UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	
FLORIDA POWER & LIGHT COMPANY	Docket No. 50-335-OLA
(St. Lucie Plant, Unit No. 1)	ASLBP No. 88-560-01-LA

AFFIDAVIT OF JOHN B. HOUGHTALING
ON ADMITTED CONTENTIONS 4 AND 5

I, John B. Houghtaling, being duly sworn, say as follows:

1. I am a Project Manager with Ebasco Services Inc., Two World Trade Center, New York, New York 10048 and presently assigned at the New Orleans Regional Office located on 2400 Veterans Memorial Boulevard in Kenner, Louisiana 70065 where I am the Manager of Operations. I am familiar with the systems at St. Lucie 1 having worked on the project during the design and subsequent stages of its operation. A summary of my qualifications and experience is attached hereto as Exhibit A, which is incorporated herein by reference. I have personal knowledge of the matters stated herein, and believe them to be true and

correct. This affidavit is offered in support of "Licensee's Motion for Summary Disposition of Intervenor's Contentions," regarding Admitted Contentions 4 and 5.

2. Admitted Contention 4 (Originally Amended Petition Contention 8) states:

> That the high-density design of the fuel storage racks will cause higher heat loads and increases in water temperature which could cause a loss-of-cooling accident and/or challenge the reliability and testability of the systems designed for decay heat and other residual heat removal, which could, in turn, cause a major release of radioactivity into the environment.

The bases for Admitted Contention No. 4 were stated as follows:

> a. The NRC has stated in numerous documents that the water in spent fuel pools would normally be kept below 122 degrees F. The present temperature of the water at the St. Lucie plant, Unit No. 1 is estimated to be 110 degrees F. After the reracking, the temperature of the water would rise to 152 degrees F on a normal basis, and could reach 182 degrees F with a full core load added.
>
> b. There is also the possibility that a delay in the make-up emergency water could cause the zirconium cladding on the fuel rods to heat up to such high temperatures that any attempt at later cooling by injecting water back into the pool could hasten the heat up, because water reacts chemically with heated zirconium to produce heat and possible explosions. Thus, the zirconium cladding could catch on fire especially in a high-density design and create an accident not previously evaluated.

3. Admitted Contention No. 5 (Originally Amended Petition Contention No. 9) states:

> That the cooling system will be unable to accommodate the increased heat load in the pool resulting from the high density storage system and a full core discharge in the event of a single failure of any of the pumps or the electrical power supply to the

> pumps on the shell side of the cooling system and/or in the case of a single failure of the electrical power supply to the pumps on the pool side of the spent fuel pool cooling system. This inability will, therefore, create a greater potential for an accidental release of radioactivity into the environment.

No basis was specified to support Admitted Contention No. 5.

4. The purpose of my affidavit is to describe the design and operation of the spent fuel pool cooling system, present NRC criteria and guidance for evaluation of the heat removal capability of the spent fuel pool cooling system, and demonstrate compliance. My affidavit establishes that there is no increased risk of a loss-of-cooling event and/or reduction in system reliability or testability. The affidavit also demonstrates that, consistent with the requirements of Criterion 44 of Appendix A to 10 C.F.R. Part 50, even in the event of a single active failure, the spent fuel pool cooling system at St. Lucie Unit 1 will adequately accommodate the increased heat load resulting from high density storage and a full core discharge.

5. The spent fuel pool cooling system is a closed loop consisting of two full capacity pumps, one heat exchanger and associated valves, piping and instrumentation. This system is designed to transfer decay heat from spent fuel in the spent fuel pool to the component cooling water (CCW) system. From the CCW system the heat is transferred to the intake cooling water (ICW) system. The spent fuel pool cooling system draws water from the spent fuel pool near the surface and returns it to the

bottom on the opposite side of the spent fuel pool after passing the water through the heat exchanger to remove decay heat. A completely separate loop with its own pump, filters, demineralizer, piping and valves is used to purify the water and maintain spent fuel pool clarity. Since this loop is independent of the cooling system it will not be described further except to say that complete failure of the purification system could not cause unacceptable loss of cooling fluid because both the suction and return lines are provided with siphon breakers to prevent draining of the spent fuel pool to a level below the top of the spent fuel storage racks.

6. The spent fuel pool heat exchanger is a horizontal shell and tube design with a two pass tube side. The spent fuel pool water circulates through the tube side and CCW circulates through the shell side. The heat exchanger is constructed of a carbon steel shell and stainless steel tubes. As stated in the Safety Analysis Report submitted to the NRC, the heat exchanger is capable of transferring 32×10^6 BTU per hour with 100°F CCW and the spent fuel pool at 150°F. It has been constructed to ASME Section III Class C requirements. The spent fuel pool pumps are of the horizontal centrifugal type with mechanical seals. Each pump is capable of pumping 1500 gpm at a 70 foot head. The pumps are constructed of cast stainless steel. Each pump is driven by a 40 HP, 3-Phase, 460 Volt AC motor. All piping in the spent fuel pool cooling system is constructed of seamless stainless steel with welded joints, except for the pump connectors which

are flanged. The operation of the cooling system is controlled manually from a local control panel. High spent fuel pool temperature, high/low spent fuel pool water level and low spent fuel pool cooling pump discharge pressure are annunciated in the control room which is continuously manned. In addition, the opening of spent fuel pool pump breakers and high/low CCW flow alarms are annunciated in the control room. This instrumentation is sufficient to alert the operators in the event of abnormal conditions in the spent fuel pool. Local indication is also provided for pump discharge pressure, heat exchanger inlet temperature and heat exchanger outlet temperature.

7. The spent fuel pool cooling pumps are powered by independent power supplies. The pumps are capable of receiving backup power from the Emergency Diesel Generators and, sufficient time and capacity exists to do so. All active components in the CCW and ICW systems are powered from safety related power sources. All A train components receive A power and all B train components receive B power. Both the components and power supplies are separate and independent. Both the CCW system and ICW system are loaded onto the Emergency Diesel Generators in the event of loss of offsite power.

8. In the highly unlikely case of an extended loss of forced cooling, the spent fuel pool might boil. However, there are several sources of water on the site available to the pool; namely, the Refueling Water Tank (RWT), the Primary Water Tank (PWT), and the city water tank. In addition, there is water

available via a crosstie to the ICW system. This system is seismic Category I and is capable of providing the design capacity of 150 gpm to the spent fuel pool. Adequate time exists for makeup water sources to be utilized and, 150 gpm is more than adequate to maintian the spent fuel pool level under maximum abnormal heat load conditions.

9. The spent fuel pool cooling system normally operates with one pump in service. Water in the pool circulates around the fuel bundles removing heat by forced convection. The heated water is drawn from the pool by the spent fuel pool cooling pump. It then passes through the spent fuel pool heat exchanger, transferring the dcay heat to the CCW system. Failure of a spent fuel pool cooling pump or loss of CCW to the heat exchanger is annunciated in the control room. Sufficient time exists (on the order of hours) for the operators to diagnose and resolve the problem. The CCW system, which removes heat from the spent fuel pool heat exchanger, removes decay heat and other heat loads from the safety related and other systems in the plant during normal modes of operation and, removes decay heat and provides containment cooling after a design basis accident.

10. The CCW system consists of three loops: an A safety loop, a B safety loop and a N common non-safety loop. The N loop is isolated by a Safety Injection Actuation Signal (SIAS). However, the N loop is not isolated on a postulated loss of offsite power event. The A and B loops each have their own pumps which are independently powered. There is a C pump

which can be aligned either to the A or B loop. The A and B loops are redundant and are capable of removing the abnormal maximum heat load from the spent fuel pool during operation with only 1 loop operating. The CCW system water is treated to inhibit corrosion and is monitored on a routine basis.

11. The CCW system rejects the plant heat loads via the CCW heat exchangers to the ICW system. The ICW system pumps seawater from the plant's intake through the CCW heat exchangers, where it removes the heat from the CCW system to the plant discharge which empties into the Atlantic Ocean. The water in the intake is normally drawn from the Atlantic Ocean but, in the event of a severe natural phenomenon which makes that impossible, water can be drawn from the Indian River via Big Mud Creek.

12. The ICW system consists of an A and B train which matches the CCW system, with 3 pumps. The third pump can be aligned with either train and is capable of removing the maximum heat load of a design basis accident with only one train in service. The ICW system is monitored on a regular basis.

13. As stated in the Safety Analysis Report submitted to the NRC, the maximum expected heat generation is 16.43×10^6 BTU during normal operations. This occurs immediately after a fresh batch of 80 fuel bundles are added to the pool with 1440 bundles in the pool from previous refuelings. The maximum expected heat generation is 33.71×10^6 BTU/hour during the time that the full

core is off loaded into the pool with 1440 bundles in the pool from previous refueling. Removal of the heat generated in both cases is within the capability of the spent fuel pool heat exchanger, CCW system and ICW system.

14. As discussed in the Affidavit of Dr. K.P. Singh regarding Admitted Contentions 4 and 5, the maximum expected temperature of the spent fuel pool during normal operation immediately after fuel discharge is 133.3°F, which is below the Section 9.1.3.III.1.d., Standard Review Plan (SRP), NUREG 0800 requirement of 140°F. As is also discussed in the Affidavit of Dr. K.P. Singh regarding Admitted Contentions 4 and 5, the maximum expected temperature of the spent fuel pool during a full core discharge is 150.8°F which is below the SRP Section 9.1.3.III.1.d requirement of less than boiling.

15. The spent fuel pool cooling system has been evaluated against and found to comply with the requirements of Criterion 44 of Appendix A to 10 C.F.R. Part 50. A single active failure of a spent fuel pool cooling pump, either the pump or power supply, will reduce the cooling flow to that of one pump. If this occurs during the maximum normal condition the maximum pool temperature will be 133.3°F. If it occurs under abnormal maximum heat load conditions, the temperature will be less than 167°F. These temperatures are acceptable. Since the pumps are independently powered, failure of a power supply has the same consequences as a failure of a pump. A single active failure of a pump in the CCW system would not reduce cooling to the spent fuel pool since there is a spare pump in that system. Failure of a power supply to one train of the CCW system could reduce the CCW system to one

pump since it might not be possible to align the spare pump to the same electrical bus that the operating CCW train pump would be using. However, the CCW system is fully redundant and is capable of removing the abnormal maximum heat load with only one pump operating. The same is true for the ICW system which provides the ultimate heat sink.

16. A total loss of cooling is not expected to occur based on the following. The only active component in the spent fuel pool cooling system is the spent fuel pool cooling pumps. There are two pumps which are independently powered. For both pumps to fail by either a mechanical failure or loss of power supply is considered unlikely. The CCW system and ICW system to which this system transfers the decay heat are fully redundant and no single active failure can reduce their capacity below that required.

17. All components in the spent fuel pool cooling, CCW and ICW systems have been specified to operate continuously without degradation at their maximum design temperature. These design temperatures are above the expected maximum operating temperatures. The electrical equipment associated with the spent fuel pool system is remotely located and, thus, is not affected by the pool area environmental conditions. All critical components are required to be tested on a regular basis as stated in the Plant Technical Specifications. These specifications have been reviewed and accepted as meeting

all of the requirements for testing. The increase in fuel storage does not change any of the testing requirements and will not reduce the reliability of the system.

18. As stated in the Affidavit of Dr. K.P. Singh regarding Admitted Contentions 4 and 5, even in the unlikely event of a total loss of forced cooling, it would take approximately 13 hours under normal conditions and 5 hours under full core discharge conditions for the pool to boil. This is sufficient time to provide makeup from the RWT, PWT, city water storage tank or the crosstie to the ICW system. Even if the pool were to boil, it would take approximately 52 hours to reach the minimum acceptable water level of 10 feet (Standard Review Plan Section 9.1.3.III.1.e) above the fuel for the normal discharge case and approximately 26 hours for the full core discharge case. This is more than sufficient time to provide makeup to the spent fuel pool. As previously stated, the spent fuel pool has many sources of makeup. These sources are capable of supplying sufficient water to maintain pool water level under the worst postulated conditions. The maximum fuel cladding temperature will be maintained well below any possible zirconium-water reaction temperature because the spent fuel pool is not pressurized and, therefore, the bulk temperature cannot exceed the boiling temperature. As stated in the Affidavit of Dr. K.P. Singh regarding Admitted Contentions 4 and 5, the maximum fuel cladding temperature is well below that at which damage could

occur. Therefore, since sufficient makeup sources exist to maintain the pool water level, the fuel will remain covered and the bulk temperature will not exceed boiling.

19. In conclusion, for both the normal and abnormal maximum heat load conditions the spent fuel pool cooling system will maintain pool temperatures consistent with the NRC criteria and guidance, such that there is no increased risk of a loss-of-cooling event and/or reduction in system reliability or testability. Further, I conclude that even assuming a loss-of-cooling event, the fuel will be kept covered and maintained at a safe temperature.

Further Affiant Sayeth Naught.

John B. Houghtaling

John B. Houghtaling

STATE OF LOUISIANA)
)
JEFFERSON PARISH)

Subscribed and sworn to before me this 28th day of July, 1988. My commission expires: AT DEATH, 19__.

NOTARY PUBLIC

EXHIBIT A

JOHN B. HOUGHTALING

Manager of Operations

EXPERIENCE SUMMARY

Project Manager with over 15 years experience in design engineering and retrofit of nuclear generating stations. This included supervision of site backfit groups. Directly responsible for engineering, modification and maintenance support provided for the owner and the associated related services of planning, scheduling and cost control. Presently Manager of Operations for the New Orleans Office with bottom line accountability since the office was opened in the fall of 1985. Duties include budget preparation, new business planning, proposal submittals as well as overall engineering responsibility for engineering performed by Ebasco in the New Orleans office.

Specific major tasks involved TMI modifications, environmental qualification, seismic qualification, fire protection, condensate polisher, preparation of I&C system descriptions, and responses to numerous NRC Bulletins and Investigations that included responses to Construction Appraisal Team Inspection, the 23 NRC concerns, Joint Interveners Motion, and Prudency.

Field experience consists of three separate assignments with responsibilities that ranged from mechanical detail design and inspection tasks to Project Engineer in charge of design engineers, field engineers, and designers preparing construction work packages for plant modification during shutdown and refueling outages. Supervision of trades and subcontractors in order to support construction was also required.

Administrative responsibilities included implementation of task specific procedures; scope, schedule and manday estimates for accomplishing responses to various NRC Bulletins, NUREGs, Generic Letters, Federal Regulations; assigning and tracking engineering tasks; coordination with Client's engineering, construction and plant operation staff.

REPRESENTATIVE EXPERIENCE

Client	Project	Size	Fuel
Louisiana Power & Light Co.	Waterford Unit No. 3	1165 MW	Nuclear
Florida Power & Light Co.	St. Lucie Unit Nos. 1 & 2	890 MW	Nuclear
Portland General Electric Co.	Trojan	1130 MW	Nuclear
Carolina Power & Light Company	Shearon Harris Unit Nos. 1-[illegible]	900 MW	Nuclear

EMPLOYMENT HISTORY

Ebasco Services Incorporated, New York, New York; 1972 - Present

- Manager of Operations - New Orleans Office - 1986 - Present
- Project Manager, 1985 - 1986
- Project Engineer, 1983 - 1985
- Principal Engineer, 1981 - 1983
- Senior Engineer, 1978 - 1981
- Engineer, 1975 - 1978
- Associate Engineer, 1972 - 1975

Prior to employment with Ebasco, inspection and maintenance responsibilities with several firms involved all aspects of light aircraft airframe repair and engine overhaul, stocking of spare parts, compliance with government airworthness directives, factory instruction manual requirements for periodic and preventative maintenance, welding, sheetmetal, and inspection techniques. Paperwork and records, as well as the airworthness of aircraft, were kept for three large flight schools and numbered approximately 20 aircraft each in addition to those serviced locally.

Daytona Beach Aviation, Daytona Beach, Florida; 1968 - 1972

- Airframe and Engine Inspector

Tew-Mac Aero Service, Tewksbury, Massachusetts; 1966 - 1968

- Airframe and Engine Mechanic

EDUCATION

East Coast Areo Tech - FAA A & E Licenses - 1966
Embry Riddle Aeronautical University - BSAE - 1972
Adelphi University - 24 Credits in MBA Program - 1975

REGISTRATIONS

Successfully passed Part B of the New York State P.E. Exam
FAA Airframe & Power Plant Licenses No. 1678131 - 1966