in southeastern Florida, including Miami-Dade County, is brackish. The aquifer is close to land surface in central Florida and receives most of its recharge is in this area. The UFA dips to the southeast and as stated above, is present at nearly 1000 feet below sea level in the area of Turkey Point. Because of its distance from the recharge area, as well as the significant hydraulic isolation due to confinement, the UFA receives little opportunity for recharge of fresher water and is brackish in this area of South Florida.

Q33. What are the hydraulic forces that that establish the location of the saltwater/freshwater interface in the Biscayne Aquifer?

A33. (PA) The location of the freshwater/saltwater interface is established by the potentiometric surface or head of the freshwater that prevents the saltwater near the coast (usually at a head equal to sea level) from moving landward. Because the saltwater is more dense than the freshwater, it has a higher effective head at sea level, and will intrude to such a point where the fresh inland water head is high enough to balance the more dense saltwater. In this way, the inland freshwater head will govern the extent to which saltwater will intrude and hence the location of the freshwater/saltwater head in the region.

Q34. Does this saltwater intrusion in the surficial Biscayne Aquifer pre-date the operation of the Turkey Point CCS?

A34. (JB) Yes. As discussed in the FPL's 2012 Comprehensive Pre-Uprate Monitoring Report, (Exhibit FPL-014 and shown in the figure excerpted from that report in Exhibit FPL-013) the presence of saltwater in the aquifer west of Turkey Point pre-dates the CCS and was documented well inland in the 1950s (Klein 1957 – "Saltwater Encroachment in Dade County, Florida") (Exhibit FPL-015). This saltwater zone, which underlies a shallow freshwater lens, can move both seasonally and from year to year (Peters and Reynolds 2008 – "Saltwater Intrusion Monitoring in the Biscayne Aquifer near Florida City, Miami-Dade County, Florida: 1996-2007") (Exhibit FPL-016).

Q35. How do you know that the water in the Biscayne Aquifer in the vicinity of Turkey Point is saline?

A35. (PA, SS) As Mr. Bolleter discussed above, this water has been salty since at least the 1950s. More recently, FPL has withdrawn and sampled this water. For instance, the Turkey Point 6&7 project will rely on water withdrawn from the Biscayne Aquifer through radial collector wells installed on the Turkey Point peninsula. In support of the project, FPL performed an Aquifer Performance Test ("APT") using wells drilled at that location into the Biscayne Aquifer. An excerpt from the Turkey Point Units 6&7 APT is provided as Exhibit FPL-017. As Table 3.2 of this exhibit shows, the salinity of water in this aquifer in the PW-1 well was 33-35 ppt, or essentially the same as bay water. This is one of the same wells that FPL has used for it recent Biscayne Aquifer withdrawals.

(SS) Further, as the SFWMD stated in its response to FPL's 2014 Biscayne withdrawal proposal (Exhibit FPL-018):

> *Section 3.2 of the Basis of Review for Water Use Permits within the South Florida Water Management District (BOR) states that applicants using seawater to meet their total water demand are not required to obtain water use permits. Section 1.8 of the BOR defines seawater as "Groundwater or surface water with a chloride concentration at or above 19,000 milligrams per liter". Previously reported data from these wells indicates the water produced meets this definition.*

(SS, JB) FPL's recent withdrawals have shown a similar salinity level. Salinity from water taken from these wells in June to September of 2015 is shown in Exhibit FPL-019. These Biscayne Aquifer measurements were taken in compliance with a permit issued by Miami-Dade County for the 2015 L-31E withdrawals, which required salinity data for sources of CCS additions.

Q36. Is there any other evidence to show that the water in the Biscayne Aquifer at Turkey Point is not fresh?

A36. (JB) Yes, data from FPL's Uprate Monitoring Program shows that the Biscayne Aquifer water in this location is not fresh. Exhibit FPL-020 includes a figure excerpted from the 2014 Uprate Monitoring Report. It shows the elevated salinity in this area. And, as discussed above, Exhibit FPL-013, shows the approximate location of the freshwater-saltwater interface in the area to be well inland of Turkey Point, as delineated by the U.S. Geologic Survey.

Q37. Are there any regulatory designations by the FDEP that apply to the groundwater at the Turkey Point Plant site?

A37. (PA) Yes. Groundwater at the Turkey Point Plant site was designated as Class G-III by the Florida Department of Environmental Regulations (a precursor to FDEP) in the 1980s. In general, groundwater with total dissolved solids content greater than 10,000 mg/L is designated as Class G-III under FDEP Rule 62-520. Class G-III groundwaters are not expected to meet numeric concentration standards for constituents such as sodium, chlorides, specific conductance, or any of the other primary or secondary (numeric) standards.

Q38. How does FPL know that the water in the UFA is brackish?

A38. (PA, SS) The UFA is a degraded water source, and is regarded as such by the SFWMD and FDEP in this region. Similar to the APT for the Turkey Point Units 6&7 project, FPL also conducted an APT for the Unit 5 development project. An excerpt from the Turkey Point Unit 5 APT is provided in Exhibit FPL-021. As that document reflects on page 32, the chloride concentration in the UFA wells was approximately 1,000 mg/l. These salinity levels show that, while the water is not excessively saline, it is not considered fresh. That makes this water supply ideal for freshening the CCS. Further, FPL has been operating Unit 5 with cooling water provided by the UFA for the last eight years and routinely monitors the salinity of the UFA water to determine if any degradation is observed.

(PA, JB) In addition to the performance test results, the Unit 5 APT Report also cites a report prepared by the USGS in conjunction with the SFWMD to support the proposition that the upper portion of the Florida Aquifer in this area contains brackish water (Reese, 1994, "Hydrogeology and the Distribution and Origin of Salinity in the Floridian Aquifer System, Southeastern Florida") (Exhibit FPL-022).

D. Operation, Regulation, and Monitoring of the Cooling Canal System

Q39. Does FPL operate the CCS in a manner intended to mitigate the westward movement of water from the CCS?

A39. (JB) Yes. An approximately 18-foot deep interceptor ditch is located along the west side of the CCS and was designed and constructed to create a hydraulic barrier to keep water in the CCS from migrating inland or westward in the upper zone of the fresher Biscayne Aquifer. During the dry season, when the natural groundwater gradient is westward from Biscayne Bay and Card Sound toward the Model Lands, water is pumped from the interceptor ditch into the CCS to create an artificial ground water gradient from the Everglades into the interceptor ditch. The intent is to restrict the flow of saline water from the CCS toward the west in the upper part of the Biscayne Aquifer.

Q40. Can you describe some of the history of the regulation of the CCS?

A40. (SS, JB) In 1972, FPL entered into an agreement with the Central and Southern Florida Flood Control District (later to become the SFWMD) addressing the operations and impacts of the CCS. The agreement has been updated several times, with the most recent version being the Fifth Supplemental Agreement between the District and FPL entered into on October 16, 2009 ("Fifth Supplemental Agreement"). The Fifth Supplemental Agreement brought forward much of the language and commitments from the prior agreements. Among these commitments is that "FPL shall operate the interceptor ditch system to restrict movement of saline water from the cooling canal system to those amounts which would occur without the existence of the cooling canal system." The Fifth Supplemental Agreement also provides that if the SFWMD, in its sole discretion, determines that the interceptor ditch is not effective in restricting movement of the saline water westward of the L-31E canal to those amounts which would occur without the existence of the CCS, FPL, upon notification by the SFWMD, shall begin consultation with the SFWMD to identify measures to mitigate, abate or remediate impacts from the CCS and to promptly implement those approved measures. As discussed later, the SFWMD and FDEP have determined that the interceptor ditch has not been completely effective in eliminating the movement of CCS water westward (primarily at depth in preexisting marine groundwater).

Q41. Has FPL recently increased the power output of the Units 3&4?

A41. (SS) Yes. In 2010, FPL applied to the NRC for a license amendment to allow an extended power uprate for Units 3 and 4. The NRC prepared an EA for the proposed uprate which concluded that the action would not have any significant environmental impacts. (Exhibit NRC-009).

Q42. Did state and local environmental regulators review the uprate?

A42. (SS, JB) Yes. FPL's uprate project for Turkey Point Units 3&4 required a Site Certification under the Florida Power Plant Siting Act (the original development of the nuclear units predated the Act). As a condition of certification, FPL was required to enter into a CCS monitoring program that installed surface and groundwater wells to determine the extent and dynamics of the interaction between the CCS and the regional groundwater. In 2009, a Monitoring Plan (the "Uprate Monitoring Plan") was developed with input from the FDEP, the SFWMD and Miami-Dade County's Department of Regulatory and Economic Resources (collectively, the "State Agencies") and FPL. The purpose of the Uprate Monitoring Plan was to provide information to determine the vertical and horizontal effects, and extent, of saline CCS water on existing and projected surface and groundwater resources, and ecological conditions surrounding the Turkey Point Facility. The Uprate Monitoring Plan requires the collection of groundwater, surface water, meteorological, and ecological data in and around the plant to assess pre-uprate and post-uprate conditions and to identify changes associated with the uprate project. The Uprate Monitoring Plan was also incorporated into the Fifth Supplemental Agreement.

(SS) Condition X of the certification stated that if FDEP, in consultation with the SFWMD and Miami-Dade County, determines that the pre and post-uprate monitoring data indicates harm or potential harm to the waters of the State, the FDEP would order action to abate or mitigate that potential harm.

Q43. What specifically does the Uprate Monitoring Plan encompass?

A43. (JB) The monitoring was initiated in June 2010 and is ongoing. Automated water quality and water-level data are currently recorded at 1-hour intervals at 14 well clusters (42 wells) and 18 surface water stations (multiple depths at some stations); meteorological data are collected at one automated meteorological station. Water samples are currently collected quarterly at 47 groundwater wells and 18 surface water stations (multiple depths at some stations). Ecological monitoring is conducted semi-annually in Biscayne Bay and quarterly in the marsh and mangrove areas.

For the automated stations, each groundwater well currently generates 144 data points each day. This results in 6,048 data points generated by the groundwater stations (42 wells) daily, or approximately 2.2 million points annually. Both the surface and the groundwater stations currently generate in excess of approximately 3 million data points per year. Groundwater, surface water, and pore water samples have been collected and analyzed for up to 47 parameters on a quarterly basis yielding over 60,000 individual results. This is a very comprehensive monitoring program and changes in the CCS and the surrounding environment are being closely assessed. Data collected prior to February 26, 2012, are part of the Pre-Uprate period, while data collected between February 26, 2012, and May 27, 2013, are part of the Interim Operating period. Data collected after May 27, 2013, are part of the Post-Uprate period.

Q44. How does the Uprate Monitoring Plan identify whether CCS water is present in the groundwater outside the CCS?

A44. (JB) Because the State Agencies are interested in determining the extent of groundwater affected by the hypersaline water from the CCS, water chemistry in the CCS, Biscayne Bay, and the groundwater were assessed during the Pre-Uprate phase of monitoring to determine if the CCS water could be fingerprinted. While high salinities (generally over 40 in PSS_78 scale) and specific conductance values (generally over 55,000 microSiemens per centimeter [µS/cm]) in groundwater may be an indication of CCS water, the determination of CCS water at concentrations below those found in typical marine water cannot be ascertained without a tracer. The State Agencies recommended that tritium be used as a tracer for CCS water since it is unique to the CCS at the concentrations present. As a result, the distribution of tritium can provide some insight into the possible movement and extent of CCS waters. Due to a backlog of samples at the lab, the tritium results are currently available for groundwater and surface water only through June 2014.

Q45. What levels of tritium would be indicative of saltwater from the CCS?

A45. (JB) The State Agencies have indicated that a value of 20 picoCuries per liter (pCi/L) or lower would be indicative potentially of background conditions. Values higher than that could be an indication of CCS water via a groundwater pathway. However, tritium is ubiquitous in the environment and atmospheric concentrations can influence surface water and groundwater, resulting in concentrations above 20 pCi/L. To assess the contributions of tritium via rainfall and vapor exchange, water samples are collected from seven rainfall collectors and five evaporation pans located at varying distances from the CCS. Depending upon location, atmospheric contributions have exceeded 1000 pCi/L. Atmospheric concentrations tend to be highest near the plant and drop off with distance away from the plant. Concentrations in an evaporation pan several miles west of the plant have exceeded 50 pCi/L. It is important to note that the drinking water standard for tritium is 20,000 pCi/L; it is not being tracked for radiological safety purposes, but merely being used to potentially trace water back to a CCS point-of-origin.

Q46. What has the use of the tritium tracer shown in terms of inland movement of saltwater from the CCS?

A46. (JB) Based on tritium and other groundwater samples under and immediately adjacent to the CCS indicate the presence of hypersaline CCS water at depth. Farther west of the CCS (out approximately 3 miles), CCS water in decreasing concentrations at depth is intermixed with historic marine water.

Q47. Have you seen evidence of significant effects from the CCS in areas to the east, in and beneath Biscayne Bay?

A47. (JB) To the east of the CCS, the saline groundwater under Biscayne Bay shows some presence of CCS water in wells located within 0.5 to 2 miles of the CCS, mostly at depth. This is indicated by higher salinity groundwater with tritium at notable concentrations. One deep well on the northern end of the CCS (TPGW-10) initially did not indicate any presence of CCS water. However, prior to the beginning of the Post-Uprate period, there was a notable increase in tritium, commensurate with an increase in specific conductance, chloride and other saltwater parameters, indicating the presence of CCS water. But there is no indication the CCS water in groundwater is upwelling into Biscayne Bay or that any CCS water of significant consequence has reached the Bay because it is not detected in Biscayne Bay Monitoring Stations BBSW-1, BBSW-2, BBSW-3, BBSW-4, or BBSW-5.

Q48. Would you expect to see upwelling of hypersaline CCS water into Biscayne Bay?

A48. (PA) No. Upwelling of hypersaline CCS water into the Bay is not supported by physics as the CCS water is more dense than the Biscayne Bay water and tends to sink.

Q49. Can you further discuss the extent of inland saltwater intrusion in the vicinity of the CCS?

A49. (JB) Yes. That can best be discussed with reference to Exhibit FPL-023, which are figures taken from the FPL's 2014 Annual Post-Uprate Monitoring Report (a complete version of which is provided as Exhibit FPL-024). The blue lines labeled "A" and "B" in Figure 5.2-1 show the location of cross-sections that are shown in Figures 2 and 3. Figures 5.2-2 and 5.2-3 show cross-sections of pre-CCS (February 1, 1972 through February 1, 1973) and recent (March 2014) specific conductance data. Isopleths[2] are drawn to show the approximate change in specific conductance concentrations from the early 1970s (pre-CCS operation) to the recent period. The figures show that the area under and immediately

[2] Isopleths are contour lines that depict a variable that cannot be measured at a specific point, but instead must be calculated from data collected over a wider area.

adjacent to the CCS is saltier than historic conditions, but the vertical and horizontal extent is not vastly different. Note that much of the water in the vicinity of the CCS could historically be classified as non-potable, based on pre-CCS Total Dissolved Solids ("TDS") concentrations in the groundwater (dotted line on Figures 5.2-2 and 5.2-3). All isopleths on these figures and subsequent figures represent estimations of historical and current water quality conditions and were developed based on interpolation methods and best professional judgment. Figures 5.2-4, 5.2-5, and 5.2-6 show a plan view of specific conductance isopleths for the Pre- and Post-Uprate periods in the shallow, intermediate, and deep zones respectively. These figures show that there is limited difference between the Pre-Uprate and Post-Uprate periods other than at a few wells (most notably TPGW-7D and TPGW-10D, which have shown an increase since the uprate). However, based on the data from the other, closer wells, and/or timing of increases I do not believe the changes in these two wells are a result of the uprate.

Q50. Can you show comparative isopleths using the tritium measurements?

A50. (JB) Yes. Exhibit FPL-025 is an excerpt from FPL's May 2015 Addendum to the 2014 Annual Post-Uprate Monitoring Report (the "Tritium Addendum"), which includes the delayed tritium results from the June 2013 to June 2014 time period. The Tritium Addendum reports groundwater tritium concentrations in excess of 3,000 pCi/L near the CCS. These concentrations diminish with distance from the CCS. Values are in the hundreds of pCi/L several miles west of the CCS at depth.

Figure 2.1-2 of the Tritium Addendum shows plan view maps of average tritium concentrations for the shallow, intermediate, and deep zones respectively, for the Pre and Post-Uprate periods. There is little change on any of the maps between the Pre-Uprate and Post-Uprate other than what has been previously discussed regarding TPGW-10D.

Q51. Has the Uprate Monitoring Plan had any significant findings in recent years?

A51. (JB) The most significant finding in the Post-Uprate period (monitoring from May 29, 2013) is the increase in temperature and specific conductance in the CCS. The Post-Uprate average temperatures near the plant outlet and near the plant intake were 8.1°F and 5.8°F warmer, respectively, than the Pre-Uprate period. While Pre-and Post-Uprate averages may not be directly comparable because they do not cover the same number of months, the Post-Uprate water temperatures are consistently warmer. Based on an initial assessment by FPL, the increase in CCS surface water temperatures during the Post-Uprate period cannot be explained by the Uprate since the total heat rejection rate to the CCS from Turkey Point Units 1, 2, 3, and 4, operating at full capacity prior to the Uprate, would have been higher than the Post-Uprate heat rejection rate to the CCS for Units 1, 3, and 4, operating at full capacity. Unit 2 has been dedicated to operate in a synchronous generator mode (i.e., not producing steam heat), as shown in Exhibit FPL-009. Several other factors may be influencing the temperatures, including increased turbidity and an algal bloom, which are helping to retain heat and/or reduce the specific heat capacity of the CCS water.

Q52. Does the Uprate Monitoring Program include ecological monitoring?

A52. (JB) Yes. Plant community characteristics (composition, cover, canopy, height, productivity), leaf characteristics, nutrient content in the leaves, and soil/sediment, and porewater quality are being assessed in 12 transects in marsh and mangrove areas around the CCS (See Figure 1.3-1 of the 2014 Post-Uprate Monitoring Report, Exhibit FPL-024). Two (one each in the marsh and mangrove) of these transects are in reference areas. This monitoring is conducted quarterly to annually, depending on the parameter. In Biscayne Bay submerged aquatic vegetation ("SAV"), coral and sponge community composition and cover, fish and invertebrate species composition and abundance, nutrient content in seagrass leaves and sediment, light attenuation, and porewater quality were assessed in 20 transects that paralleled the shoreline during the Pre-Uprate and Interim Operating period. This monitoring was conducted twice a year. Based on the lack of findings summarized in the Comprehensive Pre-Uprate Report, the SFWMD approved revisions to the Biscayne Bay Monitoring which included the elimination of faunal sampling during the Post-Uprate monitoring period and reduction of SAV and semi-annual pore water sampling from five transects to two at each of the four existing Bay sites. Based on five years of monitoring over nearly 100 square miles in and around the CCS as part of the Uprate Monitoring Program, there is no evidence of ecological impact to Biscayne Bay. Also there is no evidence of salt water impacts from the CCS on the marsh and mangrove areas around the CCS.

Q53. Has FPL prepared an Annual Report for 2015?

A53. (JB) The submittal date for the 2015 Annual Report has been delayed so that surface water and groundwater tritium results through May 2015 can be included. The tentative submittal date of the report is March 2016.

Q54. Since the submittal of the 2014 Annual Report have you identified any monitoring results that would materially change your understanding as described above?

A54. (JB) No.

E. Impact of the Cooling Canal System on the Biscayne Aquifer

Q55. Based on the results of the Uprate Monitoring Program, can you state whether the operation of the CCS contributes to saltwater intrusion in the Biscayne Aquifer?

A55. (JB) There are many factors that can influence saltwater intrusion. The extent to which each of the factors, including the CCS, has contributed to the saltwater intrusion is not fully established. As discussed above, the CCS has resulted in higher salt contributions in the groundwater and the denser saltwater can influence the westward movement of saltwater; however the extent of saltwater intrusion in the area today is less than it was in the 1950s and there have been limited changes in movement observed during five years of Uprate Monitoring. In fact, the results of FPL's five years of monitoring show generally limited change in saltwater constituent concentrations (i.e., chloride, sodium) and specific conductance west of the CCS, except for some reduction in thickness of the fresher water surficial zone during the 2011 drought/dry season and the previously mentioned sustained increase in saltwater constituents in TPGW-7D. Marine water existed in much of the area groundwater prior to construction of the CCS, and CCS water has since intermixed with historic saltwater.

Q56. Mr. Andersen, have you evaluated how the CCS interacts with the groundwater at the Turkey Point Plant site?

A56. (PA) Yes.

Q57. Could you please explain how the CCS interacts with the nearby water at the Turkey Point Plant site?

A57. (PA) The CCS has no direct discharge to surface waters. However, because the canals are not lined there is interaction with the groundwater. Historically, makeup water to replace evaporation and groundwater losses from the cooling canals has come from rainfall, stormwater runoff, Unit 5 cooling tower blowdown, process wastewaters from the existing units, and from groundwater inflow. Because surface water levels in the canals are lowest in the return canals along the east side of the CCS, near the circulating water pump intakes, groundwater inflow into the cooling canals occurs primarily from the saline aquifer under Biscayne Bay.

Q58. Does water leave the CCS and enter into the surrounding aquifer?

A58. (PA) Yes. Dense saline water in the CCS sinks down into the underlying portion of the aquifer. The amount of water that leaves the CCS is generally in proportion to the stage of the CCS. Therefore, the greatest quantity of water leaving the CCS occurs at the point where plant water enters the CCS, at the discharge canals, in the northwest corner of the CCS. The quantity of water leaving the CCS decreases to the south along the discharge canals as the stage decreases. As discussed above, groundwater begins to enter the CCS along the return canals, particularly to the north, where stage is the lowest.

The CCS contributes to the movement of saline water in the aquifer in that water that originated in the CCS has migrated to the west. However, there are other forces that also contribute to saltwater intrusion in this area. The U.S. Geological Survey has published a series of maps which show the location of the saltwater interface at the base of this Biscayne Aquifer from 1971 to 2010 (Exhibit FPL-013). These maps show fluctuation of the position of the interface and indicate that climatic conditions (wet or dry years) and installation of control structures on canals contribute to the movement of the saltwater interface. Similarly, Peters and Reynolds, 2008 (Exhibit FPL-016) shows the movement of the saltwater interface near the Florida Keys Aqueduct Authority wells near Turkey Point to be correlated with rainfall and water level.

IV. COOLING CANAL SYSTEM SALINITY MANAGEMENT

A. State Agency Requirements

Q59. What has been the regulatory response to the Uprate Monitoring Program?

A59. (SS) In 2013, the SFWMD, following review of FPL's 2012 Comprehensive Pre-Uprate Monitoring Program indicated in a letter to FPL (Exhibit FPL-026) that water from the CCS had migrated outside the geographic boundaries of the CCS. This was based on data prior to the implementation of the uprate. Thus, in that letter, the SFWMD initiated consultation with FPL and FDEP in accordance with the terms of the Fifth Supplemental Agreement. Following almost two years of consultation, FDEP issued an Administrative Order ("AO") in December 2014, requiring FPL to develop a salinity management plan (Exhibit INT-004).

Q60. What does the FDEP's AO require?

A60. (SS) The AO seeks to abate the westward movement of hypersaline water into class G-II aquifers (< 10,000 mg/L TDS). Further, it requires FPL to reduce salinity in the CCS to 34 psu within 4 years and to submit a salinity management plan that would enable it to meet the terms of the AO.

Q61. Is the AO currently in effect?

A61. (SS) No. The AO was challenged by Miami Dade County, Atlantic Civil Incorporated (a private mining operation 8 miles west of the Turkey Point site), the City of Miami, and the Tropical Audubon Society. An administrative hearing was held the week of November 2, 2015. Miami-Dade County and the Tropical Audubon Society have recently withdrawn their challenges. But FPL has not challenged the AO and plans to comply with its requirements.

Q62. What is the basis of the challenges to the AO?

A62. (SS) Parties challenged FDEP's actions as both not being in accordance with the established state processes and being insufficient to address the migration of hypersaline waters outside of the CCS.

Q63. Are there other requests pending that relate to addressing hypersalinity in the CCS?

A63. (SS) Yes. FPL applied for a Site Certification Modification Order under Florida's Power Plant Siting Act that would allow the installation and operation of up to six Floridan Aquifer Wells providing up to 14 MGD of brackish deep aquifer water to the CCS as a long term source that will compensate for deficits in annual rainfall. A copy of FPL's Site Certification Modification application is provided as Exhibit FPL-027. The Floridan wells are intended to be a long term water resource component to help manage and maintain a constant low salinity in the CCS. In addition to the Floridan wells, the modification application also sought authorization for a new Floridan well to provide water for Fukushima-related beyond-design basis accident mitigation and a reallocation of certain Unit 5 water to provide nuclear process water for Units 3 and 4 that had previously been provided by Miami-Dade County.

On December 23, 2014, FDEP issued a notice of intent to approve the modification. Interveners in Florida objected to the construction and operation of the UFA wells for the purpose of pumping and discharge of approximately 14 MGD of brackish water into the CCS, but not to the Unit 5 reallocation or to the Fukushima well. As a result, FDEP issued a Final Order approving those two requested modifications on March 19, 2015. That final order was not appealed. A copy of the FDEP's Final Order is provided as Exhibit FPL-028. Authorization for the construction and operation of the UFA wells to provide approximately 14 MGD of brackish water for the CCS remains subject to challenge by the same parties that challenged the AO. As such, the effect of the order is stayed pending an administrative hearing scheduled for December 2-5, 2015. Miami-Dade County has subsequently withdrawn its challenge.

Q64. Has FPL requested other authorizations related to addressing salinity in the CCS while the AO and Site Certification Modification are being challenged?

A64. (SS) Yes. As discussed in more detail below, FPL requested a Consumptive Use Permit ("CUP") from the SFWMD to obtain access to L-31E water in 2015 and 2016, as it did in 2014. The CUP was authorized, but an appeal was filed challenging that SFWMD action. In recognition of the urgency of the situation, FPL requested and was granted an Emergency Order authorizing access to the L-31E as a conditional source of water through November 30, 2015. The CUP was reviewed in an administrative hearing on October 13-14, 2015 and a Recommended Order is pending.

Q65. Why did Miami-Dade County withdraw from the AO and Site Certification Modification cases?

A65. (SS) FPL worked with Miami-Dade County to address its concerns and came to a negotiated settlement. Working collaboratively, a set of actions that will address concerns regarding the migration of hypersaline water from the CCS into the regional saline groundwater were identified. In October, Miami-Dade County issued a Notice of Violation ("NOV") for groundwater chloride concentration levels that exceeded County groundwater standards. (Exhibit INT-005). Upon receiving the NOV, FPL entered into a Consent Agreement with the County. (Exhibit INT-006). The activities in the Consent Agreement provide for abatement through water resources that will reduce and maintain CCS salinity within an acceptable range, remediation by the installation of a recovery well system, and monitoring to ensure progress is made without adverse impacts.

Q66. Are there any key differences or conflicts between the AO and the CA?

A66. (SS) The principal difference between the AO and the CA is that the CA specifically requires remediation in the form of a recovery well system. There are no conflicts between the AO and the CA. It is my opinion that a Salinity

Management Plan implemented in accordance with the AO could incorporate the elements of the CA.

Q67. What is the basis of that opinion?

A67. (SS) The objectives of each are complimentary. Further, in paragraph 37.d of the AO, the FDEP provides a listing of options that may be proposed, alone or in combination, in the Salinity Management Plan. These include the water resources FPL is pursuing and the removal of hypersaline groundwater that is explicitly required by the CA.

Q68. What is the significance of these regulatory requirements in relation to CASE's contention?

A68. (SS) Regardless of how the AO and SC Modification challenges are resolved, FPL has taken action, and is committed to taking additional specific steps to reduce salinity in the CCS through regulator-approved actions. In CASE's Contention, it argues that the increased temperature associated with the NRC's approval of the UHS license amendment will lead to a marginal increase in temperature in the CCS, which would lead to a marginal increase in the salinity in the CCS, which would exacerbate saltwater intrusion. Any alleged marginal increase in salinity stemming from the UHS license amendment must be viewed in the context of FPL's recent successes and future commitments to manage the CCS salinity and remediate hypersaline groundwater. In light of these ongoing salinity management activities, any marginal increase in salinity due to the license amendment should not result in a significant environmental impact. Thus, these actions strengthen the conclusion of the NRC's Environmental Assessment, which concluded that the amendment would not involve a significant environmental impact after considering the context of the increase in temperature.

Q69. Mr. Andersen, what role have you had in FPL's proposal to withdraw water from the UFA for use in the CCS at the Turkey Point plant site?

A69. (PA) I initially managed a project in which we considered and evaluated the feasibility of many alternatives for the purpose of reducing salinity in the CCS and to prevent or reverse saltwater intrusion that was believed to be occurring in the area west of the Turkey Point Plant. One of the alternatives we considered was the addition of Floridan Aquifer water into the CCS with the objective of lowering the salinity in the CCS and hence reducing migration of high salinity water into the aquifer underlying the CCS. We performed detailed analysis of the effects of adding Floridan water to the CCS using a water and salt balance as well as a cross-sectional groundwater flow and solute transport model. This analysis was refined with additional data that was collected from the CCS Uprate Monitoring Program and ultimately determined that the addition of 14 MGD on a consistent and continuous basis would lower the salinity of the CCS from 60 psu to 34 psu. This is the UFA water that is the subject of FPL's pending Site Certification modification proceeding. I refer to this as the CCS "freshening" project. The analysis further evolved to include the "Fukushima well," which is intended to be a reliable emergency backup supply of water, in response to a recent requirement by the NRC. Most recently, I have evaluated the benefits and impacts of various other options involving the addition of water into the CCS with the objective of lowering salinity within the CCS from the higher levels currently being experienced.

Q70. Can you provide more detail on your study of ways to lower salinity and temperature in the CCS?

A70. (PA) Yes. Since the fall of 2014, I have been involved with determination of the causes of recent increases in temperature and salinity of the CCS waters and assessment of additional remedial alternatives for lowering the salinity and temperature. In addition to the use of the UFA water as part of the CCS freshening effort, FPL also considered and used other water sources to address temperature and salinity in the CCS. The additional salinity reduction alternatives (the "additional measures") I have evaluated include:

- Addition of up to 10 MGD from a marine source, specifically the Unit 6 and 7 aquifer test well, PW-1, and 10 MGD from each of two new wells at Turkey Point;
- Addition of up to 100 MGD of water from a nearby canal, L31-E;
- Addition of approximately 5 MGD of Floridan Aquifer water from an existing Unit 5 well; and
- Sediment removal from the northwest side of the CCS.

Although these alternatives, whether part of the freshening project or the additional measures, most directly target the salinity reduction, there should be a supplementary effect of temperature reduction by the addition of water to the CCS that makes the CCS a more efficient cooling device. The additional water increases the flow rate through the CCS, creates additional surface area for cooling, and decreases the turbidity due to dilution. The primary tool I have used in this evaluation is the water and salt balance that we developed as a part of the Uprate Monitoring Program.

Q71. Did you consider how much water would be necessary to achieve a CCS salinity level of 34 psu?

A71. (PA) Yes. I modeled the amount of water that would be necessary from the UFA. A copy of my technical memorandum "Evaluation of Required Floridan Water for Salinity Reduction in the Cooling Canal System," dated May 9, 2014, was included as Appendix A to FPL's application to the FDEP to modify the Site Certification (Exhibit FPL-027). This memorandum concludes that in order to address the hypersaline conditions within the CCS, water and salt balance modeling determined that an average of 14 MGD of Floridan water with a salinity of 2 g/L would need to be added to the CCS.

Q72. Can you describe FPL's UFA withdrawals?

A72. (SS) Based on Mr. Andersen's evaluations, FPL sought approval to utilize UFA Aquifer water to minimize the groundwater makeup flow from the saline water under Biscayne Bay. As FPL explained in its application to the FDEP, its salinity management plan will include the installation of up to six new production wells that will discharge approximately 14 MGD of UFA water into the CCS. The wells will be artesian flow, between 1,000 and 1,250 feet deep, and spaced approximately 1,900 feet apart, generally along the northernmost canal of the CCS and along the west side of the CCS, east of the interceptor ditch as seen in Exhibit FPL-029, a figure excerpted from FPL's application to FDEP to modify its Site Certification to construct and operate the Upper Floridan wells.

Q73. Could you please describe the effects on the salinity levels in the CCS from the addition of lower salinity water?

A73. (PA) Addition of water of lower salinity than the CCS will reduce the salinity levels in the CCS. The amount of reduction is dependent upon the difference in salinity between the added and resident water as well as the quantity of added water. At an initial salinity of 60 psu, the addition of the lower salinity water will reduce the salinity of the CCS to an annual average of 34 psu, as required by the FDEP administrative order. Further, the steady supply of this water will help to dampen high salinity peaks in the dry season and moderate the seasonal swing of salinity.

Q74. Have you evaluated the potential impact of adding water into the CCS on the groundwater adjacent to the CCS?

A74. (PA) Yes.

Q75. Please describe your analyses.

A75. (PA) The impacts to groundwater adjacent to the CCS were evaluated using a combination of the water and salt balance that I described earlier and a groundwater flow and saltwater transport model of the aquifer system extending from off-shore to approximately 10 miles inland. This model was adapted from a modeling study conducted by the U.S. Geological Survey. I modified their model configuration to account for site specific conditions and calibrated to time series data that quantified the rate of inland movement of saltwater. With confidence that the model could approximate past conditions, I evaluated the effect of adding the 14 MGD from the UFA to the CCS.

In order to model the effect of adding the 14 MGD on the regional aquifer system, I had to understand the effect on the CCS, which is a boundary condition in the flow and transport model. The water and salt balance indicated that the addition of 14 MGD would raise the water levels within the CCS by 0.1 feet. This computation was verified by comparison to the actual effect of adding 30 MGD for a three week period in 2014. The modeling analysis also showed that salinity in the CCS would begin to decrease almost immediately upon addition of the Floridan water and would take no more than 2 years to decrease from 60 psu to 34 psu.

Q76. How does the salinity reduction in the CCS affect the surrounding aquifer?

A76. (PA) The addition of 14 MGD of UFA water is designed to improve water quality in the CCS and in turn, the aquifer system beneath and near the CCS. The proposed addition of the 14 MGD of UFA water will bring the salinity of the CCS to a level similar to seawater. This alone is a positive change in that there will no longer be a source of hypersaline water. In addition, because of the "weight" of the water in the CCS will be reduced, there will be less of a pushing effect that drives saltwater westward in the groundwater system. The water that does enter the groundwater system will be at a lower salinity than the resident water and will mix and decrease the overall salinity of the aquifer. The net effect is that the proposed addition will reduce the rate of saltwater migration. It will slow down the westward advance of the saline interface and will, with time, cause the hypersaline plume to recede both laterally to the east and vertically to the base of the aquifer. The benefits of the 14 MGD are realized almost immediately and most dramatically within and near the CCS. However, benefits are also realized over time in the aquifer system as the fresher water introduced in the CCS spreads out and lowers the salinity in the aquifer.

It should be noted, that, initially, as this water is added, the increased water elevation in the CCS will cause an approximately 0.1 foot increase in hydraulic head. I believe that this increase in hydraulic head will be present over a very short period of time, on the order of perhaps months. This is because the "weight" of the hypersaline water that is currently in the CCS is equivalent to a stage that is 0.06 to 0.37 feet greater, for shallow 3 foot canals and deep 20 foot canal, respectively, than if the comparatively lighter saline (seawater) were present in the CCS. Thus, although there is a temporary increase in effective stage of 0.1 feet as the 14 MGD is added, this effective stage quickly begins to dissipate as the salinity of the CCS decreases. The net effect of the freshening is a decrease in hydraulic head of 0.26 feet within the deep 20 foot canals of the CCS and an increase of 0.04 feet in the shallow 3 foot canals.

Q77. What is "hydraulic head" and why is it important?

A77. (PA) Hydraulic head is a measure of liquid pressure above a geodetic datum. It is generally expressed as an elevation. The head at a point in an aquifer is equal to the elevation of the water surface in a well which is open or screened at the point. The amount of water that leaves the CCS is generally in proportion to the hydraulic head, some of which is reflected in the stage of the water in the CCS.

Q78. This evaluation considered the addition of water from the UFA. Do the additions from the L-31E Canal and the Biscayne Aquifer change your analysis?

A78. (PA) My understanding is that the L-31E Canal and Biscayne Aquifer additions are intended to be used as a bridging strategy until the 14 MGD from the UFA is available for a long term solution. Therefore these bridging strategy additions would not occur simultaneously with the 14 MGD UFA freshening. However, the impacts would be similar. Data from 2014 indicate that the amount of actual use of the L-31E water would average approximately 15 MGD over the course of a year, a quantity that is similar to the 14 MGD of Floridan Aquifer water proposed for the 14 MGD of freshening. In addition, the L-31E water is similar in quality to that of the Floridan Aquifer water proposed for the 14 MGD of freshening. Therefore, although the sources are different, the quantity and quality of water used for the bridging strategy and longer term freshening are similar.

B. Impact of the Biscayne Aquifer Withdrawals

Q79. Will FPL's current withdrawals from the Biscayne Aquifer cause saltwater intrusion into areas where saltwater is not already present or otherwise increase saltwater intrusion?

A79. (PA) No. Because the water FPL withdraws from the Biscayne Aquifer is seaward of the freshwater/saltwater interface, it is classified as seawater. These wells are on the seaward side of the freshwater/saltwater interface and so will not pull the interface further inland, which is the classic mechanism of saltwater intrusion. The regulatory criteria for saltwater intrusion refer to the movement of the 250 mg/L chloride isochlor. The water quality of the Biscayne Aquifer in this area exceeds the 250 mg/L threshold and hence there is no 250 mg/L isochlor that could be moved.

C. Impact of the Upper Floridan Aquifer Withdrawals

Q80. What is the salinity level in the water that is and will be withdrawn from the UFA Wells and how does that salinity level compare to salinity levels in the water within the CCS?

A80. (PA) The salinity of water in the UFA is approximately 2.5 psu. The water in the UFA is relatively fresh, compared to the water in the CCS, but is still salty enough that it must be treated prior to its use as drinking water.

Q81. Will the groundwater withdrawals from the proposed withdrawal of up to 14 MGD from the UFA cause saltwater intrusion into areas where saltwater is not already present or otherwise increase saltwater intrusion?

A81. (PA) No.

Q82. What is the basis for your opinion?

A82. (PA) First, the regulatory criteria for saltwater intrusion refer to the movement of the 250 mg/L chloride isochlor. The water quality of the Floridan Aquifer exceeds the 250 mg/L threshold—it is a brackish water aquifer—and hence there is no 250 mg/L chloride isochlor that could be moved. Beyond that technical regulatory explanation, it is my opinion that the withdrawal of 14 MGD from the Floridan Aquifer will have little to no impact on existing water levels or water quality in the Floridan Aquifer. My opinion is based on several lines of evidence: 1) groundwater modeling I performed in support of the SCA for salinity reduction, 2) the results of an APT performed as a condition of certification for Turkey Point Unit 5, 3) the lack of documented drawdown impact from pumping a similar quantity of water for the existing Unit 5 wells, and 4) the minor degradation of water quality over a 10-year period from pumping existing Unit 5 wells. Each of these items is discussed below.

- Groundwater modeling in support of the salinity reduction Site Certification Modification Application quantified the drawdown that was expected to result from the pumping of an additional 14 MGD from the Floridan Aquifer. These results indicated a maximum UFA drawdown ranging between 14.4 feet and 15.1 feet at the Turkey Point site. The extent of drawdown, as defined by the 1-ft drawdown contour encompasses four existing legal users. Overall, the impacts to off-site permitted wells are minor. These findings are presented in a memorandum I prepared entitled "Evaluation of Drawdown in the Upper Floridan Aquifer Due to Proposed Salinity Reduction-based Withdrawals", dated May 13, 2014, which is included as Appendix B to FPL's Site Certification Modification application (Exhibit FPL-027). An updated version of this memorandum, dated November 13, 2014, was provided as an attachment to FPL's response to State Agency Completeness Questions and is provided here as Exhibit FPL-0030.
- FPL conducted an aquifer performance test (APT) in support of the Unit 5 site certification application. A Floridan water supply well was pumped for 72 hours and drawdown was measured in two other water supply wells

and a shallow observation well. This test, which was conducted at 4500 gallons per minute or 6.5 MGD, provided data on the magnitude and extent of drawdown for a withdrawal that was approximately one-half of the proposed 14 MGD. In addition, the APT provided data for derivation of aquifer parameters that can be used in the groundwater models.

- FPL pumped two of the three Unit 5 wells at an approximate rate of 3.5 MGD from 2007 through 2013. Recently, the third well has been pumped at a rate of approximately 4 MGD to assist in managing the salinity of the CCS. There have been no documented drawdown impacts to existing legal users as a result of the current withdrawal.
- With respect to salinity in the UFA, FPL has monitored the water quality of the pumped wells since they began pumping in 2005. There has been only a slight increase in salinity of the pumped water, from 2.1 to 2.6 psu in 10 years of pumping (from 2100 mg/L to 2600 mg/L TDS). This increase was expected and represents a worst case in terms of spatial impact since the measurement is made where the drawdown and potential for upconing of saline water are the greatest. As shown in Exhibit FPL-029, the Floridan wells that are proposed for freshening are separated by about 1900 feet along a linear well field, while the Unit 5 well field is concentrated very close to the plant. For this reason, I expect that any salinity increase in the UFA will be minimal and localized to the FPL production wells.

And, as discussed above, the Floridan and Biscayne aquifers are separated by a confining bed and there is very limited interaction between the two. Therefore, the UFA withdrawals will have no effect on saltwater intrusion in the surficial Biscayne Aquifer.

D. Impact of the L-31 E Canal Withdrawals

Q83. What is the L-31E Canal?

A83. (SS) The L-31E Canal system is part of the Central and Southern Florida Flood Control Project ("C&SF Project"). The SFWMD operates the C&SF Project components, including the L-31E Canal system and the surface water flow to tide from the associated basins. The L-31E Canal system is a borrow canal and levee system that stretches north – south both intercepting water as it flows eastward to tide in southeast Dade County and providing storm surge protection. The L-31E Canal runs parallel to the South Central Biscayne Bay and is operated for reducing the potential for flood and storm surge damage as well as limiting saline water intrusion. Water from the L-31E is discharged to Biscayne Bay at several coastal structures.

Q84. What is the quality of the water FPL has withdrawn from the L-31 E canal?

A84. (JB) The L-31E canal water is fresh, with chloride concentrations consistently below the drinking water criteria of 250 mg/L chloride, which is approximately equivalent to 0.5 psu.

Q85. What is the significance of the L-31E canal water to the salinity in the CCS?

A85. (SS) In order to reduce temperature and salinity in the CCS it is essential that the deficit between evaporation and rainfall is addressed and that water quality is improved. The L-31E is a proximate, high quality source of water that can significantly address the issues in the CCS today in a timely manner.

Q86. When did FPL originally request to utilize L-31E Canal water?

A86. (SS) On August 27, 2014, FPL requested the SFWMD to issue an Emergency Order for temporary authorization to use water from the L-31 E Canal System to help moderate unusually high temperatures and salinity that were occurring in the CCS. On August 28, 2014, the SFWMD granted FPL's request for a temporary authorization (Exhibit FPL-031).

Q87. Were there limitations to FPL's utilization of this L-31E Canal water?

A87. (SS) Yes. FPL was only allowed to withdraw water which otherwise would be discharged to tides in excess of an environmental reservation for Biscayne Bay. Operation of the C&SF Project coastal structure gates in this canal network controls the quantity and timing of water discharged into this portion of Biscayne Bay. Water levels in the L-31E Canal System are influenced by the operation of coastal canal structures. Under normal operating conditions for April 30- October 15, the S-20F, S-20G, and S-21A structures are operated in the "high range," meaning discharges to tide are conditionally made when stages upstream of the structure, including stages within the L-31 E Canal, are 2.2 feet. National Geodetic Vertical Datum ("NGVD") or higher. The structure gates close when headwater stages drop to 1.8 ft. NGVD. During the drier season, the levels are lower.

Further, FPL was prohibited from withdrawing and using water from the L-31E Canal system that was reserved for fish and wildlife by Rule 40E-10.061, F.A.C., for the Nearshore Central Biscayne Bay.[3] The Order included an operational protocol to ensure that the Biscayne Bay reservation was met. Therefore, the only water available to FPL was that water which would otherwise have been discharged to tide and was in excess of the flows reserved for protection of fish and wildlife. There were no assurances provided by this Order that water would be available for FPL's withdrawal and use on any given day. This temporary approval terminated October 15, 2014.

Q88. Did FPL seek additional authorization to use L-31 E water in 2015?

A88. (SS) Yes. On January 26, 2015, FPL submitted a consumptive use permit application to the SFWMD, seeking authorization to divert and use non-reserved water from the L-31E Canal System in order to help reduce high temperature and salinities occurring in the water in the CCS. A copy of FPL's application is provided as Exhibit FPL-032. Like the 2014 request, FPL sought to divert surface water that is available, above the water reserved by Rule 40E-10.061, and which would otherwise be discharged to Biscayne Bay. The SFWMD granted this request on April 10, 2015. A copy of the order is provided as Exhibit FPL-033. In addition to the reservation restriction, this authorization was limited to the time frame of June 1 to November 30, and terminates in 2016, providing FPL with access to the relatively higher quality water from the L-31E for the 2015 and 2016 rainy seasons. This Order also included an operational protocol to ensure the Biscayne Bay reservation was met. Rule 40E-2.301, Fla. Admin. Code, provides the requirements for consumptive use permits. This rule requires reasonable

[3] Rule 40E-10.061, Florida Administrative Code, is the water reservation rule for the Nearshore Central Biscayne Bay. Pursuant to this rule, surface water flowing into the Nearshore Central Biscayne Bay, as derived from various and listed contributing canal reaches, is reserved from allocation.

assurance that the proposed use of water "[w]ill not cause harmful saline water intrusion."

Q89. Has FPL withdrawn water pursuant to that April 10, 2015 Order?

A89. (SS) No, third parties challenged the Order, staying its effectiveness. FPL subsequently asked the SFWMD for an Emergency Order, which it granted on May 19. The Emergency Order allowed FPL to withdraw water from the L-31E, subject to the above described conditions, during the pendency of a challenge. The Emergency Order only provides approval for withdrawals through November 30, 2015. A copy of the order is provided as Exhibit FPL-034.

Q90. Has FPL been able to withdraw and use excess stormwater from the L-31E water pursuant to the 2015 Emergency Authorization?

A90. (SS) Yes. Withdrawals from the L-31E canal have averaged approximately 43 MGD in September and October of 2015.

Q91. What would happen to the water in the L-31E canal if FPL did not utilize it?

A91. (PA) (SS) As stated in FPL's permit, it would be discharged to Biscayne Bay.

Q92. Will FPL's use of this water have any impact on saltwater intrusion in the local aquifers?

A92. (PA) Yes, lowering the salinity of the CCS will help to mitigate saltwater intrusion because the salinity of water discharging from the CCS will be of lower salinity than it otherwise would be. Computer modeling has shown that the westward extent of saltwater intrusion will be less if the freshening is implemented than if nothing is done. I prepared a report, entitled "Evaluation of L-31E Water Addition Impacts on CCS Salinity Reduction," dated March 13,

2015. This report is attached to the SFWMD's April 10, 2015 Final Order (Exhibit FPL-033), which discusses how effective this water will be at CCS salinity reduction. But I understand the intervenor to argue that by using this water FPL directly exacerbates saltwater intrusion. That is not correct. It should be noted that L-31E serves as a means of importing canal water from further north into the CCS. Since the amount of water that is pumped to the CCS is equivalent to the amount diverted to L-31E from the north, there is no net gain or loss of water from L31-E west of the CCS. Because there is no net gain or loss of water in L31-E, there is also no net change in L-31E stage from the level it would be had water not been imported via L-31E.

V. NRC ULTIMATE HEAT SINK LICENSE AMENDMENT

A. FPL's Request for a License Amendment

Q93. Please generally describe the events that led to the filing of the requested amendment.

A93. (SS) In 2013, the CCS experienced a below average rainfall year. At the time, CCS salinity levels were elevated, but not outside of ranges experienced in the past 40 years of operation. As the dry season of 2013/2014 continued, FPL observed a beyond-normal increase in CCS salinity and a corresponding blue-green algae bloom in March 2014. The blue-green algae bloom resulted in high turbidity and impacted the thermo/fluid dynamic properties of the CCS water, making heat exchange in the plant equipment less efficient. Throughout the summer of 2014, the CCS experienced additional algal blooms, increasing salinity and increasing temperature.

Q94. What immediate action, if any, did FPL take as a result of the increased temperature?

A94. (SS) The temperature increases approached the Technical Specification limitation of 100ºF in place at the time. This required FPL to take action to reduce power multiple times during July and August of 2014. As a result, FPL analyzed the CCS intake temperature limitation and through a safety analysis, determined that the 100ºF limitation could be raised to 104ºF, without causing any safety issues. As a result, on July 10, 2014, FPL sought approval from the NRC to increase the UHS temperature limit in Technical Specification 3.7.4 to 104ºF. The NRC reviewed the safety analysis and agreed with FPL's conclusions. The NRC reviewed the environmental impacts of the proposed action and determined that the proposed increase in temperature to 104 ºF would not result in significant environmental impacts.

Q95. Did FPL seek authorization from the NRC to withdraw water?

A95. (SS) No. The NRC simply amended the Technical Specifications to increase the maximum temperature for the UHS. All authorizations to withdraw water came from the SFWMD or the FDEP, with ancillary permits from Miami-Dade County and the U.S. Army Corps of Engineers for activities involving work in wetlands.

Q96. Are FPL's water withdrawals a result of the NRC's license amendment?

A96. (SS) No. FPL's withdrawals have been utilized to reduce temperature and avoid approaching the TS temperature limit, and to reduce salinity, in a regulatory process that has been ongoing for several years. None of these withdrawals were triggered by the NRC license amendment.

B. Impact of the Amendment on Cooling Canal System Salinity and Saltwater Intrusion

Q97. Have you evaluated the impact of the NRC UHS License Amendment on salinity in the CCS?

A97. (PA) Yes. I have evaluated the potential salinity change as a result of the license amendment and find it to be insignificant. My opinion is based on my experience and familiarity with the CCS as well as on an analysis performed for FPL's Site Certification Application (SCA) to the FDEP for the uprate project. A copy of this analysis, "Appendix 10.6 Cooling Canal System Modeling Report," is provided in Exhibit FPL-035. This analysis predicted a 0.9 degree Fahrenheit (F) increase in temperature of water leaving the CCS and returning to the units and a 2.5 degree F increase in water entering the CCS as a result of increasing the output from 1400 MW to 1608 MW from Units 3 and 4. FPL then used this temperature increase to predict an increase in evaporation from the CCS that would in turn increase salinity by 2.5 to 3.6 psu.[4] The relevant passage from the Site Certification Application (Chapter 5) is also included in Exhibit FPL-035. On a percentage basis, this temperature rise is between 23 and 63 percent of the 4 degree increase that could theoretically occur from the UHS amendment and of the same order of magnitude. I have reviewed this evaluation and find it to be reasonable and reliable and that it can be used to understand the impact of a 4 degree F increase in temperature from the UHS amendment.

Q98. Can you extrapolate the uprate analysis to ascertain the impacts from the NRC's UHS amendment?

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[4] In fact, my understanding is that, with the retirement of Unit 2 following the uprates, there was no increased heat load into the CCS as a result of the uprate.

A98. (PA) Yes. In FPL's SCA for the uprate, the predicted uprate temperature increase was characterized as "insignificant relative to the existing seasonal changes of up to 20 degrees F between seasons at any given location in the system." Using similar reasoning, the effect of the 4 degree temperature increase due to the amendment would also be minimal. Using the computations from the uprate, a 2.5 degree increase at the plant intake resulted in a maximum increase in salinity of 3.6 psu. A linear interpolation for a 4 degree average increase in temperature results in a 5.8 psu increase in salinity at the plant intake. The incremental effect of increasing salinity by 5.8 psu is to increase density by 0.0021 g/cm^3. This increase in density increases the hydraulic head at the bottom of a 20 foot canal by 0.04 foot. The 0.04 foot increase in hydraulic head is practically small, less than ½ inch, and well within random natural fluctuations caused by climate, wind, pumping, and CCS operations. It would have little impact on the surrounding aquifer, considering the temporary nature of the 4 degree increase, as discussed in more detail below.

Q99. Is this analysis conservative?

A99. (PA) Very much so. The uprate increase would be more temporally constant than the seasonally required 4 degree increase for the amendment. In other words, while the maximum allowed temperature was increased by 4 degrees through the UHS amendment, it would not result in an increase in the *average* temperature by nearly that amount because in the non-peak summer months the temperature would not be affected, and even in the summer, the temperature would only potentially be affected. So, while it is difficult to predict with certainty the precise average temperature increase associated with the UHS amendment, it will certainly be significantly less than 4 degrees.

Q100. Are there other factors to consider in this analysis?

A100. (PA) Yes. The computed increases in density and hydraulic head resulting from the 4 degree temperature increase outlined above are also conservative because a temperature increase has the opposite effect on density than salinity: warmer water is less dense than colder water. The incremental effect of increasing water temperature by 4 degrees F is to decrease density by 0.00077 g/cm^3. The magnitude of this decrease in density is equivalent to 0.37 times the increase in density due to the salinity increase (0.00077g/cm^3 / 0.0021 g/cm^3). So, instead of increasing the hydraulic head by 0.04 feet, the net effect of the salinity and temperature increase is to increase the hydraulic head by 0.025 feet. Other relevant variables that influence the stage in the CCS, such as precipitation, air temperature, and wind speed would also affect the stage to a greater degree.

Q101. Assuming FPL complies with the FDEP Administrative Order and continues freshening the CCS, how would that impact this analysis?

A101. (PA) FPL's freshening project would have a number of impacts. As I discuss in more detail below, the addition of 14 MGD of UFA water will increase the volume of water and stage in the CCS. However, the added water, which has a very low salinity (~3 psu), also decreases the overall salinity of the CCS. Since hydraulic head is a function of density, the hydraulic head in the CCS decreases as the salinity of the CCS decreases. The added stage due to added water and the reduced hydraulic head due to the salinity decrease tend to cancel one another. In the longer run, the freshening impacts of these additions would overwhelm any potential salinity increases from the UHS amendment. Moreover, I would anticipate that the freshening project will make it much less likely that the CCS temperature would extend into the 4 degree band authorized by the amendment. Because the water would be fresher, it would be better able to serve as a heat sink to the environment. In other words, once the CCS freshening project is complete, there may no longer be a need to utilize the higher CCS temperatures authorized by the UHS amendment.

Q102. Has the Uprate Monitoring Plan identified any environmental effects from the NRC's approval of a higher ultimate heat sink temperature limit?

A102. (JB) No. In fact, despite the increase in the CCS specific conductance (salinity) and temperature in the CCS since the summer/fall of 2013 (preceding FPL's license amendment request), increased effects have yet to be identified in the surrounding environment

It should be noted that the Uprate Monitoring station closest to the intake (TPSWCCS-6, located several thousand feet upstream) has had an average temperature of 86.8°F in the Post-Uprate period. And since the NRC's approval in early August 2014 to increase the temperature operating limits from 100°F to 104°F, there have been a total of only 61 hours where water temperature at TPSWCCS-6 was in excess of 100°F (through September 30, 2015). During this time, the maximum temperature at this location was 101.8°F. As TPSWCCS-6 is not located right at the plant intake and additional cooling occurs before the water reaches the plant, I understand that the plant intake temperature has not exceeded 100°F since August 2014, as shown in Exhibit FPL-012.

Q103. Mr. Andersen's evaluation was based on a four degree average temperature increase, which he noted was very conservative because the CCS likely would not experience an average four degree increase. Can you quantify a temperature increase that would be more likely?

A103. (JB) Yes. The percentage of time when inlet temperatures are greater than 100°F is so limited (if they even occur) that I would expect the effects to be negligible. To illustrate this point, I looked at temperature data in the CCS from August 9, 2014 (the day after the NRC approved the license amendment increase to 104°F) to September 30, 2015 and calculated CCS–wide averages. As discussed above, while the plant intake has not experienced temperatures above 100°F, the closest Uprate Monitoring Program station TPSWCCS-6, has. I then calculated the average CCS temperatures with and without the intake temperatures at TPSWCCS-6 over 100°F. The first calculation included all temperatures in the CCS (based on stations TPSWCCS-1, 2, 4, 5, and 6) including the 61 hours the temperature at CCS-6 exceeded 100°F. This calculated average temperature was 91.876°F. For the second calculation, all temperatures in the CCS (based again on stations TPSWCCS-1, 2, 4, 5, and 6) were included except for any temperatures at TPSWCCS-6 which were over 100°F. To account for the fact that the rest of the CCS would be warmer than normal when the TPSWCCS-6 exceeded 100°F, I then subtracted the amounts by which TPSWCCS-6 exceeded 100°F from each of the other stations. The resulting average temperature was

91.871°F. In other words, based on actual data and using TPSWCCS-6 as an illustrative and conservative proxy for the inlet temperature, the effect of the NRC's license amendment over the past year would have been an increase in CCS average temperature of only 0.005°F. In essence, this calculation illustrates what the average CCS temperature increase might have been if the Technical Specification monitoring location were at TPSWCCS-6, instead of a few thousand feet upstream. This calculation is explained in more detail in Exhibit FPL-036.

Q104. If there were an impact to the surrounding aquifers from the NRC license amendment, would the data from the Uprate Monitoring Program identify that impact?

A104. (JB) Yes, but with a caveat. As required by the Monitoring Plan, components of water and salt inflow and outflow from the CCS are calculated on a daily basis for each reporting period. The water and salt budgets help explain the hydrologic dynamics within the CCS and may be used to assess the effect of climatic or operational changes on the CCS water levels and salinities. The water budget reasonably simulates changes that have been occurring in the CCS, including the increases in the salinity and effects of temporary freshening efforts. This tool, coupled with the current monitoring, provides reasonable assurances that the effects of the CCS on the groundwater are being carefully evaluated. That said however, the monitoring will not be able to detect the effects associated with a negligible temperature change in the CCS such as 0.005°F. In fact, the instrumentation would not be able to detect that small of a change in temperature.

VI. THE NRC'S ENVIRONMENTAL ASSESSMENTS

Q105. Have you reviewed the NRC's EA for the UHS License Amendment?

A105. (All) Yes.

Q106. Does the NRC's EA address the environmental impacts of the license amendment?

A106. (All) Yes. At the outset, the NRC's EA explains that it has performed several previous evaluations of environmental impacts at Turkey Point, including the NRC's March 2012 environmental assessment and final FONSI for the Turkey Point extended power uprate (the "Uprate EA") (Exhibit NRC-022). It explains that the descriptions therein continue to accurately depict the Turkey Point site and environs. In the Uprate EA, the NRC explained that

- the CCS is hypersaline, but does not discharge directly to fresh or marine surface waters;
- makeup water to replace water lost due to evaporation comes from rainfall, storm water runoff, and from infiltration and exchange of saline water with local groundwater and Biscayne Bay;
- while the Biscayne Aquifer has been declared a sole-source aquifer by the EPA, it contains saline to saltwater in the area of Turkey Point and is not usable as a potable water supply;
- below about 40 feet into the Biscayne aquifer relatively high salinity (greater than 28 ppt) exists year round;
- Florida classifies the groundwater in this area as G-III based on its salinity, which means that it has no reasonable potential as a future source of drinking water due to high total dissolved solids.
- because the canals are unlined, there is an exchange of water between the CCS and local groundwater;
- under uprated conditions the quantity of waste heat discharged by each nuclear unit would increase, which would increase temperature and salinity in the CCS; and

- data and other documentation show that there is indirect surface water communication between the CCS and Biscayne Bay.

The Uprate EA also notes that FDEP imposed Conditions of Certification on its approval of the uprate to address impacts from the salinity of the CCS, and explained that:

- the Conditions of Certification require FPL to monitor and assess the potential direct and indirect impacts to ground and surface water from the proposed uprate, which includes measuring water temperature and salinity in the CCS and monitoring the American crocodile populations;

- the monitoring plan expands FPL's monitoring of the CCS's ground and surface water to include the land and water bodies surrounding the PTN site such as Biscayne Bay;

- groundwater monitoring well clusters at selected sites had been constructed in accordance with the monitoring plan and an associated quality assurance plan and would provide field data prior to implementation of the proposed uprate to characterize existing environmental conditions;

- FDEP would require additional measures if the data indicate an adverse impact, including enhanced monitoring, modeling or mitigation would likely be required to evaluate or to abate such impacts; and

- Mitigation measures to comply with State and local water quality standards may include methods to reduce and mitigate salinity levels in groundwater and operational changes to the CCS system to reduce environmental impacts.

Q107. Is this generally consistent with your testimony?

A107. (All) Yes.

Q108. How does the 2014 UHS Amendment EA update this information?

A108. (All) The NRC's 2014 UHS Amendment EA explains that FPL requested the license amendment because "high air temperatures, low rainfall, and other factors contribute[d] to conditions resulting in a UHS temperature in excess of 100°F that would otherwise necessitate FPL to place Turkey Point in cold shutdown." It goes on to state:

> Under the proposed action, the CCS could experience temperatures between 100°F and 104°F at the TS monitoring location near the north end of the system for short durations during periods of peak summer air temperatures and low rainfall. Such conditions may not be experienced at all depending on site and weather conditions. Temperature increases would also increase CCS water evaporation rates and result in higher salinity levels. This effect would also be temporary and short in duration because salinity would again decrease upon natural freshwater recharge of the system (i.e., through rainfall, stormwater runoff, and groundwater exchange). No other onsite or offsite waters would be affected by the proposed UHS temperature limit increase.

Q109. Is this description consistent with your testimony?

A109. (All) Yes.

(SS) The EA's statement that temperatures within this band would be temporary or may not occur at all has proven to be correct as the monitored UHS temperature has not, in fact, reached 100°F in 2015.

(JB) The EA's discussion is consistent with the environmental impacts I would have expected and the environmental impacts I have observed. Even with the significant increase in salinity prior to the license amendment and the continuation of relatively high salinities over the past year, there still has not been a discernable corresponding impact on groundwater outside the CCS, indicating a muted or buffered response. I would expect any impact from the marginal increase in salinity associated with the limited amount of time the temperature exceeds 100°F to be negligible.

(PA) The EA's discussion is consistent with what I would expect based on the operation of the CCS and the insignificant impacts on salinity that I would predict.

Q110. Do you agree with the NRC's conclusion that the UHS amendment would not have a significant environmental impact?

A110. (JB, PA) Yes.

Q111. Did the EA provide any update of the monitoring activities required by the FDEP Conditions of Certification that were discussed in the 2012 Uprate EA?

A111. (All) Yes. The EA explained that FPL "anticipate[d] the FDEP to issue an Administrative Order requiring FPL to install up to six new wells that will pump approximately 14 MGD of water from the Floridan Aquifer into the CCS." It explained that the addition of this water would reduce the salinity of the CCS to the equivalent of Biscayne Bay and that such withdrawals could also help moderate water temperatures. This Administrative Order implements and enforces Condition X of the Site Certification for Turkey Point Units 3, 4 and 5.

Q112. Did the AO as issued present significantly different information from the anticipated AO described in the EA?

A112. (SS) No. The AO reflects that the CCS has had some interaction with nearby groundwater and, as anticipated in the NRC's EA, it requires FPL to reduce CCS salinity to approximately that of nearby Biscayne Bay. UFA wells are the method FPL intends to use to reduce and maintain salinity in the CCS at the target level identified in the AO.

Q113. Does the recent Miami-Dade County NOV and Consent Agreement present significantly different information from that described in the EA?

A113. (SS) While they reflect certain details not addressed in the EA, they are generally consistent. Like the AO, the NOV reflects that the CCS has had some interaction with nearby groundwater. Under the Consent Agreement, FPL has agreed to take additional measures to mitigate this impact, which will generally improve groundwater quality in the region.

Q114. Did the NRC's EA discuss FPL's withdrawal of other water to alleviate CCS temperature and salinity?

A114. (All) Yes. The NRC's EA discussed FPL's anticipated withdrawal of 30 MGD of saltwater from the Biscayne Aquifer and the reallocation of 5 MGD of brackish Floridan Aquifer water from Unit 5.

Q115. Is this description consistent with your testimony?

A115. (All) Yes, although beginning in 2015, FPL's withdrawals from the Biscayne Aquifer have exceeded the EA's prediction by up to 15 MGD.

Q116. The EA did not identify any negative environmental impacts from the Biscayne or UFA withdrawals. Do you agree with that position?

A116. (JB, PA) Yes. As discussed above, these withdrawals will alleviate CCS salinity and have a positive impact on saltwater intrusion.

Q117. Has FPL utilized any additional water not discussed in the EA?

A117. (All) Yes. After the NRC published the EA and granted the license amendment, FPL obtained emergency approval to utilize excess storm water from the L-31E canal in 2014 and again in 2015.

Q118. Would the inclusion of this information materially change the EA?

A118. (JB, PA) No. We do not expect any significant environmental impact associated with the L-31E withdrawals.

Q119. Did the NRC's EA evaluate the impact of the amendment on federally-protected species or habitats?

A119. (SS) Yes. The EA determined that the American crocodile is the only Federally-listed species that has the potential to be affected by the proposed action. In accordance with the Endangered Species Act, the NRC staff consulted with the local staff of the U.S. Fish and Wildlife Service. The NRC staff prepared a biological assessment (Exhibit NRC-010) that considers the potential for the amendment to reduce hatchling survival, alter crocodile growth rates, and reduce habitat availability and concludes that the amendment is not likely to adversely affect the American crocodile and would have no effect on the species' designated critical habitat. By letter dated July 29, 2014, (Exhibit NRC-021) the Fish and Wildlife Service concurred with the NRC's conclusions.

Q120. Did the NRC's EA evaluate FPL's use of copper sulfate to manage algae and the potential effects on crocodiles?

A120. (SS) Yes. The EA explained that FPL received permission to use copper sulfate, hydrogen peroxide, and a bio-stimulant to treat the algae, that FPL would be required to monitor the CCS for associated impacts, and that the NRC had performed a biological assessment in accordance with the Endangered Species Act, in which it stated that FPL has not observed any behavioral or distributional changes or any other noticeable differences that would indicate effects to crocodiles resulting from either the presence of higher algae concentrations or the chemical treatments.

Q121. Did the NRC's EA consider alternatives to the license amendment?

A121. (SS) Yes. As an alternative to the proposed action, the EA considered denial of the proposed license amendment, which it noted would have negative impacts on grid reliability.