UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In The Matter Of:	)	
	)	
FLORIDA POWER & LIGHT COMPANY	)	**Docket Nos. 52-040-COL & 52-041-COL**
	)	**ASLBP No. 10-903-02-COL-BD01**
(Turkey Point Units 6 and 7)	)	
	)	

PRE-FILED DIRECT TESTIMONY OF MR. PAUL JACOBS

Introduction

What is your name and business address?

1. My name is Paul Jacobs. My business address is 15430 Endeavor Drive, Jupiter, FL 33478.

Who is your current employer and what is your position there?

2. My current employer is Florida Power & Light Company (FPL). I am the Supervising Engineer for the new Turkey Point Units 6 & 7 (Turkey Point) nuclear projects. In that role, I am the engineering lead for the preparation of licensing documents submitted in support of obtaining federal and state permits. I also support responses to requests for additional information from the U.S. Nuclear Regulatory Commission (NRC), as well as questions from state and local agencies.

Please describe your professional qualifications and experience.

3. I have 45 years of experience in the power generation industry as a design engineer, consulting engineer, and independent business owner. I have held my current position

since May 2006, and have worked for FPL since January 2006. From 1997-2005, as well as earlier in my career, I worked at the Indian Point Nuclear Plant facility in New York in many capacities. These included acting as a power uprate project engineer, an inservice test engineer, an inservice test assessment engineer, a project engineer, and a design basis engineer. I've also done engineering work for the J.A. Fitzpatrick Nuclear Plant, the Susquehanna Nuclear Station, and the Comanche Peak Nuclear Power Plant. Some of the above work was done through the "Energy and Environmental Management Corporation," which I was president of from 1985-2000. Prior to going into the private sector, I worked as a Coast Guard licensed Third Assistant Engineer on several United States flag vessels.

4. I am certified as a professional engineer in the State of California, and am a member of the American Nuclear Society and the American Society of Mechanical Engineers. I have a Bachelor of Science degree in Nuclear Engineering from the State University of New York, Maritime College. I also have taken graduate courses towards a master's degree in nuclear engineering from New York University. My resume is attached to this testimony in Attachment A.

What is the purpose of your testimony?

5. This testimony provides background information regarding FPL's proposed Turkey Point nuclear power plant. It also summarizes the processes for obtaining, using, and disposing of water associated with the circulating water system for the proposed plant.

Discussion

Please describe the proposed Turkey Point project.

6. FPL currently owns and operates the Turkey Point Nuclear Generating Station in southeastern Florida, which is located approximately 25 miles from Miami. On June 30, 2009, FPL submitted combined license applications to the U.S. NRC to construct and operate Turkey Point Units 6 & 7 at that Station, which will be two Westinghouse Advanced Passive 1000 (AP1000) Pressurized Water Reactors. These two Units will generate approximately 2,200 megawatts of electricity,[1] sufficient to supply over one million additional residential customers.

The Use of Cooling Water in Turkey Point's Circulating Water System

What is the origin of the primary source of water to be used for cooling purposes in the circulating water system at the proposed Turkey Point Units?

7. Turkey Point will use water for cooling in its circulating water system. The primary source of this water will be treated wastewater from the Miami-Dade Water and Sewer Department's South District Wastewater Treatment Plant, located at 8950 SW 232nd St., Miami, FL 33190 (South District Plant).

Is reclaimed wastewater the only source of water that will be used for cooling?

8. No. While reclaimed wastewater will be the primary source of cooling water, radial collector wells will be available to extract saltwater whenever the reclaimed wastewater

[1] NRC-008A, U.S. Nuclear Regulatory Commission, *Environmental Impact Statement for Combined Licenses (COLs) for Turkey Point Nuclear Plant Units 6 and 7: Final Report*, at 3-5 (Oct. 2016) (hereinafter FEIS).

is not provided in sufficient quality and quantity.[2] These radial collector wells will be located in the subsurface sediment of Biscayne Bay.[3] FPL anticipates that the radial collector wells will be used infrequently and for a specified limited duration, however, because FPL does not expect there to be much disruption to the supply of reclaimed wastewater.[4] However, the radial collector wells are capable of supplying the Units with their full requirements for cooling water, if necessary.[5]

How is wastewater treated at the South District Plant?

9. The South District Plant is required to meet standards set by Florida regulations for using reclaimed wastewater in open cooling towers. The initial treatment of the raw wastewater at the South District Plant will undergo conventional treatment to separate heavy solids; progressively converting biological matter into a solid mass, and then neutralization of the biological solids followed by chemical or physical disinfection.[6] Recently established enhanced treatment includes sand filtration and additional disinfection. This added treatment meets the requirement that allows the use of reclaimed water in open cooling towers.

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[2] NRC-008A (FEIS) at 3-8.
[3] NRC-008A (FEIS) at 3-8.
[4] NRC-008A (FEIS) at 5-34.
[5] NRC-008A (FEIS) at 3-41.
[6] Miami-Dade.gov, South District Wastewater Treatment Plant, *available at* http://www.miamidade.gov/water/south-dade-reclamation.asp.

How does FPL intend to transport reclaimed water from the South District Plant to its own water treatment facility on site at Turkey Point?

10. Once treated at the South District Plant, the reclaimed wastewater will be transported to the Turkey Point wastewater treatment facility through nine miles of new pipeline.[7] Most of the pipeline (approximately 6.5 miles) would be located in existing FPL transmission corridors.[8]

How will FPL further treat the reclaimed wastewater after it arrives at the Turkey Point water treatment plant?

11. Once the wastewater arrives at the Turkey Point Reclaimed Water Treatment Facility, additional treatment will be performed to reduce or eliminate certain constituents from the waste stream. Turkey Point's treatment facility will use pumps, several types of filters, and clarifiers to reduce concentrations of iron, magnesium, oil and grease, total suspended solids, nutrients, and silica.[9] It will also treat the wastewater to prevent biofouling in the pipelines that would supply water to the cooling towers.[10] The process will involve flow equalization, continuous water quality monitoring, flow metering, dechlorination, nitrification, chemical phosphorous removal, clarification, pH adjustment, deep filter bed denitrification, chlorination, and water quality monitoring.

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[7] NRC-008A (FEIS) at 3-20.
[8] NRC-008A (FEIS) at 3-20.
[9] NRC-008A (FEIS) at 3-9.
[10] NRC-008A (FEIS) at 3-31.

Where will the reclaimed wastewater be stored after it is treated at the South District Plant and Turkey Point's facility?

12. After receiving treatment at both the South District Plant and at Turkey Point's treatment facility, the reclaimed wastewater will be stored in a "makeup water reservoir" at the Turkey Point site. This reservoir will occupy 37 acres just south of Units 6 & 7.[11] The reservoir will have reinforced concrete walls that are approximately 25 feet high, along with a concrete slab floor.[12]

13. In addition to the water treatment process at the South District Plant and at Turkey Point's treatment facility, the chemistry of the circulating water system is maintained by a local chemical feed system at the circulating water system cooling tower. The purpose of this system is to maintain a noncorrosive, nonscale forming condition and to limit the biological film formation on the plant heat removal components.

How will the reclaimed wastewater be used at Turkey Point?

14. The treated reclaimed wastewater will be used as cooling tower makeup water in the circulating water system attached to one of the six cooling towers that will support Units 6 & 7. Additional reclaimed wastewater will be continually added to the circulating water system to make up for water leaving the system through the normal process of evaporation and drift (as described in more detail below).

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[11] NRC-008A (FEIS) at 3-9.
[12] NRC-008A (FEIS) at 3-9.

Why do nuclear power plants need circulating water systems for cooling use?

15. Nuclear power plants similar to those proposed at Turkey Point have essentially three different water loops. The first loop consists of "primary" water that is directly heated by the nuclear fuel source. This hot, pressurized water circulates through a steam generator in thousands of tubes. Outside the tubes in the steam generator is another water source. The heat from the tubes in the first loop heats this "secondary" water in the second loop, which ultimately turns to steam and generates electricity by spinning the main turbines. After generating electricity, the steam from the secondary water system passes through a condenser, which is cooled by water in the third loop. This is known as the "circulating water system." The reclaimed wastewater discussed in this Testimony will be used for the cooling water in the circulating water system. That water system gradually loses water through (1) evaporation in cooling towers; (2) drift (i.e. droplets or mist) from the cooling towers; and (3) reclaimed wastewater that remains in the system (also known as "blowdown water") and which needs to be disposed.

What happens to the blowdown water that remains in the circulating water system but needs to be disposed?

16. Blowdown water contains concentrations of minerals resulting from the heat removal process that remain in the circulating water system. To maintain the heat removal efficiency, this more concentrated water is no longer optimum for use in the cooling process. Therefore, this water will need to be removed and replaced with new reclaimed water. The cooling tower blowdown will be collected in a sump and then pumped to the underground injection control system consisting of 12 deep injection wells and 6 monitoring wells located along the east and south side of the plant site. The deep

injection wells will then inject the blowdown water into the ground at a depth of approximately 3,000 feet. The final location of the disposed water is known as the "Boulder Zone."

What will happen to the wastewater from the South District Plant if it is not used at Turkey Point?

17. Consistent with the method by which the Miami-Dade Water Treatment and Sewer Department (MDWASD) currently disposes of its wastewater,[13] if the wastewater is not used by Turkey Point 6 & 7, the MDWASD will inject it into the Boulder Zone at the South District Plant.

[13] NRC-008A (FEIS) at 2-61.

I, Paul Jacobs, swear under penalties of perjury that the foregoing testimony is true and correct to the best of my knowledge and belief.

Paul Jacobs

Signature

March 1, 2017

Date

Attachment A

Paul R. Jacobs

EDUCATION
B.S. in Nuclear Engineering, State University of New York, Maritime College, New York
Graduate Courses toward Masters Degree, Nuclear Engineering, New York University

LICENSES & CERTIFICATIONS
Professional Engineer - State of California
U.S. Coast Guard - Third Assistant Engineer

SUMMARY OF QUALIFICATIONS
Forty five years of experience in the power generation industry as a design engineer, consulting engineer, and independent business owner.

PROFESSIONAL EXPERIENCE

Florida Power & Light Company May 2006-Present
New Nuclear Project - Engineering Supervisor
Performed initial reviews of all proposed reactor types being considered for the new nuclear project contemplated by FPL.
Engineering lead for preparation of licensing documents submitted in support of obtaining federal and state permits including final safety analysis report (FSAR) and environmental report (ER) submitted to the Nuclear Regulatory Commission (NRC) and the Site Certification Application submitted to the State of Florida. Provides engineering studies supporting federal and state applications. Continuing support for responses requests for additional information from the NRC and responses to questions from state and local agencies.

Florida Power & Light Company - Turkey Point Nuclear Plant January 2006-May 2006
Procedure writer
As a member of the Life Cycle Management Team, provided assistance to the Maintenance Department, Instrumentation and Control, in support of design modification to the feedwater control system. Specific activities included review of the plant design modification for replacement of the feedwater control valve (main and bypass) control system with digital positioners, revision of all maintenance procedures to incorporate required changes, and development of new procedure for calibration of the positioners and position sensors using hand held communicator or valve link software.

Developed new procedure for performing dynamic testing of the feedwater control system to optimize feedwater control system parameters.

Completed procedure upgrades for conversion of Copes Vulcan valve actuators from D100 to D1000. Developed new procedure for the inspection and overhaul of Anchor Darling double disc gate valves. Provided general support for the revision of maintenance procedures to incorporate feedback and corrective actions. Reviewed and provided input to plant modification for the Feedwater Pump Recirculation Flow Transmitter Replacement project.

Entergy - Indian Point Nuclear Plant, Units 2 & 3 January 2003-November 2005
I&C Power Uprate Project Engineer
Provided assistance to the Indian Point 2 and 3 Maintenance Instrument and Control Department in the preparation, technical review and revision of Technical Specification Surveillance Procedures, Technical Requirement Manual and Offsite Dose Calculation Manual Surveillance Procedures and Instrument Calibration Procedures. During this assignment, Indian Point 2 and 3 implemented a power uprate program. Assigned as the Instrument and Control representative to interface with Power Uprate Project Management and Design Engineering Department to evaluate the required instrumentation hardware and software changes. Responsible for revising the Surveillance and Calibration Procedure for the required uprate changes.

Performed a review of Surveillance Test procedures as part of the Design Basis Initiatives Project. The project objective was to determine if the I&C surveillance procedures were in compliance with design basis requirements. The procedure review included a comprehensive review of the purpose statements, conduct of the test and test acceptance criteria to assure a well defined and documented basis. The review also included the impact of the newly implemented Improved Technical Specifications on the surveillance test performance.

Energy and Environmental Management Corporation 1985-2000
President

Company provided services to the utility industry and to the energy conservation market. Was directly involved in providing services to the nuclear utility industry and was responsible for several major projects as described below.

Indian Point Nuclear Plant, Unit 2 June 2001-December 2002
Inservice Test Engineer
Responsible for performing Inservice Testing (IST) Program related tasks.

- Review, revision and issuance of ASME pump and valve surveillance tests.
- Issuance of quarterly, cold shutdown and refueling valve tests.
- Review and evaluation of valve and pump tests for compliance with ASME Section XI and Technical Specification requirements. Perform pump and valve analyses and prepare 96 hour evaluations.
- Review of Post Maintenance Tests and establishment of reference values.
- Maintain B&C Leak Monitoring System Running Total.
- Maintain External Recirculation Leakage Running Total.
- Incorporate plant changes into IST Basis Document and prepare IST Program for submittal to the NRC.
- Maintain IST Augmented Program.
- Maintain 10CFR50 Appendix J administrative and test procedures and database.
- Provided outage related engineering support for testing of valves and pumps during cold shutdown and refueling.

Indian Point Nuclear Plant, Unit 2 July 1998-June 2001
IST Assessment Engineer
Led a multi-disciplined team that performed a comprehensive re-evaluation of the existing Inservice Test Program (IST) Program at Indian Point 2. The review encompassed all valves and pumps in ASME and non-ASME support systems that provide safety related functions to establish the basis for including or excluding components from the IST Program. The review resulted in the development of an IST Basis Document and a revision to the IST Program that was approved by the NRC without comment.

The effort also included the development of a computerized IST Program Database to capture design and licensing basis information for each component covered by the review team. The database maintains surveillance test information for pumps and valves and is used for trending and analysis of component performance.

Indian Point Nuclear Plant, Unit 2 July 1997-June 1998
Project Engineer
Performed a review of the Indian Point 2 Snubber Program, including a review of all historical records for the visual and functional testing of all snubbers, development of a management data base, revision of all snubber procedures, and resolution of outstanding Quality Assurance Audit items.

Indian Point Nuclear Plant, Unit 3 January 1997-June 1997
Design Basis Engineer
Part of the design engineering group performing design basis and licensing analysis to determine the safety function and safety classification of mechanical and electrical components.

J.A. Fitzpatrick Nuclear Plant November 1996-December 1996
Design Engineer
Assigned to the J.A. FitzPatrick plant as part of a special design-engineering group assembled to assist station management in the performance outage related and general station activities. Included were preparation of nuclear safety evaluations, preparation of design calculations, and review of engineering documents prepared by discipline engineers.

Indian Point Nuclear Plant, Unit 2 July 1996-November 1996
Safety & Licensing Engineer
Provided assistance to the Indian Point 2 Nuclear Safety and Licensing Department including NRC interface, preparation of 10CFR50.59 analyses, Licensee Event Reports preparation, resolution of outstanding technical and licensing issues, review and revision to department procedures, and response to Quality Assurance audits.

Energy & Environmental Management Corp. January 1996-June 1996
Energy Conservation Business Development

Participated in the development of the energy conservation business for Energy and Environmental Management Corporation. The company signed and implemented a marketing and engineering agreement with a major Northeast utility to provide energy conservation services. The company provided services to private, municipal and governmental clients in New York State and other states in the Northeast.

Indian Point Nuclear Plant, Unit 2 June 1991-December 1995
Project Engineer
Was a member of the team performing the Component Declassification Evaluation Project for Con Edison's Indian Point Unit No. 2 Nuclear Power Station. This project involved the evaluation of over five hundred selected safety related components, parts and commodities to determine if the item could be declassified. This effort involved a detailed review of plant systems, operating and emergency procedure and the review of Commercial Grade Dedication packages.

Supervised Service Water Pump operation and maintenance review and an analysis of the lubrication requirements for several thousand components.

Acted as the Project Coordinator for design engineering projects being performed for NYPA Indian Point 3 associated with Cataract's off-site engineering support contract. Mr. Jacobs was also involved in the preparation of dedication packages to support the 1992 refueling Outage.

Indian Point Nuclear Plant June 1988-June 1990
Led a multi disciplined team responsible for performing an analysis of all safety and safety-related systems to identify the required operation in response to various plant events. The purpose of the analysis was to evaluate the effect of the failure of various mechanical components on the ability of the system to perform its intended function. The program resulted in recommendations to management regarding the inclusion of components in the inservice testing program.

Susquehanna Nuclear Station February 1986-September 1986
EAL Project Engineer
Member of the project team that prepared the Emergency Action Level (EALs) for PP&L's Susquehanna Station, including . a complete rewrite of existing EALs and a detailed review of operating and emergency procedures.

Comanche Peak Nuclear Power Plant November 1985-January 1986
Assistant Chief Engineer
Involved in the Design Adequacy Program for Comanche Peak Nuclear Power Plant. Responsibilities included review of system design against applicable design criteria, including design documentation, NSSS specifications, design drawings, NRC regulations, single failure criteria, pipe rupture, etc.

Impell Corporation 1973-1985
Vice President and Northeast Region Manager; Manager, Systems Engineering and Management Services

Responsible for the overall operation, complete responsibility, and authority for the technical, administrative and financial aspects of the operation. The office had in excess of 150 engineers and clerical staff and generated over 15 million in annual revenues.

Responsible for the management of mechanical engineering, pipe support, structural design and analysis, systems engineering, design review, licensing and quality assurance projects for utility and engineering clients.

Responsible for developing a methodology for analyzing plant system response to various initiating events. The methodology, Safety Sequence Analysis, was used by utility clients to verify system design (mechanical, electrical, I&C, etc.) and to evaluate the ability of the plant to respond to pipe break events, single failure criteria (active and passive) and environmental considerations.

Supervised a staff of more than 70 professionals assigned to the Systems Engineering and ManagementServices Division; responsible for overall coordination of division and project activities including technical review of work, client liaison, division and project budget, and schedule control.

Was the Project Coordinator for a five (5) year effort at the Shoreham Nuclear Power Station during its construction. Managed a group of twenty five (25) engineers and designers involved in the layout and design of mechanical systems, large bore and small bore piping and support design and conduit and conduit support design.

Ebasco Services, Inc. 1968-1973
Principal Mechanical/Nuclear Engineer

Principal Mechanical/Nuclear Engineer for a large architect-engineering firm. As Lead Mechanical Job Engineer and Project Engineer on several large nuclear power plant projects was responsible for the preparation of detailed system designs, design and analysis of manufacturer equipment proposals for the reactor, auxiliary, and steam conversion systems.

As Project Engineer on the Chin-Shan Nuclear Power Station, responsibilities included cross-discipline coordination of licensing and engineering activities. Duties also included responsibility for work assignments and review of all mechanical work on the project.

As Mechanical Nuclear Engineer on Tsuruga Nuclear Power Station, Vermont Yankee Nuclear Power Station, and WPPSS Nuclear Project No. 3, duties included total technical responsibility for the design of safety related engineering activities.

Assignments also included preparation and review of the Preliminary Safety Analysis Report, ER, and State Application for the WPPSS Nuclear Project. During the early WPPSS Project stages, assignments included NSSS evaluations, site studies and conceptual design.

Military Sea Transportation Service 1966-1968
Coast Guard Licensed Third Assistant Engineer
Performed duties of a Third Assistant Engineer on a United States merchant vessel. Responsible for the operation of the main steam boilers and propulsion systems and ship auxiliaries. Performed maintenance activities on ships engineer room equipment.

PROFESSIONAL AFFILIATIONS
American Nuclear Society
American Society of Mechanical Engineers