FEB 9 1983

DOCKET NUMBER: 70-2946

APPLICANT: Louisiana Power and Light Company

FACILITY: Waterford Steam Electric Station, Unit 3

SUBJECT: SAFETY EVALUATION REPORT - Review of License Application Dated July 27, 1981, and Supplements Dated March 4, June 1, and 28, July 23, September 16, and December 13, 1982, and January 7, 20, and 24, 1983, for a Materials License

I. Introduction

General

By application dated July 27, 1981, and supplements dated March 4, June 1, June 28, July 23, September 16, and December 13, 1982, and January 7, 20, and 24, 1983, Louisiana Power and Light Company (LPL) requested an NRC materials license authorizing the receipt, possession, inspection, and storage of enriched uranium fuel assemblies and two Pu-Be neutron sources.

The fuel assemblies authorized by this license will be supplied by Combustion Engineering, Inc., and is for use in the Waterford Steam Electric Station, Unit 3, a pressurized water reactor. The reactor is located on the west bank of the Mississippi River, about 25 miles west-northwest of New Orleans.

Each fuel assembly contains 236 fuel rods and five control element guide tubes. The rods and tubes are arranged in a 16 x 16 square array. Each assembly is 7.972-inches square by 176.8-inches long. The active fuel length is 150 inches. Table 1 gives general fuel rod parameters that describe the fuel.

Each assembly contains approximately 427 kg of uranium as uranium dioxide. The fuel assemblies for the first core loading will be enriched to a maximum of 3.5 w/o U-235.

Table 1. LPL Fuel Rod Parameters

Parameter	Initial Core
Fuel rod array, square	16 x 16
Fuel rod material (sintered pellet)	UO_2
Pellet diameter, in.	0.325
Pellet length, in.	0.390
Pellet density, g/cm^3	10.38
Pellet density (% theoretical)	94.75
Stack density, g/cm^3	10.06
Clad material	Zircaloy-4
Clad ID, in.	0.332
Clad OD (nominal), in.	0.382
Clad thickness (nominal), in.	0.025
Fuel rod pitch, in.	0.506

II. Scope of Review

The staff safety review of LPL's request for a materials license included an evaluation of Waterford's organization, nuclear criticality safety, radiation safety, fire safety, and physical security of the site. The application was discussed with staff members of the applicant, the NRR project manager, and the NRC resident inspector.

The evaluation of the physical security plan was made by the Physical Security Licensing Branch, Division of Safeguards, Office of Nuclear Material Safety and Safeguards.

III. Authorized Activities

A. Enriched Uranium Fuel Assemblies

The applicant requests authorization to receive fuel assemblies from Combustion Engineering, Inc., in shipping containers approved by the NRC. The fuel assemblies will be unloaded onto the operating deck of the fuel handling building in their shipping containers. The assemblies will be inspected, then stored in the new fuel storage racks and/or the spent fuel storage racks.

Authorization is also requested for the repackaging of any assembly, if necessary, for delivery to a carrier. This will permit the return of damaged fuel assemblies to the manufacturer. It should be noted the license will not authorize insertion of a fuel assembly into the reactor vessel.

B. Neutron Startup Sources

The applicant has also requested authorization to receive, possess, and store two plutonium-beryllium (Pu-Be) neutron sources. Each source will contain up to 1.5 g of Pu, primarily Pu-238. The sources will be shipped to LPL in containers approved by the NRC. Each container will hold only one neutron source (~20 Ci).

IV. Possession Limits

The applicant has requested authorization to receive 2400 kg of U-235 in the form of fuel assemblies and 3.0 g Pu in the form of sealed sources; accordingly, the following license conditions are recommended:

6. Material	7. Chemical or Physical Form	8. Quantity
A. Uranium enriched in the U-235 isotope	A. UO_2 in unirradiated reactor fuel assemblies	A. 2400 kg of U-235 in uranium enriched to a maximum of 3.5 w/o U-235

6. Material	7. Chemical or Physical Form	8. Quantity
B. Plutonium	B. Pu(238)-Be sealed sources	B. 2 sources with a maximum of 20 curies per source and with a maximum of 3.0 g total Pu

V. Organization

A. Radiation and Nuclear Safety Responsibilities

The Health Physics Superintendent is responsible for managing the Waterford-3 Radiation Protection Plan. He is responsible for the control of radiation exposures to personnel, conduct of surveillance, and the maintenance of related records.

The Nuclear Engineering Engineer-Nuclear is responsible for fuel and neutron source handling, the development and implementation of fuel handling procedures, and the administrative controls to ensure storage of fuel assemblies in alternate rows and columns in the spent fuel pool.

B. Minimum Technical Qualifications

By supplements dated December 13, 1982 and January 7, 1983, the applicant specified the minimum technical qualifications for the positions of Health Physics Superintendent and Nuclear Engineering Engineer-Nuclear. The Health Physics Superintendent has a B.S. degree in science or engineering and at least 2 years of experience working in a radiation protection field. Although he does not meet all minimum qualifications for a Radiation Protection Manager (e.g., at least 5 years of professional experience in applied radiation protection) specified in Regulatory Guide 1.8, "Personnel Selection and Training," his qualifications are adequate for facility operations under the 10 CFR Part 70 license.

The Nuclear Engineering Engineer-Nuclear meets the ANSI/ANS 3.1-1978 qualifications for a reactor engineer. This includes a B.S. degree in engineering and

4 years' experience or a graduate degree and 3 years' experience. At least two of these years of experience are at a nuclear power plant in such areas as reactor physics, core measurements, core heat transfer, and core physics testing programs.

The staff recommends Condition Nos. 11 and 12 be added to the license to emphasize the minimum qualifications of the Health Physics Superintendent and the Nuclear Engineering Engineer-Nuclear, respectively.

C. Training

The applicant has stated that all individuals working with licensed materials shall complete a training program covering radiation protection prior to working with the licensed materials.

The applicant did not state that fuel handling personnel would complete training for inspection and receipt procedures associated with fuel handling. Therefore, the staff recommends Condition No. 13 be included to ensure that personnel are sufficiently trained to carry out activities authorized by this license.

The training program includes instruction in applicable NRC regulations and plant procedures for protection of personnel in accordance with 10 CFR 19.12. Topics covered include the basics of radiation, dose limits specified in 10 CFR 20, emergency response, and ALARA. A refresher training program is conducted annually. Radiation protection training will be administered by the Nuclear Training Group, assisted by General Physics Corporation, and training covering fuel handling activities will be administered by Middle South Quality Assurance Department Services. The training program will be reviewed annually. The staff has concluded, that the applicant's training program is adequate to allow LPL personnel to safely carry out activities authorized by this license.

VI. Nuclear Criticality Safety

A. General

The fuel assemblies may be stored at Waterford Steam Electric Station, Unit 3, in three locations: the operating deck of the fuel handling building, the new fuel storage racks, and the spent fuel storage racks. The applicant has not specified the conditions under which more than one fuel assembly out of the shipping containers or the storage racks at the same time would be subcritical. One assembly, however, cannot be made critical with any degree of water moderation or reflection. Therefore, the staff recommends Condition No. 14 limiting the number of fuel assemblies out of its shipping container or storage rack location to one be included in the license.

The fuel assemblies may be covered with a plastic wrapper while in storage. If the wrappers around the assemblies could fill with water, while water between the assemblies drained, criticality may occur under postulated accident conditions. The applicant has stated that if plastic covers are used, the covers will be open on the bottom so that water could drain from the assemblies. Because of the significance of the drainage of water from within the fuel assemblies, Condition No. 15 is recommended.

B. Shipping Container Storage Area

The fuel assemblies will be delivered to Waterford Steam Electric Station, Unit 3, in shipping containers, Model No. 927C1. The container, a steel structure capable of storing or transporting one or two fuel assemblies, has been approved for use by the NRC. In the event of an unloading delay, the loaded fuel containers will be stored on the operating deck of the fuel handling building.

The containers are Fissile Class III and no more than eight containers can be shipped together (NRC Certificate of Compliance No. 6078). Since the applicant

did not specify interim storage in shipping containers, the staff recommends Condition No. 16. This condition specifies that at least 20 feet of air or 2 feet of concrete must be between storage arrays and groups of 8 shipping containers. The 2 feet of concrete provides a shield which effectively isolates the arrays and groups of containers from each other; the distance in air reduces interaction between arrays to insignificant quantities (see "Nuclear Safety Guide 1961," TID-7016, Rev. 1).

C. New Fuel Storage Racks

The new fuel storage racks may be used to store up to 80 unirradiated reactor fuel assemblies. The racks consist of eight 2 x 5 arrays. The fuel assemblies in each 2 x 5 array are spaced on 21-inch centers. Four of the 2 x 5 arrays are parallel to each other and separated by 40-inch wide aisles. Each of the remaining four 2 x 5 arrays is in line with a corresponding 2 x 5 array in the first group and separated from it by a 46-inch aisle.

Independent nuclear criticality safety analyses made by the staff indicate the maximum k_{eff} of the fuel storage array in the new fuel vault is 0.842±0.004 at an optimum mist density of 0.05 g/cm^3 within and between fuel assemblies and full concrete reflection surrounding the array.

D. Spent Fuel Storage Racks

During the initial fuel receipt, more new assemblies will be delivered to LPL than can be stored in the new fuel storage racks. Accordingly, additional fuel assemblies, and perhaps all of the assemblies, will be stored in the spent fuel storage racks. The fuel assembly storage locations are separated by 10.25 inches center-to-center in both directions. The staff has determined that the array would become supercritical at this spacing in the absence of neutron absorbers. In fact, a 4 x 3 array of fuel assemblies in the spent fuel pool would have a k_{eff} of 1.003 when moderated with full density water. To assure safety of this

array, the applicant proposes to use a boron poison in the form of Boraflex,[1] encased in steel, between each assembly. Figure 1 shows the proposed spent fuel storage rack design. The NRC staff calculated a maximum k_{eff} for an infinite Boraflex-poisoned array to be 0.914 ± 0.004 under optimum conditions of water moderation. This value is in close agreement with that calculated by the applicant (0.905) under the same moderator conditions.

The applicant has attempted to show that the Boraflex poison is in place by a 15% random sampling program; however, because the presence of the poison is important to nuclear criticality safety the staff feels that the sampling program is inadequate. Accordingly, it is recommended Condition 17 be added to the license to require the applicant to confirm the presence of the Boraflex in all design locations in the spent fuel storage pool storage rack array before fuel assemblies can be stored in adjacent cells. Until the confirmatory tests have been completed, the applicant requests authorization to store the fuel assemblies in alternate rows and columns in the spent fuel pool storage racks. This would position the fuel assemblies on 20.5-inch centers. In the absence of Boraflex, an array of assemblies at this spacing is safe in the spent fuel pool storage racks under optimum conditions of water moderation and reflection. Condition 17 also permits the applicant to store the fuel assemblies on 20.5-inch centers until satisfactory completion of the Boraflex testing.

The applicant has made a commitment to the following to control spacing in alternate storage locations: (1) the Nuclear Engineering Engineer-Nuclear shall appoint an SNM handling supervisor for each shift to supervise fuel handling operations, (2) the fuel assemblies shall be stored in alternate locations in the spent fuel pool racks in accordance with a prepared map approved by the Nuclear Engineering Engineer-Nuclear that specifies a specific

[1]Trade name for the boron containing plastic material.

storage location for each fuel assembly by serial number, (3) an independent loading verification will be made by the SNM handling supervisor and by the crane operator, and (4) they both will sign a transfer document assuring the proper storage of each fuel assembly. It is recommended Condition No. 18 be added emphasizing the administrative controls to assure proper location of the fuel assemblies in the spent fuel storage pool.

E. 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 upon 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 storage and inspection of unirradiated fuel containing uranium enriched to less then 5.0% 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 otherwise in the public interest. This exemption is authorized pursuant to 10 CFR 70.14. The staff recommends that this exemption be added as Condition No. 19 to the license.

VII. Radiation Safety

A. Control of Personnel Exposure

Personnel external exposures are evaluated and controlled on the basis of the data from personnel dosimeters (TLDs), which must be used as required by 10 CFR 20.202. The dosimeters for monitoring beta-gamma exposure are read and evaluated at least quarterly. Neutron dosimetry is conducted in accordance with guidance in Regulatory Guide 8.14, "Personnel Neutron Dosimeters."

Since the radioactive materials that are authorized under this license are sealed sources and fresh fuel assemblies for storage purposes, an individual receiving internal exposure under this license would be unlikely.

B. Control of Surface Contamination

All the fuel is surveyed upon receipt by both wipe testing and direct beta-gamma survey for surface contamination.

Two sealed Pu-Be neutron sources doubly encapsulated in stainless steel rods shall be tested for leakage every 6 months as required by proposed Condition No. 20 to this license. The radiation safety personnel will post the Pu-Be source storage area with appropriate radiation signs and will survey the area.

C. Calibration of Instruments

The radiation detecting devices are calibrated semiannually to ensure that they are functioning properly. The frequency meets the recommended frequency as given in Regulatory Guide 8.24, "Health Physics Surveys During Enriched Uranium 235 Processing and Fuel Fabrication."

D. Management of Radiation Waste

Since this license is authorized only for storage of fuel assemblies and sealed sources, very little radioactive waste, if any, will be generated under this license. However, if there is any radioactive waste generated, the waste shall be shipped to an offsite licensed burial facility for disposal.

VIII. Environmental Protection

The Final Environmental Statement related to the operation of Waterford Unit 3 dated September 30, 1981, has been prepared and issued by the NRC as

NUREG-0779. Based on the environmental statement relating to the operating license, implementation of the 10 CFR Part 70 license for the storage and handling of special nuclear material will have an insignificant effect on the environment. Accordingly, 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.

IX. Fire Safety

The fuel storage areas will be constructed from materials that are not combustible. LPL will have ionization detectors in the fuel handling building capable of detecting a fire in its incipient stage. Fire extinguishers have been provided in all fuel storage areas. Fire hose stations are within 75 feet of all points of the fuel handling building. The staff has determined the fire protection measures provided are adequate for the facility.

X. Physical Security

Fuel storage areas are located in the fuel handling building which is a controlled access area. The Division of Safeguards has reviewed the LPL Physical Security Plan and has determined that it is adequate and meets the requirements of 10 CFR 73.67. The applicant was notified by the NRC by letter dated November 26, 1982, that his revised plan was approved as conditioned. It will be implemented by the date of fuel receipt and will remain in effect whenever fresh fuel is stored onsite. The staff recommends that Condition No. 21 be added requiring the plan to be fully implemented by the date the requested materials are received.

XI. Conclusions

The NRC 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) and 70.23(a).

XII. Recommendations

The staff recommends approval of the application and its supplements with the addition of the following conditions:

11. The minimum technical qualifications for the Health Physics Superintendent shall be at least a B.S. degree in engineering, science, or equivalent and 2 years' experience in a radiation protection field. The Health Physics Superintendent shall be responsible for radiation safety at Waterford Steam Electric Station, Unit 3.

12. The Nuclear Engineering Engineer-Nuclear shall be responsible for special nuclear material handling at the Waterford Steam Electric Station, Unit 3, and shall have the qualifications for a Reactor Engineer as specified in Section 4.4.1 of ANSI/ANS-3.1-1978, "Standard for Selection and Training of Nuclear Power Plant Personnel."

13 All individuals working with licensed materials shall complete a training program covering radiation protection and fuel handling procedures prior to receipt of the licensed material.

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

15. Fuel assemblies shall be stored in such a manner that water will drain freely from the assemblies in the event of flooding and subsequent draining of the fuel storage areas.

16. Fuel assemblies stored in their shipping containers shall be limited to groups of eight containers, independent of separation. The groups shall be separated from each other and from all fuel storage arrays by at least 20 feet of air or 2 feet of concrete.

17. The applicant shall confirm the presence of the Boraflex in all design locations in the spent fuel pool rack array prior to storing fresh fuel in adjacent cells in the racks in the spent fuel pool. The spent fuel storage racks may be used prior to satisfactory completion of the confirmatory tests, providing fresh fuel assemblies are stored only in alternate rows and columns in the racks on a center-to-center spacing between fuel assemblies of at least 20.5-inches.

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18. The Nuclear Engineering Engineer-Nuclear shall appoint an SNM handling supervisor for each shift to supervise fuel handling operations. The supervisor shall verify that each assembly is positioned in its location in the spent fuel racks in accordance with a written plan approved by the Nuclear Engineering Engineer-Nuclear. The crane operator shall independently verify the authorized loading of each assembly into the racks.

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

20. The licensee shall comply with the provisions of the attached Annex A, "License Condition for Leak Testing Sealed Plutonium Sources," dated November 1979.

21. The "Physical Security Plan - Protection of Special Nuclear Material of Moderate or Low Strategic Significance - Waterford 3 Steam Electric Station Unit 3 - Louisiana Power and Light Company," shall be fully implemented by the date of fuel receipt, and shall be in effect whenever fresh fuel is stored onsite.

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Approved by: W. T. Crow

W. T. Crow, Section Leader

FC:FCUP	FC:FCUP	FC:FCUP	FC:FCUF	FC:FCUP
BLSerini	ALSoong	NKetzlach	VTharpe	WTCrow
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18. The Nuclear Engineering Engineer-Nuclear shall appoint an SNM handling supervisor for each shift to supervise fuel handling operations. The supervisor shall verify each assembly, by serial number, is positioned in its location in the spent fuel racks in accordance with a written plan approved by the Nuclear Engineering Engineer-Nuclear. The crane operator shall independently verify the authorized loading of each assembly into the racks.

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

20. The licensee shall comply with the provisions of the attached Annex A, "License Condition for Leak Testing Sealed Plutonium Sources," dated November 1979.

21. The "Physical Security Plan - Protection of Special Nuclear Material of Moderate or Low Strategic Significance - Waterford 3 Steam Electric Station Unit 3 - Louisiana Power and Light Company," shall be fully implemented by the date of fuel receipt, and shall be in effect whenever fresh fuel is stored onsite.

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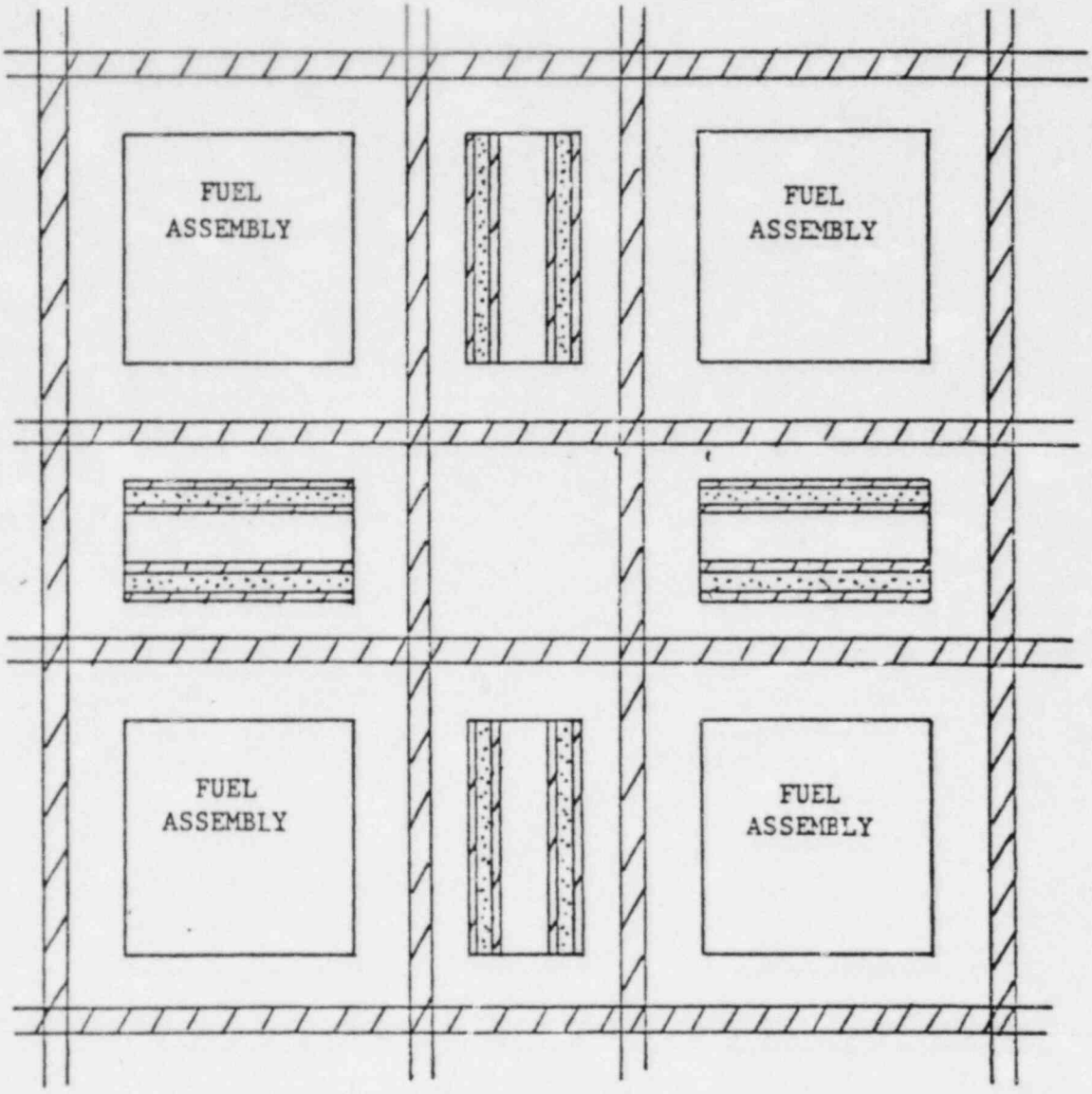
CRESS:SS	FC:FCUP	FC:FCUP	FC:FCUP	FC:FCUF	FC:FCUP
5520	BLSerini:is	ALSoong	NKetzlach	VTharpe	WTCrow
2/3/83	2/4/83	2/4/83	2/4/83	2/7/83	2/8/83

FIGURE - 1

SPENT FUEL STORAGE RACK ASSEMBLY DESIGN



NOT TO SCALE