August 31, 1989

Docket No. 50-400

DISTRIBUTION
See attached list

Mr. Lynn W. Eury
Executive Vice President
Power Supply
Carolina Power & Light Company
Post Office Box 1551
Raleigh, North Carolina 27602

Dear Mr. Eury:

SUBJECT: ISSUANCE OF AMENDMENT NO. 12 TO FACILITY OPERATING LICENSE NO. NPF-63 - SHEARON HARRIS NUCLEAR POWER PLANT, UNIT 1, REGARDING INCREASING MAXIMUM ALLOWED ENRICHMENT OF STORED FUEL (TAC NO. 72885)

The Nuclear Regulatory Commission has issued the enclosed Amendment No. 12 to Facility Operating License No. NPF-63 for the Shearon Harris Nuclear Power Plant, Unit 1. This amendment consists of changes to the Technical Specifications (TS) in response to your request dated April 11, 1989, as supplemented June 29, 1989.

The amendment would revise TS 5.3.1 by increasing the maximum allowed enrichment of stored fuel to 5.0 weight percent U-235 from 4.2 weight percent U-235. An additional requirement for storage would also be added to TS 5.6.1 to require that a maximum core geometry k-infinity for PWR fuel assemblies be less than or equal to 1.470 at 68°F. The amendment also contains an administrative correction for duplicate numbering in TS Section 5.6.1.

A copy of the related Safety Evaluation is enclosed. A Notice of Issuance will be included in the Commission's regular Bi-weekly Federal Register notice.

Sincerely,

Les Kintner/for

Richard A. Becker, Project Manager
Project Directorate II-1
Division of Reactor Projects I/II
Office of Nuclear Reactor Regulation

Enclosures:
1. Amendment No. 12 to NPF-63
2. Safety Evaluation

cc w/enclosures:
See next page

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PDR ADOCK 05000400
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[SHARRIS ISSU AMEND 72885]

| OFC | :LA:PD21:DRPR | :PM:PD21:DRPR | :D:PD21:DRPR | : | : | : |
|---|---|---|---|---|---|---|
| NAME | :PAnderson | : RBecker:bld | : EAdensam | : | : | : |
| DATE | :07/ /89 | :07/28/89 | :0 / /89 | : | : | : |

OFFICIAL RECORD COPY

Mr. L. W. Eury
Carolina Power & Light Company

Shearon Harris

cc:

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AMENDMENT NO. 12 TO FACILITY OPERATING LICENSE NO. NPF-63 - HARRIS, UNIT 1

Docket File
NRC & Local PDRs
PDII-1 Reading
S. Varga (14E4)
G. Lainas
E. Adensam
P. Anderson
R. Becker
OGC
D. Hagan (MNBB 3302)
E. Jordan (MNBB 3302)
B. Grimes (9A2)
T. Meeks (4) (P1-137)
W. Jones (P-130A)
J. Calvo (11D3)
M. Hodges
L. Kopp
ACRS (10)
GPA/PA
OC/LFMB

cc: Licensee/Applicant Service List

OFol
1/1

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

# CAROLINA POWER & LIGHT COMPANY, et al.

## DOCKET NO. 50-400

## SHEARON HARRIS NUCLEAR POWER PLANT, UNIT 1

## AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 12
License No. NPF-63

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

   A. The application for amendment by Carolina Power & Light Company (the licensee), dated April 11, 1989, as supplemented June 29, 1989, 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. NPF-63 is hereby amended to read as follows:

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, and the Environmental Protection Plan contained in Appendix B, both of which are attached hereto, as revised through Amendment No. 12, are hereby incorporated into this license. Carolina Power & Light Company shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

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

FOR THE NUCLEAR REGULATORY COMMISSION

Original Signed By:

Elinor G. Adensam, Director
Project Directorate II-1
Division of Reactor Projects I/II
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance: August 31, 1989

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| OFC | LA:PD21:DRPR | PM:PD21:DRPR | OGC | D:PD21:DRPR | | | |
| NAME | PAnderson | RBecker:bld | | EAdensam | | | |
| DATE | 07/20/89 | 07/20/89 | 08/8/89 | 08/24/89 | | | |

OFFICIAL RECORD COPY

ATTACHMENT TO LICENSE AMENDMENT NO. 12

FACILITY OPERATING LICENSE NO. NPF-63

DOCKET NO. 50-400

Replace the following pages of the Appendix A Technical Specifications with the enclosed pages. The revised areas are indicated by marginal lines.

| Remove Pages | Insert Pages |
|---|---|
| 5-6 | 5-6 |
| 5-7 | 5-7 |

DESIGN PRESSURE AND TEMPERATURE

5.2.2 The containment building is designed and shall be maintained for a maximum internal pressure of 45.0 psig and a peak air temperature of 380°F.

## 5.3 REACTOR CORE

FUEL ASSEMBLIES

5.3.1 The core shall contain 157 fuel assemblies with each fuel assembly normally containing 264 fuel rods clad with Zircaloy-4 except that limited substitution of fuel rods by filler rods consisting of Zircaloy-4, stainless steel, or by vacancies may be made in fuel assemblies if justified by a cycle-specific evaluation. Should more than a total of 30 fuel rods or more than 10 fuel rods in any one assembly be replaced per refueling a Special Report describing the number of rods replaced will be submitted to the Commission, pursuant to Specification 6.9.2, within 30 days after cycle startup. Each fuel rod shall have a nominal active fuel length of 144 inches. The initial core loading shall have a maximum enrichment of 3.5 weight percent U-235. Reload fuel shall be similar in physical design to the initial core loading and shall have a maximum enrichment of 5.0 weight percent U-235. Fuel with enrichments greater than 4.20 weight percent U-235 shall contain sufficient integral burnable absorbers such that the requirement of Specification 5.6.1.a.2 is met.

CONTROL ROD ASSEMBLIES

5.3.2 The core shall contain 52 shutdown and control rod assemblies. The shutdown and rod assemblies shall contain a nominal 142 inches of absorber material. The nominal values of absorber material shall be 80% silver, 15% indium, and 5% cadmium, or 95% hafnium with the remainder zirconium. All control rods shall be clad with stainless steel tubing.

## 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 680°F.

VOLUME

5.4.2 The total water and steam volume of the Reactor Coolant System is 9410 ± 100 cubic feet at a nominal $T_{avg}$ of 588.8°F.

## 5.6 FUEL STORAGE

### CRITICALITY

5.6.1.a The spent fuel storage racks are designed and shall be maintained with a $k_{eff}$ less than or equal to 0.95 when flooded with unborated water, which includes an allowance for uncertainties as described in Section 4.3.2.6 of the FSAR. This is assured by maintaining:

1. A nominal 10.5 inch center-to-center distance between fuel assemblies placed in the PWR storage racks and 6.25 inch center-to-center distance in the BWR storage racks.

2. The maximum core geometry $K_{\infty}$ for PWR fuel assemblies less than or equal to 1.470 at 68°F.

5.6.1.b The $k_{eff}$ for new fuel for the first core loading stored dry in the spent fuel storage racks shall not exceed 0.98 when aqueous foam moderation is assumed.

### DRAINAGE

5.6.2 The new and spent fuel storage pools are designed and shall be maintained to prevent inadvertent draining of the pools below elevation 277.

### CAPACITY

5.6.3 The new and spent fuel storage pools are designed for a storage capacity of 1832 PWR fuel assemblies and a variable number of PWR and BWR storage spaces in 48 interchangeable 7x7 PWR and 11x11 BWR racks. These interchangeable racks will be installed as needed. Any combination of BWR and PWR racks may be used.

## 5.7 COMPONENT CYCLIC OR TRANSIENT LIMIT

5.7.1 The components identified in Table 5.7-1 are designed and shall be maintained within the cyclic or transient limits of Table 5.7-1.

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 12 TO FACILITY OPERATING LICENSE NO. NPF-63

CAROLINA POWER & LIGHT COMPANY, et al.

SHEARON HARRIS NUCLEAR POWER PLANT, UNIT 1

DOCKET NO. 50-400

## 1.0 INTRODUCTION

By letter dated April 11, 1989, as supplemented June 29, 1989, the Carolina Power & Light Company (the licensee) requested changes to the Shearon Harris, Unit 1, (Harris) Technical Specifications (TS). The June 29, 1989, letter provided clarifying information that did not alter the action noticed, or change the initial determination of no significant hazards consideration as published in the Federal Register. The proposed changes would revise TS 5.3.1 by increasing the maximum allowed enrichment of stored fuel to 5.0 weight percent U-235 from 4.2 weight percent U-235. In addition, a requirement for storage would be added to TS 5.6.1 to require that a maximum core geometry k-infinity for PWR fuel assemblies be less than or equal to 1.470 at 68°F. The licensee's submittal includes a Westinghouse report, "Criticality Analysis of Shearon Harris Spent Fuel Racks with IFBA Fuel," November 1988, which supports the requested amendment. Plant operation using the higher enriched fuel will be demonstrated to be acceptable by a cycle specific reload safety evaluation performed prior to each fuel loading.

Also, in this amendment request, the numbering sequence of Section 5.6.1, Criticality, has been revised to eliminate duplicate specification numbers. The reactivity analysis and administrative change associated with this amendment are delineated below.

## 2.0 EVALUATION

The Harris spent fuel storage racks consist of square stainless steel cans having an inside dimension of 8.75 inches and a 0.75 inch wall thickness. On the outer surface of each side of the cans, Boraflex sheets having a minimum area density of 0.02 grams per square centimeter of Boron-10 (B-10) are held in place by a thin-walled stainless steel wrapper plate. The rack structure maintains these cans on a 10.5 inch center-to-center spacing.

The spent fuel is normally stored in pool water containing about 2000 ppm of soluble boron which results in about a 30 percent reduction in reactivity. However, for conservatism the spent fuel rack reactivity is calculated assuming no soluble boron in the water.

The Harris spent fuel pool was previously analyzed for the storage of Westinghouse 17x17 optimized fuel assemblies (OFA) and standard (STD) fuel assemblies with enrichments up to 4.2 weight percent U-235 and no contained burnable absorbers. The current analysis, which supplements the previous analysis, analyzes the storage of 5.0 weight percent 17x17 OFA and STD fuel assemblies with integral fuel burnable absorbers (IFBAs). The fuel assembly IFBAs consist of a neutron absorbing material such as gadolinium or boron which is homogeneously mixed with the fuel pellet or applied as a thin coating on the outside of the fuel pellet. The analytical methods and models used in the reactivity analysis have been benchmarked against experimental data and have been found to adequately reproduce the critical values. The staff has found these methods and models to be acceptable.

The design basis for preventing criticality outside the reactor is that, including uncertainties, there is a 95 percent probability at a 95 percent confidence level (95/95 probability/confidence) that the effective multiplication factor (k-effective) of the fuel assembly array will be no greater than 0.95. Two analytical techniques are used to ensure the criticality criterion for the storage of IFBA fuel in the Harris storage racks. The first method uses reactivity equivalencing to establish the poison material loading required to meet the criticality limits. The second method uses the fuel assembly infinite multiplication factor (k-infinity) to establish a reference reactivity.

The concept of reactivity equivalencing is predicated upon the reactivity decrease associated with the addition of IFBA fuel rods and fuel depletion. A series of reactivity calculations are performed to generate a set of IFBA rod numbers versus enrichment-ordered pairs which all yield the equivalent k-effective when the fuel is stored in the spent fuel racks. This is shown in the enclosed Figure which appeared in the supporting Westinghouse report noted above. From the Figure, it can be seen that the rack reactivity of fuel with 48 IFBA rods with an initial U-235 enrichment of 5.0 weight percent is equivalent to the rack reactivity of unirradiated fuel having an initial U-235 enrichment of 4.2 weight percent. The method of reactivity equivalencing has been widely used by other licensees for fuel storage analyses and has been accepted by the staff.

The resulting k-effective for the Harris spent fuel storage racks was 0.9448 including all appropriate biases and uncertainties at a 95/95 probability/confidence level. This meets the NRC acceptance criterion and is, therefore, acceptable.

In order to store fuel assemblies that may have a non-standard IFBA rod pattern and, therefore, cannot use the IFBA versus enrichment Figure, an infinite multiplication factor for a nominal fresh 4.2 weight percent U-235 fuel assembly was determined. As mentioned earlier, this is equivalent to the reactivity of a 5.0 weight percent U-235 fuel assembly with 48 IFBA rods. When k-infinity is used as a reference reactivity point, the need to specify an acceptable enrichment versus number of IFBA rods correlation is eliminated. Calculation of the infinite multiplication factor for a fuel array of 4.2 weight percent fuel in the Harris reactor geometry resulted in a reference k-infinity of 1.470. The licensee has shown that fuel with a reference k-infinity of 1.470 results in a maximum k-effective of less than 0.95 when stored in the Shearon Harris spent fuel storage racks. Therefore, the only requirement needed to ensure that the fuel racks are maintained at a k-effective below 0.95 is to verify that for each assembly, the k-infinity is no greater than 1.470 at 68°F in the core geometry. The IFBA rods versus enrichment Figure is, of course, an acceptable way for the licensee to verify that the k-infinity limit is met if a particular fuel assembly design meets the assumptions under which the enclosed Figure was generated.

It is possible to postulate events which could lead to an increase in storage rack reactivity, such as misplaced fuel assemblies. However, for such events, credit may be taken for the approximately 2000 ppm of boron in the spent fuel pool water by application of the double contingency principle of ANSI N16.1-1975. This states that one is not required to assume two unlikely, independent, concurrent events to provide for protection against a criticality accident. The staff finds this acceptable since administrative procedures require that the boron concentration be verified to be no less than 2000 ppm in the spent fuel pool once a week. The reduction in k-effective caused by the borated water more than offsets the reactivity addition caused by credible accidents.

Based on the above evaluation, the staff concludes that the spent fuel storage racks at Harris can accommodate Westinghouse 17x17 standard or optimized fuel assemblies with maximum enrichments of 5.0 weight percent U-235 provided that fuel with enrichments greater than 4.2 weight percent U-235 contain sufficient integral burnable absorbers such that the maximum core geometry k-infinity of these assemblies is no greater than 1.470 at 68°F.

The current TS have two Sections numbered 5.6.1. The licensee requests revising the identification sequences so that the two parts will become 5.6.1a and 5.6.1b. In addition, the subparts of 5.6.1a would be changed from alphabetic to numeric. The revised numbering is an administrative change that clarifies the TS and, therefore, is acceptable to the staff.

## 3.0 ENVIRONMENTAL CONSIDERATION

Pursuant to 10 CFR 51.21, 51.32, and 51.35, an environmental assessment and finding of no significant impact have been prepared and published in the Federal Register on August 30, 1989 (54 FR 35953). Accordingly, based upon the environmental assessment, the Commission has determined that the issuance of this amendment will not have a significant impact on the quality of the human environment.

## 4.0 CONCLUSION

The Commission made a proposed determination that this amendment involves no significant hazards consideration which was published in the Federal Register (54 FR 25370) on June 14, 1989, and consulted with the State of North Carolina. No public comments or requests for hearing were received, and the State of North Carolina did not have any comments.

The staff has 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.

Principal Contributors: L. Kopp
R. Becker

Dated: August 31, 1989

Enclosure to Safety Evaluation Supporting Amendment No. 12,
Shearon Harris Nuclear Power Plant, Unit 1

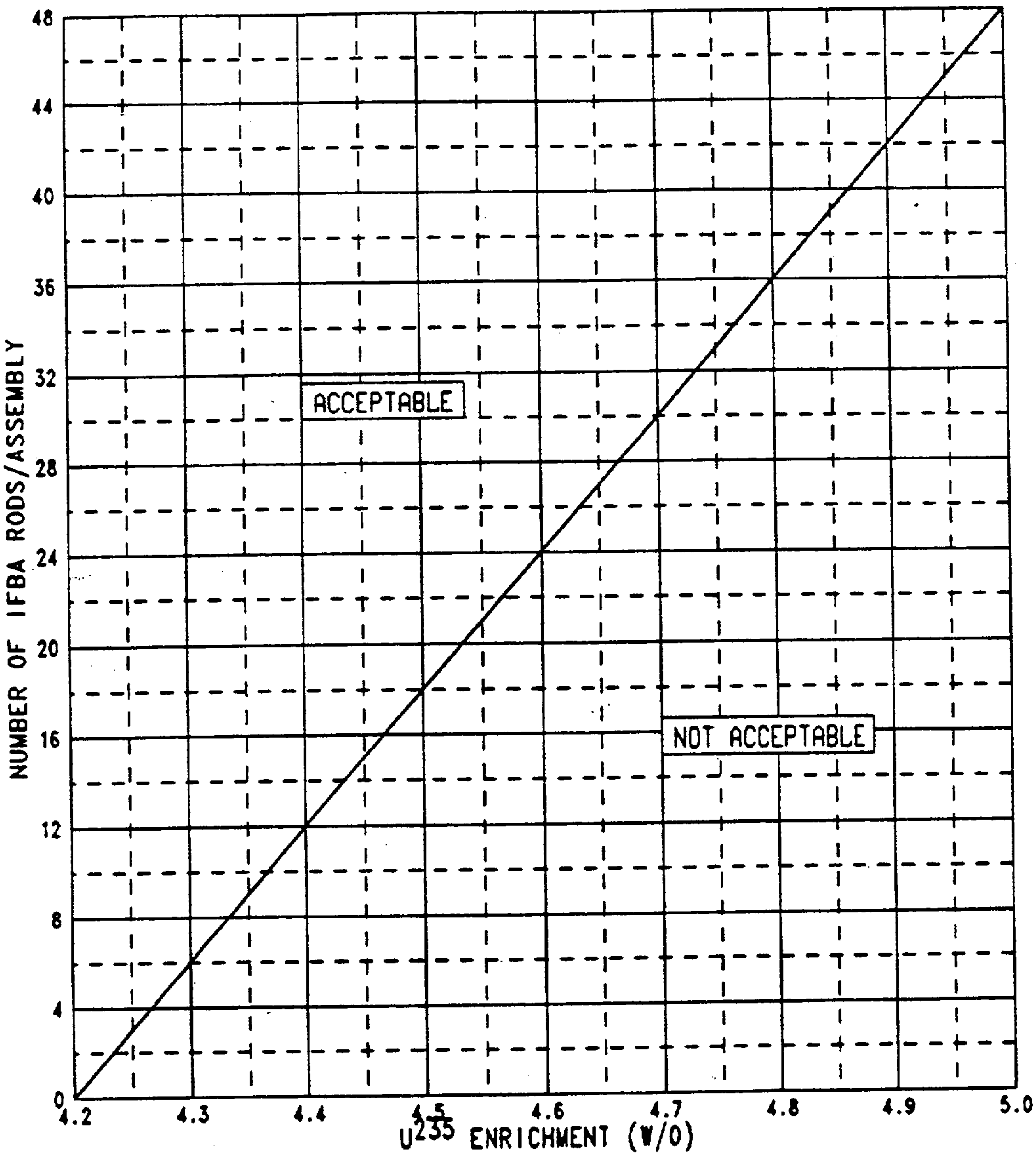


**Figure 2. Shearon Harris Fuel Assembly Minimum Number of IFBA Rods vs. Initial $U^{235}$ Enrichment for Storage in Region 1 Spent Fuel Racks**
"Criticality Analysis of Shearon Harris Spent Fuel Racks with IFBA Fuel," Westinghouse, November, 1988.