March 29, 1978

Docket No.: 50-335

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Florida Power & Light Company
ATTN: Dr. Robert E. Uhrig
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Gentlemen:

The Commission has issued the enclosed Amendment No. 22 to Facility Operating License No. DPR-67 for St. Lucie Plant, Unit No. 1. The amendment consists of changes to the Technical Specifications in response to your request dated August 31, 1977, as supplemented December 8 and 19, 1977 and February 8, 1978.

This amendment allows an increase in the spent fuel storage capability from 310 to a maximum of 728 fuel assemblies in the spent fuel pool through the use of high capacity spent fuel racks.

Copies of the Safety Evaluation, Environmental Impact Appraisal, and Notice of Issuance/Negative Declaration are also enclosed.

Sincerely,

Original Signed by

Robert W. Reid, Chief
Operating Reactors Branch #4
Division of Operating Reactors

Enclosures:
1. Amendment No. 22 to DPR-67
2. Safety Evaluation
3. Environmental Impact Appraisal
4. Notice/Negative Declaration

cc w/enclosures: See next page

STSG:DOR
JMcGough
3/25/78
per changes agreed to

OK DONE 3/28/78 MBF
Conc. 1

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SURNAME	RIngram	MFairtile:rm	PErickson	C. Woodhead	RReid	VStello
DATE	3/22/78	3/22/78	3/22/78	3/23/78	3/28/78	3/29/78

NRC FORM 318 (9-76) NRCM 0240 ☆ U.S. GOVERNMENT PRINTING OFFICE: 1976 — 626-624

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

FLORIDA POWER & LIGHT COMPANY

DOCKET NO. 50-335

ST. LUCIE PLANT, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 22
License No. DPR-67

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Florida Power & Light Company (the licensee) dated August 31, 1977, as supplemented December 8 and 19, 1977, and February 8, 1978, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Facility Operating License No. DPR-67 is hereby amended to read as follows:

   (2) <u>Technical Specifications</u>

   The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 22, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Victor Stello, Jr., Acting Assistant
Director for Operating Reactors
Division of Operating Reactors

Attachment:
Changes to the Technical
Specifications

Date of Issuance: March 29, 1978

ATTACHMENT TO LICENSE AMENDMENT NO. 22

FACILITY OPERATING LICENSE NO. DPR-67

DOCKET NO. 50-335

Replace the following pages of the Appendix "A" Technical Specifications with the enclosed pages. The revised pages are identified by Amendment number and contain vertical lines indicating the area of change.

Pages

5-5

5-6

CONTROL ELEMENT ASSEMBLIES

5.3.2 The reactor core shall contain 73 full length and 8 part length control element assemblies. The control element assemblies shall be designed and maintained in accordance with the original design provisions contained in Section 4.2.3.2 of the FSAR with allowance for normal degradation pursuant to the applicable Surveillance Requirements.

5.4 REACTOR COOLANT SYSTEM

DESIGN PRESSURE AND TEMPERATURE

5.4.1 The reactor coolant system is designed and shall be maintained:

a. In accordance with the code requirements specified in Section 5.2 of the FSAR with allowance for normal degradation pursuant to the applicable Surveillance Requirements,

b. For a pressure of 2485 psig, and

c. For a temperature of 650°F, except for the pressurizer which is 700°F.

VOLUME

5.4.2 The total water and steam volume of the reactor coolant system is 11,100 ± 180 cubic feet at a nominal T_{avg} of 567°F.

5.5 EMERGENCY CORE COOLING SYSTEMS

5.5.1 The emergency core cooling systems are designed and shall be maintained in accordance with the original design provisions contained in Section 6.3 of the FSAR with allowance for normal degradation pursuant to the applicable Surveillance Requirements.

5.6 FUEL STORAGE

CRITICALITY

5.6.1 The new fuel storage racks are designed and shall be maintained with a center-to-center distance of not less than 21 inches between fuel assemblies placed in the storage racks. The spent fuel storage racks are designed and shall be maintained with a center-to-center distance of not

CRITICALITY (Continued)

less than 12.53 inches between fuel assemblies placed in the storage racks. These spacings ensure a K_{eff} equivalent to $\leq$ 0.95 with the storage pool filled with unborated water. The K_{eff} of $\leq$ 0.95 includes the conservative assumptions as described in Section 9.1 of the FSAR. In addition, fuel in the storage pool shall have a U-235 loading of $\leq$ 41.45 grams of U-235 per axial centimeter of fuel assembly.

DRAINAGE

5.6.2 The fuel pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 56 feet.

CAPACITY

5.6.3 The spent fuel pool is designed and shall be maintained with a storage capacity limited to no more than 728 fuel assemblies of which the 217 fuel assemblies in the three 7x7 modules and the one 7x10 module nearest the fuel cask compartment shall have decayed for at least 1553 hours.

5.7 SEISMIC CLASSIFICATION

5.7.1 Those structures, systems and components identified as seismic Class I in Section 3.2.1 of the FSAR shall be designed and maintained to the original design provisions contained in Section 3.7 of the FSAR with allowance for normal degradation pursuant to the applicable Surveillance Requirements.

5.8 METEOROLOGICAL TOWER LOCATION

5.8.1 The meteorological tower location shall be as shown on Figure 5.1-1.

5.9 COMPONENT CYCLE OR TRANSIENT LIMITS

5.9.1 The components identified in Table 5.9-1 are designed and shall be maintained within the cyclic or transient limits of Table 5.9-1.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 22 TO FACILITY OPERATING LICENSE NO. DPR-67

FLORIDA POWER & LIGHT COMPANY

ST. LUCIE PLANT UNIT NO. 1

DOCKET NO. 50-333

Introduction

By letter dated August 31, 1977, as supplemented December 8 and 19, 1977 and February 8, 1978, Florida Power & Light Company (FPL or the licensee) requested an amendment to Facility License No. DPR-67 for the St. Lucie Plant Unit No. 1. The amendment request would allow an increase in the spent fuel storage capability from 310 to a maximum of 728 fuel assemblies in the spent fuel pool through the use of high capacity spent fuel racks.

Background

FPL proposes to modify the existing St. Lucie Unit No. 1 spent fuel pool (SFP) to allow continued operation while accommodating an expected increase in the inventory of spent fuel assemblies above the present pool capacity. The first refueling of St. Lucie is scheduled to begin about April 1, 1978. The presently installed spent fuel assembly storage racks have a minimum center-to-center distance of 18 inches. The proposed rack design will establish a minimum center-to-center distance of 12.53 inches between spent fuel assemblies.

Evaluation

Mechanical Design and Materials Aspects

The proposed spent fuel pool modification consists of replacing the existing fuel storage racks with new spent fuel racks that will increase the storage capacity from 310 to 728 fuel assemblies. The modified storage rack is a Combustion Engineering HIGH CAPACITY rack design essentially the same as that licensed in 1977 for Turkey Point, Units 3 and 4. The new design consists of 12 modules having a 7x7 array and two modules with a 7x10 array. Each module is free standing and is supported by four base channels. The interface with the pool boundaries and between modules is designed to transfer normal and shear loads via the rack supports to the pool bottom slab. Each storage module is composed of rectangular storage cavities fabricated from one-quarter inch thick stainless steel plate. Each cavity is capable of accepting one fuel assembly. The cavities are open at the top and bottom to provide a flow path for convective cooling of the fuel assemblies through natural circulation. The entire fuel storage rack assembly is constructed of 304 stainless steel.

The materials, design, fabrication, installation and examination requirements for the racks are in accordance with Subsection NF of Section III of the ASME Boiler and Pressure Vessel Code for Class 3 component supports. The racks are designed to remain within normal code stress limits for loading conditions which include the effects of normal operating loads, thermal loads, and shipping and installation loads. Furthermore the racks are designed to remain within faulted code stress limits for loading conditions which include the effects of normal loads, extreme thermal loads, seismic loads from the maximum earthquake (safe shutdown earthquake (SSE)) and loads from a dropped fuel assembly. The licensee has also determined that the racks would remain within the required (upset) code stress limits for loading conditions that include the effects of the normal design earthquake (operating basis earthquake), which is approximately half the maximum earthquake (SSE).

The seismic design of the racks is based on the structural models and ground motion acceleration records described in the Final Safety Analysis Report (FSAR). The seismic analysis of the racks was performed by the nonlinear time history method for each of the two horizontal directions and by the response spectrum method for the vertical direction. Damping values used were consistent with those specified in the FSAR. Analyses were made for two damping conditions; ie, considering no additional damping due to submergence in water and for an additional 2% damping due to submergence. The seismic excitations along the three orthogonal directions were imposed simultaneously by the method outlined in Regulatory Guide 1.92.

The analysis considered two limiting friction conditions. First, an infinite friction coefficient value was assumed. This provides the maximum loads on the rack and pool structures. Second, a low coefficient of friction was used to obtain the maximum slip motion and to assure that the spacing between modules is sufficient to preclude contact under accident conditions.

The licensee performed a review of the load carrying ability of the spent fuel pool structure and found that the existing structure is capable of supporting the increase in overall loading as a result of the proposed fuel pool modification. With the exception of the increased load due to the additional fuel assemblies, the loads and load combinations considered in the analysis are the same as those listed in the FSAR.

Since the possibility of long term storage of spent fuel exists, we are investigating the effects of the pool environment on the racks, fuel cladding and pool liner. Based upon our preliminary review and previous operating experience, we have concluded that at the pool temperature and the quality of the demineralized water, and taking no credit for inservice inspection, there is reasonable assurance that no significant corrosion of the racks, the fuel cladding or the pool liner will occur over the lifetime of the plant. However, if the results of the current generic review indicate that additional protective measures are warranted to protect the racks, the fuel cladding and/or the liner from the effects of corrosion, the necessary steps and/or inspection programs will be required to assure that an acceptable level of safety is maintained. Any conceivable problems which could be uncovered are of a long term nature and warrant no need for immediate concern.

The criteria used in the analysis, design, and construction of the new spent fuel racks to account for anticipated loadings and postulated conditions that may be imposed upon the structures during their service lifetime are in conformance with established criteria, codes, standards, and specifications acceptable to the NRC staff. The modified spent fuel storage racks meet the standards for seismic Category I components. Therefore, we find that the subject modification proposed by the licensee is acceptable, and in part satisfies the requirements of the General Design Criteria 2, 4, and 61.

Criticality Analyses

The proposed spent fuel assembly racks are to be made up of individual stainless steel containers. These will be 14 feet long and will have a square cross section with an outer dimension of 9.0 inches. The nominal wall thickness of these containers is 0.25 inch, and the minimum thickness is 0.24 inch. The minimum distance between the centers of these square containers is 12.53 inches. This results in an overall fuel region volume fraction of 0.42 in the nominal storage lattice cell.

The FPL fuel pool criticality calculations are based on no burnable poison or control rods in the fuel assemblies, fresh (i.e., unirradiated) fuel with 3.7 weight percent uranium-235, and no soluble boron in the water. For the present fuel assemblies, 3.7 percent enrichment corresponds to a fuel loading of 41.45 grams of uranium-235 per axial centimeter of fuel assembly. This is the fuel loading which was used in the calculations for the nominal storage lattice.

Combustion Engineering's CEPAK computer program was used to obtain the multigroup cross sections for the criticality analysis. The 0.025 ev macroscopic cross section for type 304 stainless steel in the CEPAK program (i.e., 0.26 cm^{-1}) is about 4 percent less than the value reported in the Evaluated Nuclear Data File #3. This lower value for the stainless steel neutron absorption cross section makes the neutron multiplication factors calculated with this method higher and thus more conservative. The NUTEST computer program was used to calculate the self shielding and flux advantage factors for the material heterogeneity, and the DOT-2W discrete ordinates transport program was used for the overall storage lattice cell calculations. The accuracy of this calculational method was checked by comparison with several critical experiments. Calculations were made for experiments with stainless steel clad fuel pins, BWR fuel assemblies surrounded by stainless steel, stainless steel reflectors in a uranyl fluoride solution reactor, and a Combustion Engineering fuel assembly in a stainless steel box. The results of these calculations agreed with the experimental results within about one half of one percent and were generally higher than the experimental values and thus conservative.

By using this calculational method, the infinite neutron multiplication factor for fuel assemblies stored in these racks was found to be about 0.92 at 39°F, and it was found to monotonically decrease as the water temperature was increased. For these racks, it was found that if a fuel assembly is laid on top of a loaded portion of the fuel rack, the neutron multiplication factor will not be greater than the k_∞ value of 0.92.

A worst case calculation was made to ensure that the maximum neutron multiplication factor for fuel assemblies in these racks will be less than 0.95. For this calculation, the most adverse combination of dimensional tolerances was assumed. In addition, it was assumed that every four fuel assemblies were clustered together in their most reactive positions. In response to our request for additional information regarding the possibility of accidentally moving a fuel assembly as close as possible to the outside of a filled rack, FPL stated in their December 8, 1977 submittal that physical constraints have been provided as necessary on the sides of the rack modules to preclude the neutron multiplication factor from exceeding its design value should a fuel assembly be placed as close as possible to the outside of the racks.

The above cited results compare favorably with the results of parametric calculations made with other methods for similar fuel pool storage lattices. By assuming new, unirradiated fuel with no burnable poison or control rods, these calculations yield the maximum neutron multiplication factor that could be obtained throughout the life of the nominal fuel assemblies. This includes the effect of the plutonium which is generated during the fuel cycle.

We find that all factors that could affect the neutron multiplication factor in this pool have been conservatively accounted for and that the maximum neutron multiplication factor in this pool with the proposed racks will not exceed 0.95. This is NRC's acceptance criterion for the maximum (worst case) calculated neutron multiplication factor in a spent fuel pool. This 0.95 acceptance criterion is based on the uncertainties associated with the rigorous calculational methods and provides sufficient margins to preclude criticality in the fuel pool.

We find that when any number of the fuel assemblies which have no more than 41.45 grams of uranium-235 per axial centimeter of fuel assembly are loaded into the proposed racks, the neutron multiplication factor will be less than 0.95.

We conclude that the combined limits of 41.45 grams of U-235 per axial centimeter of fuel assembly and a minimum center-to-center spacing of 12.53 inches between fuel assemblies precludes criticality of fuel in the SFP.

Spent Fuel Cooling

The licensed thermal power for St. Lucie Unit 1 is 2560 MWt. FPL plans to refuel annually. This will require the replacement of about 72 of the 217 fuel assemblies in the core every year.

In their August 31, 1977, submittal, FPL assumed a seven day (168 hour) time interval between reactor shutdown and the time either a one-third core refueling offload or full core offload to the spent fuel pool is completed. The licensee's March 27, 1978 submittal stated that the pool temperature due to a 96-hour interval would be only 5°F greater than the original FSAR analysis. The 96-hours include 72-hours between reactor shutdown and head removal and 24-hours to transfer the last assembly from the reactor to the SFP. We find the 5°F increase small enough to be acceptable. Therefore, FPL states that the bulk pool water temperature can be maintained below 150°F even if a full core unloading is required at a time that would fill the pool.

In Table 9.1-3 of the St. Lucie FSAR, FPL stated that the fuel pool cooling system consists of two pumps, each rated for a flow of 1500 gallons per minute, and one heat exchanger, which has a rated heat removal capacity of 9.4×10^6 BTU/hr with one pump in operation while maintaining the fuel pool water outlet temperature at 120°F with the component cooling water inlet temperature at 100°F.

The St. Lucie FSAR also states that: (1) the components of the fuel pool cooling and purification system have design temperatures of 200°F or greater, (2) there are several emergency sources of fresh water available for making up lost spent fuel pool water and a backup hose connection to the Seismic Category I intake cooling water system which can supply 150 gallons per minute of salt water, (3) alarms which annunciate in the control room are provided to monitor the fuel pool water level, fuel pool temperature and the fuel pool pump discharge pressure.

As shown in Table 9.2-4 of the FSAR, the component cooling water system (CCWS), which removes the heat from the spent fuel pool cooling heat exchanger, has a rated heat removal capacity of 55×10^6 BTU/hr for normal plant operation and a greater capacity for plant shutdown.

In their December 19, 1977 submittal, FPL states that the amount of water in the spent fuel pool is 400,000 gallons or 5.3×10^4 cubic feet without fuel assemblies present in the pool. With fuel assemblies in the pool the water volume is about 4.3×10^4 cubic feet.

After offloading fuel assemblies from a reactor, the maximum heat load in the spent fuel pool is primarily determined by: (1) the number of fuel assemblies transferred to the spent fuel pool, (2) the power history of each assembly, and (3) the cooldown time, i.e., the time interval between reactor shutdown and the time when the final fuel assembly is placed in the spent fuel pool. Since a reduced cooldown time results in an increased heat load, the assumed cooldown time must be a minimum if the associated spent fuel pool heat load not to be exceeded. FPL assumed 96-hour cooldown times for both the annual one-third core offload and the full core offload. While this appears to be conservative for the full core offload it may not always be conservative for the annual, one-third core refueling.

A consequence of this is that the maximum heat load in the spent fuel pool could exceed the 9.4×10^6 BTU/hr FSAR design value after an annual refueling. For the full core offload after which there would be 720 fuel assemblies in the spent fuel pool we calculate that the maximum heat load will be less than 27×10^6 BTU/hr.

The maximum incremental heat load that will be imposed on the plant by this modification is 1.8×10^6 BTU/hr. This increment is the difference in heat loads for a full core offload which essentially fills the present racks and a full core offload which essentially fills the modified storage racks. Since this maximum increment is small in comparison with the 55×10^6 BTU/hr capacity of the CCWS, we find that it will have a negligible effect on the operation of the CCWS and that the present CCWS is adequate for removing the incremental heat load due to the proposed modification.

We find that FPL's value of 150°F for the maximum fuel pool outlet water temperature after the final full core offload is consistent with the stated fuel pool cooling system pump flow rates and the design capability of the heat exchanger. Because of possible shorter unloading times for the annual refuelings, FPL may have to run both spent fuel pool cooling pumps for a short period of time after a refueling offload to keep the pool outlet water temperature from going above 125°F. We find this acceptable.

Since the full core offload will put the maximum heat load of 27×10^6 BTU/hr in the fuel pool, the worst postulated cooling accident would be that where both fuel pool cooling loops fail shortly after transferring a full core to the fuel pool. If we assume for this worst cooling accident: (1) an adiabatic pool with no heat lost to the surroundings; and (2) the heat capacity of 4.3×10^4 cubic feet of water as the only heat sink, the fuel pool would heat up at the rate of 10°F per hour. At this rate it would take about 6 hours to establish bulk boiling in the pool. After reaching bulk boiling, the maximum required water makeup rate for this maximum heat load would be less than 55 gallons per minute. We find that after a full core is unloaded from the reactor vessel, 6 hours will be sufficient time to detect the failure of the loops and establish a 55 gallon per minute makeup rate. We also find that under bulk boiling conditions, 23 feet below the pool surface, the temperature of the fuel will not exceed 350°F. This is an acceptable temperature from the standpoint of the fuel element integrity and surface corrosion.

We conclude that the present cooling capacity in the SFP of the St. Lucie Unit No. 1 facility will be sufficient to handle the incremental heat load that will be added by the proposed modifications. We also conclude that this incremental heat load will not alter the safety considerations of SFP cooling from that which we previously reviewed and found to be acceptable.

Installation of Racks and Fuel Handling

In their August 31, 1977 submittal, FPL states that they plan to install the modified racks in the pool prior to their first refueling. Thus, this proposed fuel rack modification can be made in a dry pool which has not had spent fuel assemblies stored in it, and the new racks can be installed without moving racks over spent fuel assemblies. FPL states that the setpoints limiting the travel of the spent fuel handling machine will be adjusted as necessary to envelope the modified rack arrangement in the pool.

Since there will be no fuel assemblies in the fuel pool for the initial modification, it will not be possible for an accident to result in any increased neutron multiplication factor. After the racks are installed in the pool, the fuel handling procedures that will be implemented in and around the pool will be the same as those procedures that were in effect prior to the modifications. These were previously reviewed and found acceptable by the NRC.

We conclude that the installation and use of the proposed racks as proposed by the licensee is acceptable.

Fuel Handling

The NRC staff has under way a generic review of load handling operations in the vicinity of spent fuel pools to determine the likelihood of a heavy load impacting fuel in the pool and, if necessary, the radiological consequences of such an event. Because St. Lucie Unit 1 is prohibited from the movement of loads with weight in excess of 2000 pounds over spent fuel assemblies in the SFP*, we have concluded that the likelihood of a heavy load handling accident is sufficiently small that the acceptability of the proposed modification is not affected, and that no additional restrictions on load handling operations in the vicinity of the SFP are necessary while our review is under way.

*Technical Specification 3.9.7

We conclude that the consequences of fuel handling accidents in the SFP are not changed from those presented in the Safety Evaluation dated November 1974 and are acceptable.

Radioactive Waste Treatment

The facility contains waste treatment systems designed to collect and process the gaseous, liquid, and solid wastes that might contain radioactive material. The waste treatment systems were evaluated in the Safety Evaluation dated November 1974 (SER) for the facility. There will be no change in the waste treatment systems or in the conclusions of the evaluation of these systems in Section 11.0 of the SER because of the proposed modification.

Summary of Fuel Handling, Radiation Exposure, and Waste Treatment

Our evaluation supports the conclusion that the proposed modification to the St. Lucie Unit 1 is acceptable because:

(1) The increase in occupational radiation exposure to individuals due to the storage of additional fuel in the SFP would be negligible.

(2) The installation and use of the new fuel racks does not alter the potential consequences of the design basis accident for the SFP, i.e., the rupture of a single fuel assembly and the subsequent release of the assembly's radioactive inventory within the gap.

(3) The likelihood of an accident involving heavy loads in the vicinity of the spent fuel pool is sufficiently small that no additional restrictions on load movement are necessary while our generic review of the issues is underway.

Technical Specifications

FPL submitted proposed Technical Specifications relating to spent fuel storage capacity and rack design. During our review of the proposed modification we determined that it was necessary to add additional requirements to the Technical Specifications. These new requirements, which were discussed with and agreed to by FPL will prohibit storage of irradiated fuel assemblies in the St. Lucie Unit No. 1 SFP that contain more than 41.45 grams of uranium-235 per axial centimeter of fuel assembly length.

Conclusion

We have concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (2) such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Dated: March 29, 1978

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

ENVIRONMENTAL IMPACT APPRAISAL BY THE OFFICE OF NUCLEAR REACTOR REGULATION SUPPORTING AMENDMENT NO. 22 TO FACILITY OPERATING LICENSE NO. DPR-67 FLORIDA POWER & LIGHT COMPANY, ST. LUCIE PLANT UNIT NO. 1 DOCKET NO. 50-335

1.0 DESCRIPTION OF PROPOSED ACTION

By letter dated August 31, 1977, as supplemented December 8 and 19, 1977, and February 8, 1978, Florida Power & Light Company (FPL or the licensee) requested an amendment to Facility Operating License No. DPR-67 for the St. Lucie Plant Unit No. 1. The amendment request would allow an increase in the spent fuel storage capability from 310 to a maximum of 728 fuel assemblies in the spent fuel pool through the use of high capacity spent fuel racks. FPL proposes to modify the existing St. Lucie Unit No. 1 spent fuel pool (SFP) to allow continued operation while accommodating an expected increase in the inventory of spent fuel assemblies above the present pool capacity. The first refueling of St. Lucie is scheduled to begin about April 1, 1978. The presently installed spent fuel assembly storage racks have a minimum center-to-center distance of 18-inches. The proposed rack design will establish a minimum center-to-center distance of 12.53-inches between spent fuel assemblies.

2.0 Need for Increased Storage Capacity

St. Lucie Unit No. 1 received its initial operating license on March 1, 1976 and is currently in its first fuel cycle. The first refueling is scheduled for the Spring of 1978. A full core consists of 217 fuel assemblies. During the normal refueling of a pressurized water reactor, about one-third of the fuel assemblies are replaced.

St. Lucie is designed to refuel every 12 months. With the presently designed storage capacity of 310 fuel assemblies, the SFP at St. Lucie could accommodate the projected refueling of the facility through 1981. Full power operation and a plant load factor of 80% was selected for estimating the length of a fuel cycle. In addition, it is prudent engineering practice to reserve space in the SFP to permit the discharge of a full core should it be necessary to inspect or repair core internals. With the present design, St. Lucie would not have the capability to discharge a full core to the SFP after the 1979 refueling outage.

The basic need for the proposed increase in onsite spent fuel storage capacity stems from the current unavailability of offsite storage for spent fuel and the expectation that several years will be required before the necessary storage capacity can be made available.

With the proposed modification, the SFP would have storage capacity to accommodate six additional refuelings over the current storage capacity (of 72 fuel assemblies per refueling). This would provide storage space for the spent fuel which is expected to be generated through 1987. There would also be space in the SFP to discharge a full core through 1984. With the proposed modification, St. Lucie could operate through 1988 before the facility would be forced to shut down due to lack of storage space for spent fuel in the SFP. In our evaluation, we considered the impacts which may result from storing up to an additional 418 spent fuel assemblies in the SFP.

The proposed modification would not alter the external physical geometry of the spent fuel pool or involve significant modifications to the SFP cooling or purification systems. The proposed modification does not affect in any manner the quantity of uranium fuel utilized in the reactor over the anticipated operating life of the facility and thus in no way affects the generation of spent uranium fuel by the facility. The rate of spent fuel generation and the total quantity of spent fuel generated during the anticipated operating lifetime of the facility remains unchanged as a result of the proposed expansion. The modification will increase the number of spent fuel assemblies that could be stored in the SFP and the length of time that some of the fuel assemblies could be stored in the pool.

3.0 Fuel Reprocessing History

Currently, spent fuel is not being reprocessed on a commercial basis in the United States. The Nuclear Fuel Services (NFS) plant at West Valley, New York, was shut down in 1972 for alterations and expansions; on September 22, 1976, NFS informed the Commission that they were withdrawing from the nuclear fuel reprocessing business. The Allied-General Nuclear Services (AGNS) proposed plant in Barnwell, South Carolina, is not licensed to operate. The General Electric Company's (GE) Midwest Fuel Recovery Plant (MFRP) in Morris, Illinois, now referred to as Morris Operation (MO), is in a decommissioned condition. Although no plants are licensed for reprocessing fuel, the storage pool at Morris, Illinois, and the storage pool at West Valley, New York, (on land owned by the State of New York and leased to NFS through 1980) are licensed to store spent fuel. The storage pool at West Valley is not full but NFS is presently not accepting any additional spent fuel for storage, even from those power generating facilities that had contractural arrangements with NFS. Construction of the AGNS fuel receiving and storage station has been completed. AGNS has applied for - but has not been granted - a license to receive and store irradiated fuel assemblies in the storage pool at Barnwell prior to a decision on the licensing action relating to the reprocessing facility. A fourth plant, the Exxon plant proposed for construction in Tennessee, was under license review; this review was suspended as a result of the Commission's decision announced December 23, 1977 to terminate the proceedings on pending or future plutonium recycle-related license applications.

4.0 The Plant

The St. Lucie Unit No. 1 (plant) is described in the Final Environmental Statement (FES) issued by the Commission in June 1973. The plant is a pressurized water reactor, manufactured by the Combustion Engineering Corporation. The reactor has a rating of 2560 megawatts thermal (MWt), corresponding to a net electrical output of 802 megawatts electrical (MWe). Pertinent descriptions of principal features of the plant as it currently exists are summarized below to aid the reader in following the evaluations in subsequent sections of this appraisal.

4.1 Fuel Inventory

The St. Lucie reactor contains 217 fuel assemblies. A fuel assembly consists of a fuel bundle and the channel which surrounds it. A fuel bundle contains 164 or 176 fuel rods, which are arranged in a 14 x 14 array. Each fuel rod consists of fuel pellets stacked in a Zircaloy-4 cladding tube. About one-third of the assemblies are removed from the reactor and replaced with new fuel each year.

4.2 Plant Cooling Water Systems

Waste heat from St. Lucie is dissipated by once-through cooling with water from the Atlantic Ocean. Cooling water is withdrawn from the Ocean at a maximum rate of 484,000 gallons per minute (gpm) through four pumps at full capacity of 121,000 gpm each and 3 intake cooling water system pumps of 14,500 gpm each for a total of 43,500 gpm for service water purposes. Upon passing through three condensers, the circulating cooling water is heated about 21 F° above the ambient ocean water temperature and discharged back into the ocean. The intake cooling water system provides cooling for the component cooling water system. The component cooling water system in turn provides cooling water to the SFP heat exchangers.

4.3 Radioactive Wastes

The plant contains waste treatment systems designed to collect and process the gaseous, liquid and solid waste that might contain radioactive material. The waste treatment systems for St. Lucie 1 are evaluated in the Final Environmental Statement (FES) dated June 1973. There will be no change in the waste treatment systems described in Section III.D.2 of the FES because of the proposed modification.

4.4 Purpose of SFP

The SFP at the plant was designed to store spent fuel assemblies prior to shipment to a reprocessing facility. These assemblies may be transferred from the reactor core to the SFP during a core refueling, or to allow for inspection and/or modification to core internals. The latter may require the removal and storage of up to a full core. The assemblies are initially intensely radioactive due to their fission product content and have a high thermal output. They are stored in the SFP to allow for radioactive and thermal decay.

The major portion of decay occurs during the 150-day period following removal from the reactor core. After this period, the assemblies may be withdrawn and placed into a heavily shielded fuel cask for offsite shipment. Space permitting, the assemblies may be stored for an additional period allowing continued fission product decay and thermal cooling prior to shipment.

4.5 Spent Fuel Pool Purification System

The SFP purification loop consists of a 150-gpm purification pump, a cartridge filter, a mixed bed demineralizer and the required piping, valves and instrumentation. The pump draws water from the SFP and discharges through the cartridge filter and the demineralizer. The water is then returned to the pool. It is possible to operate the system with either the filter or demineralizer bypassed.

Because we expect only a small increase in radioactivty released to the pool water as a result of the proposed modification as discussed in Section 5.3.1, we conclude the SFP purification system is adequate for the proposed modification and will keep the concentrations of radioactivity in the pool water to acceptably low levels.

5.0 Environmental Impacts of Proposed Action

5.1 Land Use

The proposed modification will not alter the external physical geometry of the SFP. No additional commitment of land is required. The SFP was designed to store spent fuel assemblies under water for a period of time to allow shorter-lived radioactive isotopes to decay and to reduce the thermal heat output. The Commission has never set a limit on how long spent fuel assemblies could be stored onsite. The longer the fuel assemblies decay, the less radioactivity they contain. The proposed modification will not change the basic land use of the SFP. The pool was designed to store the spent fuel assemblies for up to four normal refuelings. The modification would provide storage for up to ten normal refuelings. The pool was intended to store spent fuel. This use will remain unchanged by the proposed modification.

5.2 Water Use

There will be no significant change in plant water usage as a result of the proposed modification. Storing additional spent fuel in the SFP will increase the heat load on the SFP cooling system, which is transferred to the component cooling water system and thence to the intake cooling water system. In the August 31, 1977 submittal, the licensee stated that for both the annual refuelings or the full core offload, the SFP outlet temperature will be maintained below 150°F. As discussed in the NRC staff's Safety Evaluation of this proposed modification, we conclude that the 150°F is a conservative estimate of the maximum pool outlet water temperature if only one cooling system pump of the SFP cooling system is operating. Since the temperature of the SFP water during normal refueling operations will remain below 150°F, the rate of evaporation and, thus, the need for makeup water will not be significantly changed.

5.3 Radiological

5.3.1 Introduction

The potential offsite radiological environmental impacts associated with the expansion of the spent fuel storage capacity were evaluated and determined to be environmentally insignificant as addressed below.

The additional spent fuel which would be stored due to the expansion is fuel which has decayed at least four years. During the storage of the spent fuel under water, both volatile and nonvolatile radioactive nuclides may be released to the water from the surface of the assemblies or from defects in the fuel cladding. Most of the material released from the surface of the assemblies consists of activated corrosion products such as Co-58, Co-60, Fe-59 and Mn-54 which are not volatile. The radionuclides that might be released to the water through defects in the cladding, such as Cs-134, Cs-137, Sr-89 and Sr-90 are also predominately nonvolatile. The primary impact of such nonvolatile radioactive nuclides is their contribution to radiation levels to which workers in and near the SFP would be exposed. The volatile fission product nuclides of most concern that might be released through defects in the fuel cladding are the noble gases (xenon and krypton), tritium and the iodine isotopes.

Experience indicates that there is little radionuclide leakage from spent fuel stored in pools after the fuel has cooled for several months. The predominance of radionuclides in the SFP water appear to be radionuclides that were present in the reactor coolant system prior to refueling (which becomes mixed with water in the SFP during refueling operations) or crud dislodged from the surface of the spent fuel during transfer from the reactor core to the SFP. During and after refueling, the SFP purification system reduces the radioactivity concentrations considerably. It is theorized that most failed fuel contains small, pinhole-like perforations in the fuel cladding at the reactor operating condition of approximately 800°F. A few weeks after refueling, the spent fuel cools in the SFP so that fuel clad temperature is relatively cool, approximately 180°F. This substantial temperature reduction should reduce the rate of release of fission products from the fuel pellets and decrease the gas pressure in the gap between pellets and clad, thereby tending to retain the fission products within the gap. In addition, most of the gaseous fission products have short half-lives and decay to insignificant levels within a few months. Based on the operational reports submitted by the licensees or discussions with the operators, there has not been any significant leakage of fission products from spent light water reactor fuel stored in the Morris Operation (MO) (formerly Midwest Recovery Plant) at Morris, Illinois, or at Nuclear Fuel Services' (NFS) storage pool at West Valley, New York. Spent fuel has been stored in these two pools which, while it was in a reactor, was determined to have significant leakage and was therefore removed from the core. After storage in the onsite SFP, this fuel was later shipped to either MO or NFS for extended storage. Although the fuel exhibited significant leakage at reactor operating conditions, there was no significant leakage from this fuel in the offsite storage facility.

5.3.2 Radioactive Material Released to Atmosphere

With respect to gaseous releases, the only significant noble gas isotope attributable to storing additional assemblies for a longer period of time would be krypton-85. As discussed previously, experience has demonstrated that after spent fuel has decayed 4 to 6 months, there is no significant release of fission products from defective fuel. However, we have conservatively estimated that an additional 43 curies per year of krypton-85 may be released when the modified pool is completely filled. This increase would result in an additional total body dose at the site boundary to an individual of less than 0.002 mrem/year. This dose is insignificant when compared to the approximately 100 mrem/year that an individual receives from natural background radiation. The additional total body dose to the estimated population within a 50-mile radius of the plant is less than 0.0004 man-rem/year. This is less than the natural fluctuations in the dose this population would receive from natural background radiation. Under our conservative assumptions, these exposures represent an increase of less than 0.2% of the exposures from the plant evaluated in the FES for the individual (Table V-5) and the population (Table V-7). Thus, we conclude that the proposed modification will not have any significant impact on exposures offsite.

Assuming that the spent fuel will be stored onsite for several years, iodine-131 releases from spent fuel assemblies to the SFP water will not be significantly increased because of the expansion of the fuel storage capacity since the iodine-131 inventory in the fuel will decay to negligible levels between refuelings.

Storing additional spent fuel assemblies is not expected to increase the bulk water temperature above the 120°F during normal refuelings used in the design analysis. Therefore, it is not expected that there will be any significant change in evaporation rates or the release of tritium or iodine as a result of the proposed modification from that previously evaluated. Most airborne releases from the plant result from leakage of reactor coolant which contains tritium and iodine in higher concentrations than the SFP. Therefore, even if there were a slightly higher evaporation rate from the SFP, the increase in tritium and iodine released from the plant as a result of the increase in stored spent fuel would be small compared to the amount normally released from the plant and that which was previously evaluated in the FES. If levels of radioiodine become too high, the air can be diverted to charcoal filters for the removal of radioiodine before release to the environment.

5.3.3 Solid Radioactive Wastes

The concentration of radionuclides in the pool is controlled by the filter and the demineralizer and by decay of short-lived isotopes. The activity is high during refueling operations while reactor coolant water is introduced into the pool and decreases as the pool water is processed through the filters and demineralizer. The increase of radioactivity, if any, should be minor because the additional spent fuel to be stored is relatively cool, thermally, and radionuclides in the fuel will have decayed significantly.

While we believe that there should not be an increase in solid radwaste due to the modification, as a conservative estimate, we have assumed that the amount of solid radwaste may be increased by 32 cubic feet of resin a year from the demineralizer (an additional resin bed/year). St. Lucie 1 has not gone through a refueling. We do not consider the solid waste shipped from the plant representative of what should be expected on the average from the unit each year in the future. The annual average amount of solid waste shipped from a representative number of pressurized water reactors during 1973 to 1976 is 9,100 cubic feet per year. If the storage of additional spent fuel does increase the amount of solid waste from the SFP purification system by about 32 cubic feet per year, the increase in total waste volume shipped would be less than 0.5% and would not have any significant environmental impact.

In addition to the above, the present spent fuel racks have been contaminated; and they are to be removed from the SFP and disposed of at a licensed burial site. The estimated bulk volume to be disposed of is less than 10,000 cubic feet. Averaged over the lifetime of the plant, this will increase the total waste shipped from the plant by less than 3% and would not have any significant environmental impact.

5.3.4 Radioactivity Released to Receiving Waters

There should not be a significant increase in the liquid release of radionuclides from the plant as a result of the proposed modification. The amount of radioactivity in the pool water and on the SFP filter and demineralizer might sightly increase due to the additional spent fuel in the pool but this increase of radioactivity should not result in a significant increase in radionuclides in liquid effluents from the plant.

The cartridge filter removes insoluble radioactive matter from the SFP water. This is periodically removed to the waste disposal area in a shielded cask and placed in a shipping container. The insoluble matter will be retained on the filter.

The resins are periodically flushed with water to the solid radwaste system. The water used to transfer the spent resin is returned to the liquid radwaste system for processing. The soluble radioactivity will be retained on the resins. If any activity should be transferred from the spent resin to this flush water, it would be removed by the liquid radwaste system.

Leakage of water from the SFP is collected in the reactor building floor drainage sump. This water is transferred to the liquid radwaste system. The radioactivity in the water would be removed by the liquid radwaste system.

5.3.5 Occupational Exposures

We have reviewed the licensee's plan for the removal, disassembly and disposal of the low density racks and the installation of the high density racks with respect to occupational radiation exposure. The occupational radiation exposure for this operation is estimated by the licensee to be about 0.3 man-rem. We consider this to be a reasonable estimate based on the low concentrations of activity in the pool water. This operation is expected to be performed only once during the lifetime of the plant and will therefore represent a small fraction of the total man-rem burden from occupational exposure.

We have estimated the increment in onsite occupational dose resulting from the proposed increase in stored spent fuel assemblies on the basis of information supplied by the licensee and by utilizing relevant assumptions for occupancy times and for dose rates in the spent fuel pool area from radionuclide concentrations in the SFP water. The spent fuel assemblies themselves contribute a negligible amount to dose rates in the pool area because of the depth of water shielding the fuel. The occupational radiation exposure resulting from the proposed action represents a negligible burden. Based on present and projected operations in the spent fuel pool area, we estimate that the proposed modification should add less than one percent to the total annual occupational radiation exposure burden at this facility. The small increase in radiation exposure will not affect the licensee's ability to maintain individual occupational doses to as low as is reasonably achievable and within the limits of 10 CFR 20. Thus, we conclude that storing additional fuel in the SFP will not result in any significant increase in doses received by occupational workers.

5.3.6 Evaluation of Radiological Impact

As discussed above, the proposed modification does not significantly change the radiological impact evaluated in the FES.

5.4 Nonradiological Effluents

There will be no change in the chemical or biocidal effluents from the plant as a result of the proposed modification.

The only potential offsite nonradiological environmental impact that could arise from this proposed action would be additional discharge of heat to the atmosphere and to the Atlantic Ocean. Storing spent fuel in the SFP for a longer period of time will add more heat to the SFP water. The SFP heat exchangers are cooled by the component cooling water system which in turn is cooled by the intake cooling water system. An evaluation of the augmented spent fuel storage facility was made to determine the effects of the increased heat generation on the plant cooling water systems, and ultimately, on the environment. The maximum incremental heat load due to the proposed modification is 1.8×10^6 BTU/hr. This would be the heat load due to six annual refuelings, all of which will have had four or more years of cooling. The incremental heat load represents less than a three percent increase on the maximum duty of the component cooling water system. The intake cooling water system rejects heat to the ocean which also removes heat from the condensing steam. The incremental heat load from the SFP modification is less than 0.1 percent of the condensation process. Thus, there is a negligible thermal impact resulting from the proposed modification.

5.5 Impacts on the Community

The new storage racks will be fabricated offsite and shipped to the plant. No environmental impacts on the environs outside the spent fuel storage building are expected during removal of the existing racks and installation of the new racks. The nonradiological impacts were discussed in Section 5.4. No significant environmental impact on the community is expected to result from the fuel rack conversion or from subsequent operation with the increased storage of spent fuel in the SFP.

6.0 Environmental Impact of Postulated Accidents

Although the new high density racks will accommodate a larger inventory of spent fuel, we have determined that the installation and use of the racks will not change the radiological consequences of a postulated fuel handling accident in the SFP area from those values reported in the FES for St. Lucie Unit 1 dated June 1973.

Additionally, the NRC staff has under way a generic review of load handling operations in the vicinity of spent fuel pools to determine the likelihood of a heavy load impacting fuel in the pool and, if necessary, the radiological consequences of such an event. Because St. Lucie Unit 1 is prohibited from the movement of loads with weight in excess of 2000 pounds over spent fuel assemblies in the SFP, we have concluded that the likelihood of a heavy load handling accident is sufficiently small that the proposed modification is acceptable and no additonal restrictions on load handling operations in the vicinity of the SFP are necessary while our review is under way.

7.0 Alternatives

In regard to this licensing action, the NRC staff has considered the following alternatives: (1) shipment of spent fuel to a fuel reprocessing facility, (2) shipment of spent fuel to a separate fuel storage facility, (3) shipment of spent fuel to another reactor site, and (4) ceasing operation of the facility. These alternatives are considered in turn.

The total construction cost associated with the proposed modification is estimated to be about $3,000,000 or approximately $7,200 for each of the 418 fuel assemblies that the increased storage capacity will accommodate.

7.1 Reprocessing of Spent Fuel

As discussed earlier, none of the three commercial reprocessing facilities in the U.S. is currently operating. The General Electric Company's Midwest Fuel Recovery Plant at Morris, Illinois is in a decommissioned condition. On September 22, 1976, Nuclear Fuel Services, Inc. (NFS) informed the Nuclear Regulatory Commission that they were "withdrawing from the nuclear fuel reprocessing business." The Allied-General Nuclear Services (AGNS) reprocessing plant received a construction permit on December 18, 1970. In October 1973, AGNS applied for an operating license for the reprocessing facility; construction of the reprocessing facility is essentially completed but no operating license has been granted. On July 3, 1974, AGNS applied for a materials license to receive and store up to 400 MTU of spent fuel in the onsite storage pool, on which construction has also been completed but hearings with respect to this application have not yet commenced and no license has been granted.

In 1976, Exxon Nuclear Company, Inc. submitted an application for a proposed Nuclear Fuel Recovery and Recycling Center (NFRRC) to be located at Oak Ridge, Tennessee. The plant would include a storage pool that could store up to 7,000 MTU in spent fuel.

On April 7, 1977, the President issued a statement outlining his policy on continued development of nuclear energy in the U.S. The President stated that: "We will defer indefinitely the commercial reprocessing and recycling of the plutonium produced in the U.S. nuclear power program. From our own experience, we have concluded that a viable and economic nuclear power program can be sustained without such reprocessing and recycling."

On December 23, 1977, the Nuclear Regulatory Commission announced that it would order the termination of the now-pending fuel cycle licensing actions involving GESMO (Docket No. RM-50-5), Barnwell Nuclear Fuel Plant Separations Facility, Uranium Hexfluoride Facility, and Plutonium Product Facility (Docket No. 50-332, 70-1327 and 70-1821), the Exxon Nuclear Company, Inc. Nuclear Fuel Recovery and Recycling Center (Docket No. 50-564), the Westinghouse Electric Corporation Recycle Fuels Plants (Docket No. 70-1432), and the Nuclear Fuel Services, Inc. West Valley Reprocessing Plant (Docket No. 50-201). The Commission also announced that it would not at this time consider any other applications for commercial facilities for reprocessing spent fuel, fabricating mixed-oxide fuel, and related functions. At this time, any consideration of these or comparable facilities has been deferred for the indefinite future. Accordingly, we consider that shipment of spent fuel to such facilities for reprocessing is not a reasonable alternative to the proposed expansion of the St. Lucie SFP especially when considered in the relevant timeframe - i.e., through the early-1980's - when increased capacity at St. Lucie will be needed.

The licensee had intended to reprocess the spent fuel to recover and recycle the uranium and plutonium in the fuel. Due to a change in national policy and circumstances beyond the licensee's control, reprocessing of the spent fuel is not an available option at this time.

7.2 Independent Spent Fuel Storage Facility

An alternative to expansion of onsite spent fuel pool storage is the construction of new "independent spent fuel storage installations" (ISFSI). Such installations could provide storage space in excess of 1,000 MTU of spent fuel. This is far greater than the capacities of onsite storage pools. Fuel storage pools at GE Morris and NFS are functioning as ISFSIs although this was not the original design intent. Likewise, if the receiving and storage station at AGNS is licensed to accept spent fuel, it would be functioning as an ISFSI until the reprocessing facility is licensed to operate. The license for the GE facility at Morris, Illinois (MO) was amended on December 3, 1975 to increase the storage capacity to about 750 MTU;* as of November 1, 1977, 295 MTU was stored in the pool in the form of over 1,000 assemblies. We have discussed the status of storage space at MO with GE personnel. We have been informed that GE is primarily operating the MO facility to store either fuel owned by GE (which had been leased to utilities on an energy basis) or fuel which GE has previously contracted to reprocess. We were informed that the present GE policy is not to accept spent fuel for storage except for the fuel for which GE has a previous commitment. The NFS facility has capacity for about 260 MTU, with approximately 170 MTU presently stored in the pool. The storage pool at West Valley, New York, is on land owned by the State of New York and leased to NFS through 1980. Although the storage pool at West Valley is not full, since NFS withdrew from the fuel reprocessing business, correspondence we have received indicates that they are not at present accepting additional spent fuel for storage even from the reactor facilities with which they had contracts. The status of the storage pool at AGNS was discussed above.

*An application for an 1100 MTU capacity addition is pending. Present schedule calls for completion in 1980 if approved. However, by motion dated November 8, 1977, General Electric Company requested the Atomic Safety and Licensing Board to suspend indefinitely further proceedings on this application. This motion was granted.

With respect to construction of new ISFSIs, Regulatory Guide 3.24, "Guidance on the License Application, Siting, Design, and Plant Protection for an Independent Spent Fuel Storage Installation," issued in December 1974, recognizes the possible need for ISFSIs and provides recommended criteria and requirements for water-cooled ISFSIs. Pertinent sections of 10 CFR Parts 19, 20, 30, 40, 51, 70, 71 and 73 would also apply.

We have estimated that at least five years would be required for completion of an independent spent fuel storage facility. This estimate assumes one year for preliminary design; one year for preparation of the license application, environmental report, and licensing review in parallel with one year for detail design; two and one-half years for construction and receipt of an operating license; and one-half year for plant and equipment testing and startup.

Industry proposals for independent spent fuel storage facilities are scarce to date. In late 1974, E. R. Johnson Associates, Inc., and Merrill Lynch, Pierce, Fenner and Smith, Inc. issued a series of joint proposals to a number of electric utility companies having nuclear plants in operation or contemplated for operation, offering to provide independent storage services for spent nuclear fuel. A paper on this proposed project was presented at the American Nuclear Society meeting in November 1975 (ANS Transactions, 1975 Winter Meeting, Vol. 22, TANSAO 22-1-836, 1975). In 1974, E. R. Johnson Associates estimated their construction cost at about $20 million.

Several licensees have evaluated construction of a separate independent spent fuel storage facility and have provided cost estimates. In 1975, Connecticut Yankee, for example, estimated that to build an independent facility with a storage capacity of 1,000 MTU (BWR and/or PWR assemblies) would cost approximately $54 million and take about five years to put into operation.

Commonwealth Edison estimated the construction cost to build a spent fuel storage facility at about $10,000 per fuel assembly. To this would be added the costs for maintenance, operation, safeguards, security, interest on investment, overhead, transportation and other costs.

On December 2, 1976, Stone and Webster Corporation submitted a topical report requesting approval for a standard design for an independent spent fuel storage facility. No specific locations were proposed, although the design is based on location near a nuclear power facility. No estimated costs for spent fuel storage were included in the topical report.

On a short-term basis (i.e., prior to 1983) an independent spent fuel storage installation does not appear to be a viable alternative based on cost or availability in time to meet the licensee's needs. It is also unlikely that the total environmental impacts of constructing an independent facility and shipment of spent fuel would be less than the minor impacts associated with the proposed action.

In the long-term, the U.S. Department of Energy (USDOE) is modifying its program for nuclear waste management to include design and evaluation of a retrievable storage facility to provide Government storage at central locations for unreprocessed spent fuel rods. The pilot plant is expected to be completed by late 1985 or 1986. It is estimated that the long-term storage facility will start accepting commercial spent fuel about 1990. The design is based on storing the spent fuel in a retrievable condition for a minimum of 25 years. The criterion for acceptance is expected to be that the spent fuel must have decayed a minimum of ten years so it can be stored in a dry condition without need for forced air circulation. As interim alternative to the long term retrievable storage facility, on October 18, 1977, USDOE announced a new "spent nuclear fuel policy." USDOE will determine industry interest in providing interim fuel storage services on a contract basis. If adequate private storage services cannot be provided, the Government will provide interim fuel storage facilities. It was announced by USDOE at a public meeting held on October 26, 1977, that this interim storage is expected to be available in the 1981-1982 time frame. USDOE through their Savannah River Operations Office is preparing a conceptual design for a possible spent fuel storage pool of about 5,000 MTU capacity. Based on our discussions with USDOE personnel, it appears that the earliest such a pool could be licensed to accept spent fuel would be about 1983. The interim facility(s) would be designed for storage of the spent fuel under water. USDOE stated that it was their intent to not accept any spent fuel that had not decayed a minimum of five (5) years.

As announced in the President's energy policy statement of April 29, 1977, the preferred solution to the spent fuel storage program is to have the nuclear power plants store their spent fuel onsite until the Government's long-term storage facility is operable, which is now estimated to be about 1990. For those nuclear power plants that cannot store the spent fuel onsite until the permanent long-term storage facility is available, USDOE will provide limited interim storage facilities.

The St. Lucie plant will not have space in the SFP to discharge a full core after 1979. If the storage capacity of the SFP is not increased, the pool will be filled in 1981. The precise date that interim storage would be available is not known at this time with sufficient precision to provide for planning. Should government facilities not be available by 1982, the St. Lucie plant might be forced to shut down. Therefore, this does not appear to be a practical alternative, especially when considering the impact of plant shutdown as compared with the negligible environmental consequences of the proposed amendment.

The proposed increase in storage capacity will allow St. Lucie to operate until about 1987, by which time the Federal repository for spent fuel is expected to be operable.

7.3 Storage at Another Reactor Site

The licensee also owns and operates the Turkey Point Plants. The SFP at Turkey Point is designed to receive only Westinghouse fuel assemblies, not the Combustion Engineering fuel assemblies used at St. Lucie. The storage capacity of the Turkey Point SFP is reserved for the needs of the two operating reactors onsite and is unavailable for future storage of St. Lucie spent fuel. Therefore, the Turkey Point SFP is not an acceptable alternative. In addition, the cask handling systems at St. Lucie and Turkey Point have not yet been accepted by the NRC for handling spent fuel casks. The transfer of fuel from St. Lucie to Turkey Point would require the use of spent fuel casks and offsite transportation. There would, therefore, be no benefit in this alternative in terms of environmental impacts. In fact, there would be an increase in the potential for accidents because of the additional fuel handling operations, the transfer of spent fuel into casks and the movement of fuel between the two facilities. Compared to the proposed action, there would be no offsetting reduction in costs or increased environmental benefits associated with this alternative. We do not consider the use of the Turkey Point SFP as a viable alternative.

According to a survey conducted and documented by the former Energy Research and Development Administration, up to 27 of the operating nuclear power plants will lose the ability to refuel during the period 1977-1986 without additional spent fuel storage pool expansions or access to offsite storage facilities. Thus, the licensee cannot assuredly rely on any other power facility to provide additional storage capability except on a short-term emergency basis. If space were available in another reactor facility, it is unlikely that the cost would be less than storage onsite as proposed.

7.4 Shutdown of Facility

Storage of spent fuel at St. Lucie in the existing racks is possible for only a short period of time. As discussed above, if expansion of the SFP capacity is not approved and if an alternate storage facility is not located, the licensee may have to shut down St. Lucie in 1982 due to a lack of spent fuel storage facilities, resulting in the cessation of up to 802 megawatts net electrical energy production.

The current energy replacement value for St. Lucie is approximately $310,000 a day (assuming 802 MWe). The licensee did not identify the source or availability of replacement power. In any case, shutdown is not an economical alternative and would have an adverse socio-economic impact on the customers, employees of Florida Power & Light Co. and on the communities in the licensee's service area.

7.5 Summary of Alternatives

In summary, the alternatives (1) to (3) described above are presently not available to the licensee or could not be made available in time to meet the licensee's need. Even if available, alternatives (2) and (3) are likely to be more expensive than the proposed modification and do not offer any advantages in terms of environmental impacts. The alternative of ceasing operation of the facility would be much more expensive than the proposed action because of the need to provide replacement power. In addition to the economic advantages of the proposed action, we have determined that the expansion of the storage capacity of the spent fuel pool for St. Lucie would have a negligible environmental impact. Accordingly, deferral or severe restriction of the proposed action would result in substantial harm to the public interest.

8.0 Evaluation of Proposed Action

8.1 Unavoidable Adverse Environmental Impacts

8.1.1 Physical Impacts

As discussed above, expansion of the storage capacity of the SFP would not result in any significant adverse environmental impacts on the land, water, air or biota of the area.

8.1.2 Radiological Impacts

Expansion of the storage capacity of the SFP will not create any significant additional adverse radiological effects. As discussed in Section 5.3, the additional total body dose that might be received by an individual or the estimated population within a 50-mile radius is less than 0.002 man-rem/yr and 0.0004 man-rem/yr, respectively, and is less than the natural fluctuations in the dose this population would receive from background radiation. The total dose to workers during removal of the present storage racks and installation of the new racks is estimated by the licensee to be about 0.3 man-rem which averaged over the lifetime of the plant is a small fraction of the total man-rem burden from occupational exposure. Operation of the plant with additional spent fuel in the SFP is not expected to increase the occupational radiation exposure by more than one percent of the present total annual occupational exposure at this facility.

8.2 Relationships Between Local Short-term Use of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

Expansion of the storage capacity of the SFP, which would permit the plant to continue to operate until 1987 when offsite storage facilities are expected to be available for interim or long-term storage of spent fuel, will not change the evaluation in the FES.

8.3 Irreversible and Irretrievable Commitments of Resources

8.3.1 Water, Land and Air Resources

The proposed action will not result in any significant change in the commitments of water, land and air resources as identified in the FES. No additional allocation of land would be made; the land area now used for the SFP would be used more efficiently by reducing the spacings between fuel assemblies.

8.3.2 Material Resources

Under the proposed modification, the present stainless steel storage racks at the plant will be replaced by new stainless steel racks that will increase the storage capacity of the SFP by 418 spent fuel assemblies.

The resources to be committed for fabrication of the new spent fuel storage racks total approximately 350,000 pounds of stainless steel. The amount of stainless steel used annually in the U.S. is about 2.82×10^{11} pounds. The material is readily available in abundant supply. The amount of stainless steel required for fabrication of the new racks is less than 0.1 percent of this resource consumed annually in the United States. We conclude that the amount of material required for the new racks at St. Lucie is insignificant and does not represent a significant irreversible commitment of material resources.

The longer term storage of spent fuel assemblies withdraws the unburned uranium from the fuel cycle for a longer period of time. Its usefulness as a resource in the future, however, is not changed. The provision of longer onsite storage does not result in any cumulative effects due to plant operation since the throughput of materials does not change. Thus, the same quantity of radioactive material will have been produced when averaged over the life of the plant. This licensing action would not constitute a commitment of resources that would affect the alternatives available to other nuclear power plants or other actions that might be taken by the industry in the future to alleviate spent fuel storage problems. No other resources need be allocated because the design characteristics of the SFP remain unchanged.

We conclude that the expansion of the SFP at the St. Lucie facility does not constitute a commitment of either material or nonmaterial resources that would tend to significantly foreclose the alternatives available with respect to any other individual licensing actions designed to ameliorate a possible shortage of spent fuel storage capacity.

8.4 Commission Policy Statement Regarding Spent Fuel Storage

On September 16, 1975, the Commission announced (40FR42801) its intent to prepare a generic environmental impact statement on handling the storage of spent fuel from light water reactors. In this notice, the Commission also announced its conclusion that it would not be in the public interest to defer all licensing actions intended to ameliorate a possible shortage of spent fuel storage capacity pending completion of the generic environmental impact statement. The draft statement (NUREG-0404) was published in March 1978.

The Commission directed that in the consideration of any such proposed licensing action, among other things, the following five specific factors should be applied, balanced, and weighed in the context of the required environmental statement or appraisal:

1. Is it likely that the licensing action proposed here would have a utility that is independent of the utility of other licensing actions designed to ameliorate a possible shortage of spent fuel capacity?

   A reactor core for St. Lucie Unit No. 1 contains 217 fuel assemblies. Typically, the reactor is refueled once every 12 months. Each refueling replaces about 1/3 of the core (about 72 assemblies). The SFP was designed on the basis that a fuel cycle would be in existence that would only require storage of spent fuel for a year or two prior to shipment to a reprocessing facility. Initially, sufficient racks were installed to store 310 spent fuel assemblies (1-1/3 cores), which was a typical design basis for PWRs in the late sixties and early seventies. When St. Lucie was designed, a SFP storage capacity for 1-1/3 cores was considered adequate. This provided for complete unloading of the reactor even if the spent fuel from a previous refueling were in the pool. While not required from the standpoint of safety considerations, it is a desirable engineering practice to reserve space in the SFP to receive an entire reactor core, should this be necessary to inspect or repair core internals or because of other operational considerations.

If 72 fuel assemblies are discharged every 12 months, the SFP will be full after the refueling in 1981. The spent fuel must be stored onsite or elsewhere if the facility is to be refueled. If expansion of the SFP capacity is not approved or if an alternate storage facility is not located, the licensee will have to shut down St. Lucie about 1982. As discussed under alternatives, an alternate storage facility is not now available. Storage onsite is an interim solution to allow the plant to continue to operate.

The proposed licensing action (i.e., installing new racks of a design that permits storing more assemblies in the same space) would provide the licensee with additional flexibility which is desirable even if adequate offsite storage facilities hereafter become available to the licensee.

We have concluded that a need for additional spent fuel storage capacity exists at St. Lucie Unit No. 1 which is independent of the utility of other licensing actions designed to ameliorate a possible shortage of spent fuel capacity.

2. Is it likely that the taking of the action here proposed prior to the preparation of the generic statement would constitute a commitment of resources that would tend to significantly foreclose the alternatives available with respect to any other licensing actions designed to ameliorate a possible shortage of spent fuel storage capacity?

With respect to this proposed licensing action, we have considered commitment of both material and nonmaterial resources. The material resources considered are those to be utilized in the expansion of the SFP. The nonmaterial resources are primarily the labor and talent needed to accomplish the proposed modification.

The increased storage capacity of the St. Lucie spent fuel pool was also considered as a nonmaterial resource and was evaluated relative to proposed similar licensing actions at other nuclear power plants, fuel reprocessing facilities and fuel storage facilities. We have determined that the proposed expansion in the storage capacity of the SFP is only a measure to allow for continued operation and to provide operational flexibility at the facility, and will not affect similar licensing actions at other nuclear power plants. Similarly, taking this action would not commit the NRC to repeat this action or a related action in 1987, at which time the modified pool is estimated to be full if no spent fuel is removed.

We conclude that the expansion of the SFP at St. Lucie prior to the preparation of the generic statement, does not constitute a commitment of either material or nonmaterial resources that would tend to significantly foreclose the alternatives available with respect to any other individual licensing actions designed to ameliorate a possible shortage of spent fuel storage capacity.

3. Can the environmental impacts associated with the licensing action here proposed be adequately addressed within the context of the present application without overlooking any cumulative environmental impacts?

Potential nonradiological and radiological impacts resulting from the spent fuel rack conversion and subsequent operation of the expanded SFP at this facility were considered by the NRC Staff.

No environmental impacts on the environs outside the spent fuel storage building are expected during disposal of the existing racks and installation of the new racks. The impacts within this building are expected to be limited to those normally associated with metal working activities.

The potential nonradiological environmental impact attributable to the additional heat load in the SFP was determined to be negligible compared to the existing thermal effluents from the facility.

We have considered the potential radiological environmental impacts associated with the expansion of the SFP and have concluded that they would not result in radioactive effluent releases that significantly affect the quality of the human environment during either normal operation of the expanded SFP or under postulated fuel handling accident conditions.

4. Have the technical issues which have arisen during the review of this application been resolved?

This Environmental Impact Appraisal and the accompanying Safety Evaluation respond to the questions concerning health, safety and environmental concerns. All technical issues which have arisen in connection with this application have been resolved with the licensee.

5. Would a deferral or severe restriction on this licensing action result in substantial harm to the public interest?

   We have evaluated the alternatives to the proposed action, including storage of the additional spent fuel offsite and ceasing power generation from the plant when the existing SFP is full. We have determined that there are significant economic advantages associated with the proposed action and that expansion of the storage capacity of the SFP will have a negligible environmental impact. Accordingly, deferral or severe restriction of the action here proposed would not be in the public interest.

9.0 Benefit-Cost-Balance

This section summarizes and compares the cost and the benefits resulting from the proposed modification to those that would be derived from the selection and implementation of each alternative. The table below presents a tabular comparison of these costs and benefits. The benefit that is derived from three of these alternatives is the continued operation of St. Lucie and production of electrical energy. As shown in the table, the reactor shutdown and subsequent storage of fuel in the reactor vessel results in the cessation of electrical energy production. While this would have the "benefit" of eliminating thermal, chemical and radiological releases from St. Lucie, these effluents have been evaluated in the FES and it has been determined that the environmental impacts of these releases are not significant. Therefore, there would be no significant environmental benefit in their cessation. The remaining alternative, storage at other nuclear plants, is not possible at this time or in the foreseeable future except on a short term emergency basis.

From examination of the table, it can be seen that the most cost-effective alternative is the proposed spent fuel pool modification. As evaluated in the preceding sections, the environmental impacts associated with the proposed modification would not be significantly changed from those analyzed in the Final Environmental Statement for St. Lucie issued June 1973.

10.0 Basis and Conclusion for Not Preparing an Environmental Impact Statement

We have reviewed this proposed facility modification relative to the requirements set forth in 10 CFR Part 51 and the Council of Environmental Quality's Guidelines, 40 CFR 1500.6 and have applied, weighed, and balanced the five factors specified by the Nuclear Regulatory Commission in 40 FR 42801. We have determined that the proposed license amendment will not significantly affect the quality of the human environment and that there will be no significant environmental impact attributable to the proposed action other than that which has already been predicted and described in the Commission's Final Environmental Statement for the facility dated June 1973. Therefore, we have found that an environmental impact statement need not be prepared, and that pursuant to 10 CFR 51.5(c), the issuance of a negative declaration to this effect is appropriate.

SUMMARY OF COST-BENEFITS

Alternative	Cost	Benefit
Reprocessing of Spent Fuel		None - This alternative is not available either now or in the foreseeable future.
Increase Storage Capacity	$7,200/assembly	Continued operation of St. Lucie and production of electrical energy.
Storage at Independent Facility	$4,000 to $8,000/ assembly/10 Yr* plus shipping costs	Continued operation of St. Lucie and production of electrical energy. However, this alternative is not available now. It is uncertain whether this alternative will be available in the future.
Storage at Other Nuclear Plants	Comparable to storage at St. Lucie	Continued operation of St. Lucie and production of electrical energy. However, this altenative is not available.
Reactor Shutdown	$310,000/day for replacement energy	None - No production of electrical energy.

*In order to use this alternative a minimum commitment of seven to ten years of storage is required.

**Costs for interim Government storage are expected to be published early in 1978.

UNITED STATES NUCLEAR REGULATORY COMMISSION

DOCKET NO. 50-335

FLORIDA POWER & LIGHT COMPANY

NOTICE OF ISSUANCE OF AMENDMENT TO FACILITY OPERATING LICENSE AND NEGATIVE DECLARATION

The U. S. Nuclear Regulatory Commission (the Commission) has issued Amendment No. 22 to Facility Operating License No. DPR-67, issued to Florida Power & Light Company (the licensee), which revised the Technical Specifications for operation of the St. Lucie Plant, Unit No. 1 (the facility) located in St. Lucie County, Florida. The amendment is effective as of its date of issuance.

The amendment authorizes replacement of the existing racks in the spent fuel storage pool of the facility with racks of design capable of accommodating up to 728 fuel assemblies. The existing racks have a capacity for storage of 310 fuel assemblies.

The application for the amendment complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations. The Commission has made appropriate findings as required by the Act and the Commission's rules and regulations in 10 CFR Chapter I, which are set forth in the license amendment. Notice of Consideration of Modification to Facility

Spent Fuel Storage Pool in connection with this action was published in the Federal Register on September 15, 1977 (42 F.R. 46427). No request for a hearing or petition for leave to intervene was filed following notice of the proposed action.

The Commission has prepared an environmental impact appraisal for this action and has concluded that an environmental impact statement is not warranted because there will be no environmental impact attributable to the action significantly greater than that which has already been predicted and described in the Commission's Final Environmental Statement for the facility dated June 1973.

For further details with respect to this action, see (1) the application for amendment dated August 31, 1977, as supplemented December 8 and 19, 1977 and February 8, 1978, (2) Amendment No. 22 to License No. DPR-67, (3) the Commission's related Safety Evaluation, and (4) the Commission's Environmental Impact Appraisal. All of these items are available for public inspection at the Commission's Public Document Room, 1717 H Street, N.W., Washington, D.C. and at the Indian River Junior College Library, 3209 Virginia Avenue, Ft. Pierce, Florida. A copy of items (2), (3), and (4) may be obtained upon request addressed to the U. S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Director, Division of Operating Reactors.

Dated at Bethesda, Maryland, this 29th day of March 1978.

FOR THE NUCLEAR REGULATORY COMMISSION

Robert W. Reid, Chief
Operating Reactors Branch #4
Division of Operating Reactors