January 5, 1995

Mr. C. S. Hinnant, Vice President
Carolina Power & Light Company
H. B. Robinson Steam Electric Plant,
Unit No. 2
Post Office Box 790
Hartsville, South Carolina 29551-0790

SUBJECT: ISSUANCE OF AMENDMENT NO. 156 TO FACILITY OPERATING LICENSE NO. DPR-23 REGARDING FUEL ENRICHMENT - H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2 (TAC NO. M89999)

Dear Mr. Hinnant:

The Nuclear Regulatory Commission has issued the enclosed Amendment No. 156 to Facility Operating License No. DPR-23 for the H. B. Robinson Steam Electric Plant, Unit No. 2. This amendment changes the Technical Specifications in response to your request dated July 28, 1994.

The amendment allows an increased limit for fuel enrichment. The changes allow for the storage of fuel with an enrichment not to exceed 4.95 + 0.05 w/o U-235 in the new and spent fuel storage racks.

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

Sincerely,

Brenda L. Mozafari, Project Manager
Project Directorate II-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Docket No. 50-261

Enclosures: 1. Amendment No. 156 to DPR-23
2. Safety Evaluation

cc w/enclosures: See next page

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Mr. C. S. Hinnant
Carolina Power & Light Company

H. B. Robinson Steam Electric
Plant, Unit No. 2

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

CAROLINA POWER & LIGHT COMPANY

DOCKET NO. 50-261

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 156
License No. DPR-23

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

   A. The application for amendment by Carolina Power & Light Company (the licensee), dated July 28, 1994, 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 3.B. of Facility Operating License No. DPR-23 is hereby amended to read as follows:

B. Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 156, are hereby incorporated in the license. Carolina Power & Light Company shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of its issuance and shall be implemented within 60 days.

FOR THE NUCLEAR REGULATORY COMMISSION

for William H. Bateman, 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: January 5, 1994

ATTACHMENT TO LICENSE AMENDMENT NO. 156

FACILITY OPERATING LICENSE NO. DPR-23

DOCKET NO. 50-261

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
5.3-1	5.3-1
5.4-1	5.4-1
5.4-2	5.4-2

5.3 REACTOR

5.3.1 REACTOR CORE

5.3.1.1 The reactor core contains approximately 68 metric tons of uranium in the form of natural or slightly enriched uranium dioxide pellets. The pellets are encapsulated in Zircaloy-4 tubing to form fuel rods which are all pre-pressurized. The reactor core is made up of 157 fuel assemblies. Each fuel assembly contains 204 fuel rod locations occupied by rods consisting of natural or slightly enriched uranium pellets, solid inert materials, or a combination of the aforementioned.[1]

5.3.1.2 Deleted

5.3.1.3 Reload fuel will be similar in physical design to the initial core. The enrichment of reload fuel will be no more than 4.95 + 0.05 (nominal 4.95) weight percent of U-235.

5.3.1.4 Deleted

5.3.1.5 There are 45 full-length RCC assemblies in the reactor core. The full-length RCC assemblies contain 144-inch segments of silver-indium-cadmium alloy clad with stainless steel.[2]

5.3.1.6 Deleted

5.3.2 REACTOR COOLANT SYSTEM

5.3.2.1 The design of the Reactor Coolant System complies with the code requirements.[3]

5.4 FUEL STORAGE

5.4.1 SPENT FUEL PIT

The new and spent fuel pit structures are designed to withstand the anticipated earthquake loadings as Class I structures. The spent fuel pit has a stainless steel liner to ensure against loss of water.[1]

5.4.2 CRITICALITY

5.4.2.1 NEW FUEL STORAGE RACKS

Due to the new fuel storage rack design, a nominal 21-inch center-to-center distance is maintained between fuel assemblies. To permit storage of fuel with a maximum assembly axial plane enrichment of 4.95 + 0.05 (nominal 4.95) weight percent U-235, additional separation is maintained by use of the storage rack secured location restrictions below[2] in order to establish a geometry which ensures that k_{eff} is less than 0.95 assuming that new fuel storage racks are flooded with unborated water and which assures that k_{eff} is less than 0.98 in an optimum moderation event.

The secured location restrictions provide fuel storage locations which are secured to prevent fuel storage in those locations.

Secured Location Restrictions:

C4,5,6,7,8,9 / D4,5,8,9 / E4,5,8,9 / F1,4,5,8,9 / G1,4,5,8,9
H1,4,5,6,7,8,9 / J1 / K1

Amendment No. 81,112,125,156

5.4.2.2 SPENT FUEL STORAGE PIT

A combination of nominal assembly spacing, neutron absorber material between the assemblies, and restrictions on fuel design, integral burnable absorber content, reconstitution, and storage, is required to assure that k_{eff} is maintained less than 0.95 when the spent fuel storage pit is flooded with unborated water based on a maximum assembly planar enrichment of 4.95 + 0.05 (4.95 nominal) weight percent U_{235}. Fuel assemblies with maximum planar enrichments greater than 4.55 + 0.05 (4.55 nominal) weight percent U_{235} have requirements for minimum integral burnable absorber content.(2)

5.4.3 BORON CONCENTRATION - SPENT FUEL STORAGE PIT

The spent fuel storage pit is filled with borated water at a concentration of greater than or equal to 1500 ppm during refueling operations or new fuel movement in the spent fuel storage pit. This minimum boron concentration ensures subcriticality under worst case design events.

5.4.4 STORAGE CAPACITY - SPENT FUEL STORAGE PIT

The spent fuel storage pit provides a storage location for 544 fuel assemblies.

Reference

(1) FSAR Section 9.1

(2) EMF-94-113, "H. B. Robinson New and Spent Fuel Criticality Analysis," July 1994, Siemens Power Corporation.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 156 TO FACILITY OPERATING LICENSE NO. DPR-23

CAROLINA POWER & LIGHT COMPANY

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

DOCKET NO. 50-261

1.0 INTRODUCTION

By letter dated July 28, 1994, Carolina Power & Light Company (CP&L) requested changes to the H. B. Robinson Steam Electric Plant, Unit No. 2, (HBR2) Technical Specifications (TS) to allow an increased limit for fuel enrichment. In support of these requested changes, CP&L also provided supporting Siemens Power Corporation report, EMF-94-113, "H. B. Robinson New and Spent Fuel Criticality Analysis," dated July 1994. The current new (fresh) and spent fuel storage rack maximum enrichment is 4.2 + 0.05 weight percent (w/o) U-235. The proposed changes would allow for the storage of fuel with an enrichment not to exceed 4.95 + 0.05 w/o U-235 in the new and spent fuel storage racks.

The fresh fuel storage racks are used for temporary storage of unirradiated reload fuel and contain 105 storage cells located on 21-inch centers. The high density spent fuel storage racks have a nominal 10.5-inch cell center-to-center spacing and contain Boraflex on each cell wall face.

The NRC staff's evaluation of the criticality aspects of the proposed changes follows.

2.0 EVALUATION

The analysis of the reactivity effects of fuel storage in the new and spent fuel storage racks was performed with the SCALE system of computer codes with the three-dimensional multi-group Monte Carlo computer code, KENO.Va. Neutron cross sections were generated by the NITAWL and BONAMI codes using the 16-group Hansen-Roach library. The CASMO integral transport theory code was also used for the determination of small reactivity increments due to temperature effects and manufacturing tolerances, as well as for comparison with KENO.Va calculations. These codes are widely used for the analysis of fuel rack reactivity and have been benchmarked against results from numerous critical experiments. These experiments simulate the HBR2 fuel storage racks as realistically as possible with respect to parameters important to reactivity, such as, enrichment, assembly spacing, and absorber thickness. The intercomparison between two independent methods of analysis (KENO.Va and CASMO) also provides an acceptable technique for validating calculational methods for nuclear criticality safety. To minimize the statistical uncertainty of the KENO.Va reactivity calculations, a minimum of 30,000 neutron histories (100 generations of 300 neutrons) were accumulated in each

calculation. Experience has shown that this number of histories is quite sufficient to assure convergence of KENO.Va reactivity calculations. The staff concludes that the analysis methods used are acceptable and capable of predicting the reactivity of the HBR2 storage racks with a high degree of confidence.

The fresh fuel storage racks are normally maintained in a dry condition, i. e., the new fuel is stored in air. However, the NRC criteria for new fuel storage requires that the effective multiplication factor, k_{eff}, of the storage rack be no greater than 0.95 if accidentally flooded by pure water and no greater than 0.98 if accidentally moderated by low density hydrogenous material (optimum moderation). The new fuel storage racks were analyzed for 5.0 w/o U-235 enriched fuel for the full density flooding scenario and for the optimum moderation scenario. The calculated worst-case k_{eff} for a full rack of 5.0 w/o U-235 fuel could not meet the applicable acceptance criteria stated above. Therefore, restrictions were imposed on the storage configuration to prevent fuel from being placed in certain locations, as stated in proposed TS 5.4.2.1, reducing the number of allowable storage locations to 72. For the fully flooded accident condition, the resulting k_{eff} was 0.9447. The optimum moderation condition occurred at about 5 percent interspersed water volume and resulted in a k_{eff} of 0.9536. Appropriate biases and uncertainties due to the calculational method and material tolerances were included at the 95/95 probability/confidence level. This meets the NRC staff's acceptance criteria of 0.95 for full density water flooding and 0.98 for optimum moderation conditions and is, therefore, acceptable.

Fuel stored in the high density spent fuel storage racks is normally flooded by water borated to at least 1500 ppm. However, the NRC criterion for spent fuel storage requires that k_{eff} of the storage rack be no greater than 0.95 when flooded by unborated water, including all appropriate uncertainties at a 95/95 probability/confidence level. Each storage location contains a sheet of Boraflex secured by a stainless steel wrapper on all four walls. Thus, there are two Boraflex sheets between any pair of stored fuel assemblies. Based on measurements made at similar plants, a maximum length shrinkage of 3 to 4 percent was observed in Boraflex panels due to accumulated gamma radiation. The HBR2 analysis conservatively assumed a total shrinkage of over 6 percent in length and is, therefore, acceptable.

Reactivity calculations for the high density spent fuel racks indicated that fuel with an enrichment greater than 4.6 w/o U-235 could not meet the NRC criterion of k_{eff} no greater than 0.95. Therefore, additional calculations were performed to establish required gadolinia limits for fuel enriched to 5.0 w/o U-235. These calculations indicated that fuel assemblies containing four UO_2-gadolinia bearing rods with gadolinia loadings greater than 1.8 w/o would meet the NRC k_{eff} criterion. Only certain assembly designs containing only two 1.8 w/o gadolinia rods were found to be acceptable. Uncertainties (95/95) due to temperature, rack tolerances, and fuel tolerances, as well as the method bias and uncertainty were used with the most limiting arrangement of

four gadolinia rods and resulted in a maximum k_{eff} of 0.9466. This meets the NRC acceptance criterion of 0.95 for unborated water flooding and is, therefore, acceptable.

The following Technical Specification changes have been proposed as a result of the requested enrichment increase. The staff finds these changes acceptable.

(1) TS 5.3.1.3 is being modified to allow fuel with an enrichment of no more than 4.95 + 0.05 w/o U-235.

(2) TS 5.4.2.1 is being modified to allow fuel with an enrichment of no more than 4.95 + 0.05 w/o U-235 and to specify required secured location restrictions on new fuel storage.

(3) TS 5.4.2.2 is being changed to allow fuel with an enrichment of no more than 4.95 + 0.05 w/o U-235 in the spent fuel storage pit. Fuel assemblies with maximum planar enrichments greater than 4.55 + 0.05 w/o U-235 have requirements for minimum integral burnable absorber (gadolinia) content as given in EMF-94-113, "H. B. Robinson New and Spent Fuel Criticality Analysis," which has been added as a TS reference.

3.0 SUMMARY

Based on the review described above, the staff finds the criticality aspects of the proposed enrichment increase to the HBR2 new and spent fuel pool storage racks are acceptable and meet the requirements of General Design Criterion 62 for the prevention of criticality in fuel storage and handling.

Although the HBR2 TS have been modified to specify the above-mentioned fuel as acceptable for storage in the fresh or spent fuel racks, evaluations of reload core designs (using any enrichment) will, of course, be performed on a cycle by cycle basis as part of the reload safety evaluation process. Each reload design is evaluated to confirm that the cycle core design adheres to the limits that exist in the accident analyses and TS to ensure that reactor operation is acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the State of South Carolina official was notified of the proposed issuance of the amendment. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

Pursuant to 10 CFR 51.21, 51.32, and 51.35, and environmental assessment and finding of no significant impact have been prepared and published in the Federal Register on January 4, 1994 (60 FR 493). 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.

6.0 CONCLUSION

The Commission 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, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributor: L. Kopp

Date: January 5, 1995

AMENDMENT NO. 156 TO FACILITY OPERATING LICENSE NO. DPR-23 - H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

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