OCT 1 4 1982

Docket No: 70-2957
Applicant: Florida Power and Light Company
Facility: St. Lucie Plant Unit No. 2
Subject: Safety Evaluation Report - Review of License Application Dated March 19, 1982 and Supplements Dated April 12 and 21, May 5, and July 21, 1982 for a Materials License

I. Introduction

A. Application

By application dated March 19, 1982 and supplements dated April 12 and 21, May 5, and July 21, 1982, Florida Power and Light (FP&L) requested an NRC Materials License to receive, possess, inspect, and store uranium fuel assemblies, fission chambers, and other special nuclear and byproduct materials.

The material requested by this application is for use in the St. Lucie Plant Unit No. 2, a pressurized water reactor located on Hutchison Island in St. Lucie County, Florida.

B. Scope of Review

The staff safety review of FP&L's application for a materials license included an evaluation of St. Lucie's organization, nuclear criticality safety, radiation safety, and fire safety. The application was also discussed with the NRR project manager, the NRC resident inspector and staff members at St. Lucie.

The Division of Safeguards, pursuant to 10 CFR Part 73, has reviewed the protection of the material requested in the application. Their letter approving the protection and security of the site was issued on August 4, 1982.

II. Authorized Activities

A. Enriched Fuel Assembly Handling

The applicant proposes to receive the fuel assemblies from Combustion Engineering in shipping containers licensed by the NRC. The fuel assemblies will be removed individually from their containers and placed in the new fuel storage

area or spent fuel storage pool. In the event of delays, the loaded containers will be placed in the new fuel storage area, spent fuel cask decontamination area and/or an outside area. The outside area will be fenced and restricted to authorized personnel only. It will be located at the offloading area near the door to the fuel building.*

The maximum nominal enrichment to be delivered for the first core loading is 2.73 w/o U-235. The reactor will use fuel enriched to 3.7 w/o U-235 after the first core loading. The staff found 3.7 w/o fuel, stored in the spent fuel storage racks, to be unsafe (see Section IV-C) at the optimum degree of water moderation (mist) within and between fuel assemblies. Therefore the staff has determined that the license should be limited at this time to the storage of fuel assemblies having a maximum U-235 enrichment of 2.73 w/o. Later during reactor operation, the spent fuel pool, filled with water, will safely accommodate the storage of the 3.7 w/o fuel.

Each fuel assembly consists of 236 Zircaloy-4 rods containing UO_2 pellets. The fuel pellets are 0.325-inches in diameter. The cladding is 0.025-inches thick, with an outside diameter of 0.382-inches. The active fuel length is about 137-inches. The assembly also contains five guide tubes. The rods and guide tubes are arranged in a 16 x 16 square array. The dimensions of each assembly are about 8-inches x 8-inches x 158-inches. A typical assembly contains about 430 kg of uranium dioxide. The nominal enrichment of the fuel for the first core loading will be 1.71, 2.28, and 2.73 w/o U-235. The U-235 content in each fuel assembly, at different enrichments, is 6.66 kg, 8.29 kg, and 10.39 kg, respectively. The applicant has requested authorization to receive 1810 kg of U-235 in the form of fuel assemblies; accordingly, the following license condition is recommended:

Material	Chemical or Physical Form	Quantity
U-235	UO_2 in unirradiated fuel elements	1810 kg of U-235 in uranium enriched up to 2.73 w/o in U-235

*Information was provided on September 30, 1982 in a telephone conversation between NMSS staff and Mr. Ash Pell from FP&L.

B. Other Radioactive Materials Handing

FP&L requested authorization to receive, possess, and store other byproduct and special nuclear material. The material will be stored at the St. Lucie Plant Unit No. 2. The materials will eventually be used to calibrate nuclear instruments. Authorization is requested for:

1. Plutonium

Two plutonium-beryllium neutron source assemblies will remain in their shipping container in the new fuel storage area.

2. Uranium-235

Two moveable incore fission chambers contain 93.0 w/o enriched uranium in sealed chambers, with no more than 3.1 mg U-235 per chamber. The moveable incore detector is a miniature fission chamber with an active length of 1 inch. The incore fission detector will be stored in the new fuel storage area.

3. Byproduct Material, Atomic Numbers 1 to 83

The applicant has requested receipt of different byproduct materials. They will use any isotope with an atomic number up to 83 for calibration and response checks of instrumentation in the Health Physics and Radio-Chemistry Laboratory. Calibration of effluent and process monitors will be performed at the monitors located in the reactor auxiliary building and the fuel handling building. The isotopes will be stored in the Health Physics (HP) and Radio-Chemistry (Rad-Chem) Labs with the exception of selected check sources that are installed in the effluent and process monitors.

4. Cs-137

Sealed cesium-137 sources will be used to calibrate the post-accident reactor containment high-range radiation monitors in the reactor containment building, area radiation monitors, and pencil type pocket dosimeters. The sources will be stored in the HP laboratory.

5. Pu-238

A plutonium-238 - beryllium source will be used for calibrating portable neutron radiation measuring instruments and response verification of reactor startup instruments. The Pu-238 will be stored in the HP laboratory.

6. U-235

Uranium oxide (U_3O_8) enriched to 93.0 w/o U-235 will be plated on the inside of sealed metal cylinders. The oxide will be used as fission chambers in reactor startup instrumentation in the reactor instrumentation area. The chambers will be kept in the Quality Control Hold Compound in the plant storerooms prior to installation in the reactor vessel.

7. Plutonium-239

Plutonium-239 electroplated onto metal discs will be used to calibrate laboratory counting equipment in the HP laboratory. Storage is provided in the HP and Rad-Chem laboratories.

8. Am-241

Americium-241 deposited on stainless steel discs will be used for calibration of laboratory counting equipment in the HP and Rad-Chem laboratories, and will be stored there.

A sealed ^{241}AmBe neutron source will be installed in a boronometer for measurement of boron concentrations in the reactor coolant water. The source will be stored in the HP laboratory.

The following license conditions are recommended:

Material	Chemical or Physical Form	Quantity
Plutonium (Pu-238, 239, 240, 241)	Neutron source assemblies	3.00 grams total, 2.30 grams Pu-238

Material	Chemical or Physical Form	Quantity
Uranium enriched in the U-235 isotope	U_3O_8 in incore fission chambers	6.2 mg U-235 in uranium enriched to no more than 93 w/o in U-235
Byproduct material atomic numbers 1 to 83	Any	100 millicuries per isotope, 1 curie total
Cs-137	Sealed sources	150 millicuries
Pu-238	Sealed source	1 curie
Uranium enriched to 93 w/o in U-235	U_3O_8 fission chamber	6.5 microcuries
Pu-239	Plated source	10 microcuries
Am-241	Plated source	2 microcuries
Am-241	Sealed source	1 curie

III. Organization

A. Radiation Protection Responsibilities

The Health Physics (HP) Supervisor who is responsible for establishing and implementing the radiation protection program reports to the Operations Superintendent on matters relating to plant operations and has a direct line of communication to the Plant Manager and the Nuclear Energy Staff Health Physics Supervisor in regards to radiation exposure controls or radiologial safety. The latter function operates independently from the Plant Manager. The HP supervisor is authorized to stop any activity he believes could result in a radiological problem at the St. Lucie site. The radiation protection program ensures the protection of the plant employees and the public.

B. Minimum Technical Qualifications

FP&L's April 22 supplement specifies minimum technical qualifications for the Health Physics Supervisor. They state the Health Physics Supervisor should have at least a B.S. degree in a science or an engineering subject. He shall have a minimum of 5 years' experience in radiation protection at a nuclear reactor facility. A minimum of 2 years should be related technical training.

The Health Physics Supervisor meets the minimum qualifications for personnel selection criteria specified in Regulatory Guide 1.8 and the staff believes his qualifications are adequate to supervise the health physics requirements of this license.

C. Training

The training program includes instruction for protection of personnel from exposure to radiation and radioactive material in accordance with 10 CFR 19.12. The training, carried out by the Health Physics supervisor, will consist of a continuing series of Health Physics and Radiation Safety classes.

The staff has concluded, based upon 10 CFR 19.12 requirements, that the applicant's training program is adequate to allow FP&L to safely carry out activities authorized by this license.

IV. Nuclear Criticality Safety

The fuel assemblies may be stored at St. Lucie Plant Unit No. 2 in three locations, viz., shipping container storage areas, new fuel storage area, and the spent fuel storage pool. The applicant has not shown that more than one fuel assembly out of the shipping containers or the storage racks at the same time would be subcritical under all conditions of moderation and reflection. One assembly, however, cannot be made critical with any degree of water moderation or reflection. Therefore, the staff recommends the following license condition:

> No more then one fuel assembly shall be out of its shipping container or storage location at a given time.

The fuel assemblies are frequently shipped in polyethylene dust wrappers. If the wrappers around the fuel could fill with water, while water between assemblies drained, criticality may occur under postulated accident conditions. The applicant has stated that the wrappers will be removed prior to storage. Because of the importance of the dust wrapper removal, the following license condition is recommended:

The polyethylene dust covers shall be removed from the fuel assemblies prior to storage in the spent fuel storage pool or the new fuel storage racks.

A. Shipping Container Storage Area

The fuel assemblies will be delivered to St. Lucie Plant Unit No. 2 in shipping containers, Model No. 927C1. The container, a steel structure capable of storing or transporting one or two fuel assemblies, has been licensed by the NRC. Not more than 12 assemblies will be delivered in any one shipment. In the event of an unloading delay, the loaded fuel containers will be stored in the new fuel storage area, the spent cask decontamination area and/or an outside storage area accessible only to authorized persons.

The containers are fissile class III and no more then eight containers can be shipped or stored together (NRC Certificate of Compliance No. 6078). Therefore, the following license condition is recommended:

Fuel assemblies stored in their shipping containers shall be limited to groups of 8 containers, independent of separation. The groups shall be separated by at least 20 feet.

B. New Fuel Storage Area

The new fuel storage area may be used to store unirradiated reactor fuel assemblies. Up to 80 assemblies are stored in two 4 x 10 arrays, separated by a 46-inch aisle. The storage locations have a center-to-center spacing of 23-inches and an edge-to-edge spacing of 14.1-inches.

The applicant used a series of computer codes to design and verify the safety of the new fuel storage area. Cross sections were processed in four energy groups using CEPAK and 13 energy groups with GGC-3. Due to spectral considerations, the 13 neutron energy group model is needed to more accurately model the physical situation with mist. The spatial flux solution and multiplication factor (k_{eff}, reactivity) were obtained using DOT-2W, a two-dimensional transport code. The last computer run used a three-dimensional Monte Carlo code, KENO-IV, to check the reactivity of the array. FP&L has calculated a maximum

k_{eff} less than 0.98 occurring for the arrays of 3.7 w/o enriched fuel assemblies with low density moderator materials (mist). The NRC staff has confirmed the safety of the new fuel storage racks. They are safe from an inadvertent criticality under postulated credible scenarios. The maximum value of k_{eff} determined by the NRC staff was approximately 0.90 for optimum moderation and reflection.

C. Spent Fuel Storage Racks

During the initial fuel receipt, more new assemblies will be delivered to FP&L than can be stored in the new fuel storage racks. Accordingly, extra fuel assemblies, and perhaps all of the assemblies, will be stored in the spent fuel storage racks. The spent fuel storage racks are designed for dry or flooded storage of up to 300 fuel assemblies. Fuel assemblies are stored in steel cells with a 14-inch center-to-center spacing and a minimum 4.9-inch edge-to-edge spacing.

The applicant assumed an infinite array of fuel assemblies and analyzed the spent fuel storage rack design with the CHEETAH P/PDQ-7 model. This calculation used four neutron energy groups and a zero buckling factor to simulate an infinite fuel length. The applicant used a 123 group cross-section and KENO-IV to verify its original benchmark evaluation. The applicant has reported k_{eff} of 0.869 for a flooded pool and an enrichment of 3.7 w/o. Since the fuel will be stored dry, the NRC staff examined a range of mist densities for fuel assemblies with 3.7 w/o enrichment (conditions that may prevail in the event of an accident). The staff found that the maximum k_{eff}, which occurred with a mist density of about 0.075 gm/cm^3, is about 1.02. This is a supercritical value. Therefore, the staff recommends authorization of a nominal maximum enrichment of 2.73 w/o (maximum fuel enrichment for the first core). The maximum reactivity at the latter enrichment is approximately 0.95.

D. Request for Exemption from Criticality Alarms

The applicant has requested, pursuant to 10 CFR 70.24(d), an exemption from the provisions of 10 CFR 70.24. Based on the applicant's demonstration of subcriticality under normal and accident conditions good cause exists for

exemption from the requirements of 10 CFR 70.24. Because of the inherent features associated with the storage and inspection of unirradiated fuel containing uranium enriched to less then 2.73 w/o in the U-235 isotope when no fuel processing activities are to be performed, the staff hereby determines that granting such an exemption will not endanger life or property or the common defense and security, and is in the public interest. This exemption is authorized pursuant to 10 CFR 70.14. Accordingly, the following license condition is recommended:

> The licensee is hereby exempt from the provisions of 10 CFR 70.24 insofar as this exemption applies only to materials held under this license.

V. Radiation Safety

A. Control of Personnel Exposure

Pursuant to 10 CFR 20.202, personnel external exposures are monitored on site. Data is obtained from TLDs and neutron dosimeters. TLDs are read and evaluated on a monthly basis. Neutron dosimetry is conducted in accordance with guidance in Regulatory Guide 8.14, Personnel Neutron Dosimeters.

Personnel internal exposure is evaluated by continuously monitoring the airborne concentration level of radioactivity in the work area as required by 10 CFR 20.103 and by whole-body counting on an annual basis. The whole-body counting program, including frequency of counting, action points and action to be taken to minimize internal exposure to the worker, is based on the guidance in Regulatory Guide 8.26, "Application of Bioassay For Fission and Activation Products."

B. Control of Surface Contamination

The radiation control area is surveyed at least weekly for surface contamination. Some rooms in the area which are routinely occupied, such as Health Physics offices and laboratories, will be surveyed on a daily basis. The specification for the control of surface contamination at FP&L, including

action levels and time for cleanup action, will be as recommended in Regulatory Guides 8.2 and 8.24.

C. Leak Test of Sealed Sources

Sealed sources are tested for leakage every 6 months. Procedures for leak testing, including action point and how to take action, all fulfill the requirements as specified in the NMSS standard license conditions on leak testing sealed plutonium and byproduct sources. It is recommended, however, that two standard license conditions, "License Condition for Leak Testing of Byproduct Material" and "License Condition for Leak Testing Sealed Plutonium Sources," be added to emphasize the importance of sealed source contamination surveys.

D. Calibration of Instruments

The radiation detecting devices are calibrated every 6 months to ensure that they are functioning properly. The frequency meets the recommended frequency as given in Regulatory Guide 8.24.

E. Management of Radiation Waste*

The NRC staff recommends the following license condition:

> All radioactive solid wastes generated under this license will be shipped to a licensed burial site.

The radioactive liquid waste generated in the operation (calibration of nuclear instruments) will be analyzed for radioactivity and will meet the limits specified in 10 CFR Part 20 prior to release to the unrestricted area.

Potentially contaminated gaseous effluents generated in the operation are continuously monitored for radioactivity to meet concentration limits as specified in Appendix B, Table II, 10 CFR Part 20.

*Information was provided on July 22, 1982 in a telephone conversation between NMSS staff and Mr. Dave Chaney, and other FP&L staff.

F. Health Physics Operation Review

Each year, the corporate health physicist and health physics supervisor will conduct a formal health physics operations review to assure that the health physics program is operating in the most efficient manner and meets the ALARA goal. The review will include:

1. HP operating procedures.
2. Personnel exposure records.
3. Survey records.
4. Training courses and records.
5. Health physics records.

The results of the review and recommendation for improving the radiation protection program and reducing personnel exposures will be sent to the plant manager and FP&L management.

VI. Environmental Impact

The "Final Environmental Statement Related to the Operation of St. Lucie Plant, Unit No. 2," dated April 4, 1982 has been prepared and issued as NUREG-0842. Based on the environmental statement, implementation of the 10 CFR Part 70 license for the storage and handling of special nuclear and byproduct materials will have an insignificant effect on the environment.

VII. Fire Safety

The fire suppression system includes water to 12 yard fire hydrants, six deluge systems, one preaction system, a sprinkler system and, hose racks in various areas of the plant for fire-fighting purposes. Readily accessible 1½-inch hose lines with fog nozzles extend to all areas except the new and spent fuel storage areas. The fuel storage areas are supplied with CO_2 and dry chemical extinguishers.

The automatic fire detection system consists of ionization detectors capable of detecting a fire in its incipient stage. It is the staff's opinion that the fire protection equipment is adequate to reduce the risk of a facility fire.

VIII. Physical Security

The FP&L physical security plan has been reviewed. It is the staff's opinion that the program described is adequate and meets the requirements of 10 CFR 73.67. The applicant was notified on August 4, 1982 that his "Physical Security Plan for the Protection of Special Nuclear Material of Low Strategic Significance at St. Lucie Unit No. 2" was approved. The staff recommends the following license condition be added requiring the plan to be fully implemented by the date the requested materials are received:

> The "Physical Security Plan for the Protection of Special Nuclear Material of Low Strategic Significance at St. Lucie Unit No. 2" shall be fully implemented by the date the requested materials are received.

The Division of Safeguards has approved the security of an offloading area near the door to the fuel building where loaded shipping containers may be stored.

IX. Conclusions and Recommendations

The staff finds that the proposed activities can be performed without undue risk to the health and safety of the public and operating personnel. It has been determined by the staff that the application fulfills the requirements of 10 CFR 70.22(a).

Further, the issuance of this license is not a major federal action significantly affecting the quality of the human environment, and thus, pursuant to 10 CFR 51.5(d)(4), no environmental impact statement, negative declaration or environmental impact appraisal need be prepared.

Based upon the above discussion, the staff recommends pursuant to 10 CFR 70.23(a) that the license be issued, subject to the above conditions.

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