April 22, 2002

Mr. William R. McCollum, Jr.
Vice President, Oconee Site
Duke Energy Corporation
7800 Rochester Highway
Seneca, SC 29672

SUBJECT: OCONEE NUCLEAR STATION, UNITS 1, 2 AND 3 RE: ISSUANCE OF AMENDMENTS (TAC NOS. MB0894, MB0895 AND MB0896)

Dear Mr. McCollum:

The Nuclear Regulatory Commission has issued the enclosed Amendment Nos. 323, 323, and 324 to Renewed Facility Operating Licenses DPR-38, DPR-47, and DPR-55, respectively, for the Oconee Nuclear Station, Units 1, 2, and 3. The amendments consist of changes to the Technical Specifications (TS) in response to your application dated December 28, 2000, as supplemented by letters dated February 15, April 26, June 26, and October 31, 2001, and March 4, 2002.

The amendments revise the TS related to controls to ensure acceptable margins of subcriticality in the spent fuel pools to account for Boraflex degradation.

A copy of the related Safety Evaluation is also enclosed. A Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

/RA/

Leonard N. Olshan, Senior Project Manager, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-269, 50-270, and 50-287

Enclosures:
1. Amendment No. 323 to DPR-38
2. Amendment No. 323 to DPR-47
3. Amendment No. 324 to DPR-55
4. Safety Evaluation

cc w/encls: See next page

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PDII-1 R/F	OGC	AAttard
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JNakoski	GHill (4)	
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Package: ML021150509 TSs: ML021140052
Accession Number: ML020930470 **See previous concurrence *No major changes to SE

OFFICE	PDII-1/PM	PDII-1/LA	OGC	SPLB	SRXB*	PDII-1/SC
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DUKE ENERGY CORPORATION

DOCKET NO. 50-269

OCONEE NUCLEAR STATION, UNIT 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 323
Renewed License No. DPR-38

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

   A. The application for amendment to the Oconee Nuclear Station, Unit 1 (the facility) Renewed Facility Operating License No. DPR-38 filed by the Duke Energy Corporation (the licensee) dated December 28, 2000, as supplemented by letters dated February 15, April 26, June 26, and October 31, 2001, and March 4, 2002, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations as 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 set forth in 10 CFR Chapter I;

   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 hereby amended by page changes to the Technical Specifications as indicated in the attachment to this license amendment, and Paragraph 3.B of Renewed Facility Operating License No. DPR-38 is hereby amended to read as follows:

B. Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 323, 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 its date of issuance and shall be implemented within 90 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

John A. Nakoski, Chief, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Technical Specification Changes

Date of Issuance: April 22, 2002

DUKE ENERGY CORPORATION

DOCKET NO. 50-270

OCONEE NUCLEAR STATION, UNIT 2

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 323
Renewed License No. DPR-47

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

   A. The application for amendment to the Oconee Nuclear Station, Unit 2 (the facility) Renewed Facility Operating License No. DPR-47 filed by the Duke Energy Corporation (the licensee) dated December 28, 2000, as supplemented by letters dated February 15, April 26, June 26, and October 31, 2001, and March 4, 2002, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations as 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 set forth in 10 CFR Chapter I;

   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 hereby amended by page changes to the Technical Specifications as indicated in the attachment to this license amendment, and Paragraph 3.B of Renewed Facility Operating License No. DPR-47 is hereby amended to read as follows:

B. Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 323, 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 its date of issuance and shall be implemented within 90 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

John A. Nakoski, Chief, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Technical Specification Changes

Date of Issuance: April 22, 2002

DUKE ENERGY CORPORATION

DOCKET NO. 50-287

OCONEE NUCLEAR STATION, UNIT 3

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 324
Renewed License No. DPR-55

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

   A. The application for amendment to the Oconee Nuclear Station, Unit 3 (the facility) Renewed Facility Operating License No. DPR-55 filed by the Duke Energy Corporation (the licensee) dated December 28, 2000, as supplemented by letters dated February 15, April 26, June 26, and October 31, 2001, and March 4, 2002, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations as 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 set forth in 10 CFR Chapter I;

   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 hereby amended by page changes to the Technical Specifications as indicated in the attachment to this license amendment, and Paragraph 3.B of Renewed Facility Operating License No. DPR-55 is hereby amended to read as follows:

B. Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 324, 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 its date of issuance and shall be implemented within 90 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

John A. Nakoski, Chief, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Technical Specification Changes

Date of Issuance: April 22, 2002

ATTACHMENT TO LICENSE AMENDMENT NO. 323

RENEWED FACILITY OPERATING LICENSE NO. DPR-38

DOCKET NO. 50-269

AND

TO LICENSE AMENDMENT NO. 323

RENEWED FACILITY OPERATING LICENSE NO. DPR-47

DOCKET NO. 50-270

AND

TO LICENSE AMENDMENT NO. 324

RENEWED FACILITY OPERATING LICENSE NO. DPR-55

DOCKET NO. 50-287

Replace the following pages of the Appendix A Technical Specifications and associated Bases with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Remove	Insert
3.5.4-2	3.5.4-2
3.7.12-1	3.7.12-1
3.7.12-2	3.7.12-2
3.7.13-1	3.7.13-1
3.7.13-2	3.7.13-2
3.7.13-3	3.7.13-3
3.7.13-4	3.7.13-4
3.7.13-5	3.7.13-5
3.7.13-6	3.7.13-6
3.7.13-7	3.7.13-7
3.7.13-8	3.7.13-8
-	3.7.13-9
-	3.7.13-10
-	3.7.13-11
-	3.7.13-12
4.0.2	4.0.2
B 3.5.4-1	B 3.5.4-1

B 3.5.4-3	B 3.5.4-3
B 3.5.4-4	B 3.5.4-4
B 3.5.4-5	B 3.5.4-5
B 3.5.4-6	B 3.5.4-6
B 3.7.12-1	B 3.7.12-1
B 3.7.12-2	B 3.7.12-2
-	B 3.7.12-3
-	B 3.7.12-4
-	B 3.7.12-5
B 3.7.13-1	B 3.7.13-1
B 3.7.13-2	B 3.7.13-2
-	B 3.7.13-3
-	B 3.7.13-4
-	B 3.7.13-5

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO

AMENDMENT NO. 323 TO RENEWED FACILITY OPERATING LICENSE DPR-38

AMENDMENT NO. 323 TO RENEWED FACILITY OPERATING LICENSE DPR-47

AND AMENDMENT NO. 324 TO RENEWED FACILITY OPERATING LICENSE DPR-55

DUKE ENERGY CORPORATION

OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3

DOCKET NOS. 50-269, 50-270, AND 50-287

1.0 INTRODUCTION

By letter dated December 28, 2000, as supplemented by letters dated February 15, April 26, June 26, and October 31, 2001, and March 4, 2002, Duke Energy Corporation (the licensee) submitted a request for changes to the Oconee Nuclear Station, Units 1, 2, and 3, Technical Specifications (TS). The requested changes would revise the TS related to controls used to ensure acceptable margins of subcriticality in the spent fuel pools (SFPs) to account for Boraflex degradation. The supplements dated February 15, April 26, June 26, and October 31, 2001, and March 4, 2002, provided clarifying information that did not change the scope of the December 28, 2000, application nor the initial proposed no significant hazards consideration determination.

2.0 BACKGROUND

General Design Criterion (GDC) 62 states that "criticality in the fuel storage and handling system shall be prevented by physical systems or processes, preferably by use of geometrically safe configurations." The NRC has established a 5 percent subcriticality margin (k_{eff} is to be no greater than 0.95) to comply with GDC 62.

10 CFR 50.68, "Criticality accident requirements," states that "if credit is taken for soluble boron, the k-effective of the spent fuel storage racks loaded with fuel of the maximum fuel assembly reactivity must not exceed 0.95, at a 95 percent probability, 95 percent confidence level, if flooded with borated water, and the k-effective must remain below 1.0 (subcritical), at a 95 percent probability, 95 percent confidence level, if flooded with unborated water."

Generic Letter (GL) 96-04, "Boraflex Degradation in Spent Fuel Pool Storage Racks," dated June 26, 1996, was issued by the staff over concerns related to (1) gamma radiation-induced shrinkage of Boraflex and the potential to develop tears or gaps in the material, and

(2) long-term Boraflex performance throughout the intended service life of the racks resulting from gamma irradiation and exposure to the wet pool environment. The staff requested licensees that use Boraflex to assess the ability of Boraflex to maintain a k_{eff} of 0.95 and to submit a plan describing actions required if the 5 percent margin to criticality could not be maintained by Boraflex material due to current or projected material degradation.

The NRC staff, in a Safety Evaluation dated October 25, 1996, accepted Westinghouse Owners Group Topical Report WCAP-14416-NP-A for referencing in licensing applications where licensees propose to take credit for soluble boron in SFP criticality analysis. The review and acceptance of WCAP-14416-NP-A focused on the methodology in which credit could be taken for soluble boron in the SFP to meet the NRC recommended criterion that the spent fuel rack multiplication factor (k_{eff}) be less than or equal to 0.95, at a 95 percent probability, 95 percent confidence level. All licensees proposing to use the method described above for soluble boron credit must identify potential events that could dilute the SFP soluble boron to the concentration required to maintain the 0.95 k_{eff} limit and should quantify the time span of these dilution events to show that sufficient time is available to enable adequate detection and suppression of any dilution event.

Accordingly, the licensee is proposing to modify the TS to take credit for soluble boron in the spent fuel criticality analysis due to degradation of the spent fuel storage cell Boraflex panels, which are currently credited with maintaining margins to subcriticality at Oconee within the SFPs. The staff's evaluation of the licensee's request is provided below.

3.0 STAFF EVALUATION

3.1 Dilution Events

The licensee has proposed to credit soluble boron in the criticality analysis that will allow the neutron absorbing Boraflex material in the fuel storage racks to be ignored. Therefore, the licensee completed a boron dilution analysis to support crediting soluble boron and its proposed revision to the TS. As a result, the licensee established a minimum soluble boron concentration of greater than or equal to 2220 parts per million (PPM) for fuel assembly storage and movement within the combined SFP for Units 1 and 2 (Unit 1/2) and SFP for Unit 3. In order to ensure that the design basis k_{eff} of 0.95 is not exceeded due to potential dilution events, the licensee determined that a minimum boron concentration of 400 ppm for Units 1 and 2 SFP and 430 ppm for the Unit 3 SFP would provide a k_{eff} of less than or equal to 0.95. The licensee then evaluated plant systems that could potentially dilute the SPF.

The Unit 1/2 SFP has a water inventory of 515,740 gallons and the Unit 3 SFP has an inventory of 358,460 gallons. The volume required to dilute the Unit 1/2 SFP and the Unit 3 SFP is 883,874 gallons and SFP 588,403 gallons respectively. The volume required to dilute the Unit 1/2 SFP and the Unit 3 SFP soluble boron concentration is based on the initial concentration of 2220 ppm.

The licensee evaluated dilution events from (1) potential pipe breaks from the demineralized water (DW) supply system and the filtered water (FW) supply system; (2) misalignment of systems interfacing with the SFPs, such as the coolant treatment system, DW system, FW system, and recirculated cooling water system; and (3) loss of offsite power. In addition, the licensee evaluated the standby shutdown facility (SSF) which uses the SFP as a source of cooling water for various events and intentionally refills the pool with unborated makeup. This unborated makeup dilutes the SFPs' boron concentration by plant procedure to the overflow level in the SFPs.

The licensee's initial submittal did not adequately address the guidelines of the WCAP-14416-NP-A for crediting soluble boron in the SFPs as accepted by NRC Safety Evaluation dated October 25, 1996. The staff found the licensee's proposed soluble boron credit limit to be nonconservative as evaluated by the topical report methodology. Also, the licensee proposed that the boron concentration limit in TS 3.7.12 be specified in the core operating limits report and not in the TSs.

The licensee, in response to the staff's request for additional information (RAI), reevaluated the dilution events to the guidelines of WCAP-14416-NP-A and provided a detailed description of, and methodology for evaluating, the SSF operation. This reevaluation by the licensee resulted in the addition of the high pressure injection (HPI) suction alignment as a dilution event that was not part of the original submittal. Alignment of the HPI pump to the SFP is done to mitigate tornado events when the borated water storage tank is unavailable. Like the SSF operation, the SFP under the HPI suction alignment is refilled by procedure with unborated water. Further, in response to the staff's RAI, the licensee revised the submittal to include the minimum boron concentration in the proposed revision to TS 3.7.12.

Of the dilution events evaluated, with the exception of the SSF operation and HPI suction alignment, only the DW supply system could provide the inventory necessary to dilute the Unit 1/2 SFP and the Unit 3 SFP. The DW supply system is replenished by the low pressure service water system which uses Lake Keowee as its source. However, at a flow rate of 300 gpm, it would take 49.1 hours and 32.6 hours to dilute the soluble boron concentration for the Unit 1/2 SFP from 2220 ppm to 400ppm and the Unit 3 SFP from 2220 ppm to 430 ppm.

The staff verified the licensee's calculation for dilution by the DW supply system and determined that it would take 49.1 hours to dilute the Unit 1/2 SFP and 32.6 hours to dilute the Unit 3 SFP soluble boron concentration. The licensee's operating practice requires one operator round per shift. Therefore, if an SFP dilution were to occur from the demineralized water supply system, it would be identified and suppressed by the operator before the 0.95 k_{eff} limit was reached. Additionally, the large volume of water needed to dilute the pool would set off both SFP's high level alarm within four hours and plant personnel would readily detect the flooding caused by the overflow event in the auxiliary building well before k_{eff} reached 0.95.

3.1.1 SSF Dilution Event

SSF operation takes a suction on the Unit 1/2 SFP and the Unit 3 SFP via the reactor coolant makeup pump for seal injection flow to the reactor coolant pumps in response to security, Appendix R, fire, flooding, and tornado events. Drawdown of 29 gallons per minute from the SFPs occurs over 72 hours and will remove 250,560 gallons from the Unit 1/2 SFP and 125,280 gallons from the Unit 3 SFP. The staff determined that the SSF operation could not be evaluated using WCAP-14416-NP-A, and that the licensee had not provided sufficient information to support its conclusions concerning boron dilution from unborated makeup to the SFPs following SSF drawdown in its original submittal.

The licensee, in response to the staff RAI, provided its assumptions for makeup water following SSF drawdown. To evaluate the SSF operation the licensee made the following assumptions:

- Makeup to the SFPs is unborated and from Lake Keowee,
- The bleed holdup tanks and concentrated boric acid tanks are unavailable for makeup to the SFPs,
- The SFP will be refilled to overflow level due to potential difficulties associated with station blackout, and
- Procedures call for makeup during drawdown; however, makeup will begin after drawdown is complete.

Other factors, such as (1) removal of coolant by reactor coolant makeup pumps, (2) boiloff of SFP coolant, (3) when coolant makeup starts, (4) SSF return (letdown) flow to the SFP, (5) number of fuel assemblies in the SFP, and (6) time since last core offload, were necessarily excluded from determining the SFPs' soluble boron concentration due to their variability or time dependent nature prior to adding makeup to the SFPs.

Although procedures exist to begin makeup prior to 36 hours into the event, the licensee has conservatively assumed that makeup begins after 72 hours and has ignored SSF letdown to the SFPs during the event. The licensee then determined that the Unit 1/2 SFP and the Unit 3 SFP soluble boron concentration would be 2685 ppm and 3180 ppm following boiloff and drawdown of the SFPs. Unborated makeup from Lake Keowee is then added to the overflow level in each SFP. The soluble boron concentration in the Unit 1/2 SFP pool following the addition of 400,827 gallons was determined to be 825 ppm. The Unit 3 SFP soluble boron concentration was determined to be 1001 ppm from the addition of 275,940 gallons of makeup.

The staff agrees with the licensee's simplifying assumption for the SSF operation and finds that the methodology bounds the dynamic effects of drawdown, boiloff, SSF letdown flow, and time since last core offload. Although the licensee assumes makeup begins after 72 hours and ignores letdown flow, procedures exist to begin makeup prior to 36 hours into the event and SSF letdown returns borated makeup to the SFPs. Adding makeup flow prior to 36 hours and SSF letdown results in a higher soluble boron concentration as less makeup is needed to bring the SFPs back to the normal or overflow level. As a result, the methodology, simplifying assumptions, and administrative procedures are considered appropriate for the SSF operation, and will ensure that the dilution event ends in advance of the 0.95 k_{eff} design basis limit being reached for the SFPs.

3.1.2 HPI Suction Alignment Dilution Event

The HPI pump is aligned to take suction from the SFP to mitigate tornado events when the borated water storage tank is unavailable. This operation is limited to one HPI pump, which uses the SFP cooling discharge line. In the event the SFP heats up to the saturation temperature, the HPI pump will be unable to remove coolant from the SFP.

The methodology used for this event ignores SFP boiloff, which results in a lower boron concentration prior to makeup. Factoring boiloff into the HPI suction alignment scenario would result in a higher soluble boron concentration prior to makeup. The licensee assumes the endpoint boron concentration prior to makeup to be 2220 ppm, which is the same as the minimum required boron concentration of the TS.

Approximately 272,260 gallons are removed from the Unit 1/ 2 SFP and 187,431 gallons are removed from the Unit 3 SFP. Unborated makeup is then provided to the overflow level in both SFPs. Makeup of 332,762 gallons is added to the Unit 1/2 SFP resulting in a soluble boron concentration of 938 ppm, and 229,082 gallons are provided to the Unit 3 SFP, which results in a soluble boron concentration of 957 ppm. The staff finds that these dilution events end well in advance of the boron credit limits of 400 ppm for the Unit 1/ 2 SFP and 430 ppm for the Unit 3 SFP and that margins to subcriticality during the HPI suction alignment dilution event will be maintained within the SFPs.

The licensee concluded that an unplanned or inadvertent event that would dilute the SFP is not credible for the Oconee Nuclear Station. The staff finds that the combination of the large volume of water required for a dilution event, the operating practice of an operator round every shift, flow rates and dilution times, licensee administrative procedures, and the TS controlled boron concentration and 7-day sampling requirement are adequate to detect a dilution event prior to k_{eff} reaching 0.95. Therefore, the analysis, administrative procedures, and proposed requirement in TS 3.7.12 are acceptable for ensuring that sufficient time is available to detect and suppress the worst dilution event that can occur from the minimum TS boron concentration to the boron concentration required to maintain the 0.95 k_{eff} design basis limit.

3.1.3 Staff Conclusion

Based on the staff's independent calculation of dilution times and volumes, the staff's review of the licensee's evaluation as described above, and the staff's experience gained from review of potential dilution of SFP soluble boron concentration in similar applications, the staff finds the revisions to the TS and the dilution analysis to be acceptable. As a result, the commitments made under GL 96-04 and the Updated Final Safety Analysis Report, Section 9.1.2.5, Boraflex is no longer needed to maintain the 0.95 k_{eff} design basis limit in the Oconee SFPs.

3.2. Criticality Considerations

3.2.1 Boraflex Degradation

The Oconee SFPs contain Boraflex neutron-absorbing panels that surround each storage cell on all four sides (except the peripheral sides). The function of these Boraflex panels is to ensure that the reactivity of the stored fuel assemblies is maintained within required limits. The Boraflex panels are enclosed in a formed stainless steel wrapper sheet that is spot-welded to the storage tube. It has been observed that after Boraflex receives a high gamma dose from stored irradiated fuel, it can begin to degrade and dissolve in the wet environment. This results in the B_4C poison material being removed, reducing the poison worth of the Boraflex sheets. (See Generic Letter 96-04, “Boraflex Degradation in Spent Fuel Pool Storage Racks”).

Oconee has two independent SFPs, one pool serving Units 1 and 2 and the other pool serving Unit 3. The SFP in each pool consists of standard flux trap design. The racks for both SFPs are made of stainless steel cells with spacing of 10.65 inches, and contain Boraflex attached to the exterior cell walls with a minimum boron loading of 0.02 gm/cm^2 for Unit 1/2 SFP. The Unit 3 SFP has cell spacing of 10.60 inches and contains Boraflex attached to the exterior cell wall with a minimum boron loading of 0.03 gm/cm^2. The Unit 1/2 SFP has a capacity of 1312 locations, and the SFP for Unit 3 has a capacity of 825 locations. The spent fuel racks are divided into three regions: unrestricted, restricted and checkerboard.

Assemblies that do not qualify for unrestricted storage must be stored in a restricted storage configuration. Two restricted storage configurations are employed: restricted storage with low reactivity filler assemblies in a 2 out of 4 storage pattern, and checkerboard storage with empty cells in a specified storage pattern. The restricted storage pattern is intended for temporary storage of partially burned fuel offloaded from the reactor during refueling outages.

3.2.2 Criticality Calculations Associated with Boraflex Degradation

The Oconee spent fuel storage racks were analyzed using the Westinghouse methodology, which has been reviewed and approved by the NRC. This methodology takes partial credit for soluble boron in the SFP criticality analyses and requires conformance with the following NRC acceptance criteria for preventing criticality outside the reactor:

1. K_{eff} shall be less than 1.0 if fully flooded with unborated water, which includes an allowance for uncertainties at a 95 percent probability, 95 percent confidence (95/95) level as described in WCAP-14416-NP-A; and

2. K_{eff} shall be less than or equal to 0.95 if fully flooded with borated water, which includes an allowance for uncertainties at a 95/95 level as described in WCAP-14416-NP-A.

The licensee performed the spent fuel analysis in accordance with the methodology described in the Westinghouse WCAP-14416-NP-A.

The analysis of the reactivity effects of fuel storage in the Oconee SFP was performed with the three-dimensional Monte Carlo code, KENO-Va, and the CASMO-3/TABLES-3/SIMULATE-3 SCALE system of codes for criticality analysis. The analysis was performed primarily with CASMO-3/TABLES-3/SIMULATE-3. SCALE and KENO-Va have limited application in the overall analysis. All these codes were validated through bench-marking to relevant critical experiments.

CASMO-3 is an integral transport theory code, and SIMULATE-3 is a nodal diffusion theory code. The analytical methods and models used in the reactivity analysis permits direct coupling of incore depletion calculations and resulting fuel isotopes with out-of-core storage array criticality analyses. The codes used in this methodology have been benchmarked against experimental data for fuel assemblies similar to those for which the Oconee storage racks are designed and have been found to adequately reproduce the critical values. The experimental data used to benchmark the codes were obtained from the Babcox and Wilcox close proximity storage CX-10 facility. The data is sufficiently diverse to establish the methodology biases and uncertainty that will apply to rack conditions at the Oconee nuclear plant. Review of the bench-marking results showed no significant trends in the results with respect to moderator soluble boron concentration, array spacing or boron level in the isolation sheets. This led the staff to conclude that the analysis methods used are acceptable and capable of predicting the reactivity of the Oconee storage racks with a high degree of confidence.

Different fuel designs used, or planned for use, at Oconee were analyzed. These included Framatome Mark BW fuel designs. Only the most reactive design was used to set the storage requirements, and only the most reactive temperature was used to set the storage requirements. The analyses accounted for the bias and uncertainty associated with the bench-marking of the methodology, a bias for the under-prediction of reactivity due to boron particle self-shielding, and the uncertainty due to mechanical tolerances from the manufacturing process. Additional uncertainties related to irradiated fuel are also included with the burnup credit methodology discussed below. In addition, biases and uncertainties due to Boraflex degradation were included as discussed below. These uncertainties were appropriately determined at the 95/95 probability/confidence level. These biases and uncertainties meet the previously stated NRC requirements and are, therefore, acceptable.

The licensee implemented the use of boron credit in accordance with the methodology described in WCAP-14416-NP-A. This methodology ensures $K_{eff} \leq 0.95$ as recommended in ANSI/ANS-57-1983 ("American National Standard Design Requirements for Light Water Reactor Fuel Storage Facilities at Nuclear Power Plants," dated October 7, 1983) and in NRC guidance. The SFP storage racks were analyzed to accommodate assemblies with fuel enrichment up to 5.0 percent by weight Uranium 235 while maintaining $K_{eff} \leq 0.95$, including uncertainties, tolerances, biases, and credit for soluble boron. The soluble boron credit is used to offset the uncertainties, tolerances, and off-normal conditions and to provide subcritical margin such that the spent fuel pool K_{eff} is maintained at ≤ 0.95. Analysis by the licensee showed that a boron concentration of 400 ppm for Unit 1/2 SFP and 430 ppm for the Unit 3 SFP is needed to maintain $K_{eff} \leq 0.95$ under normal conditions and to provide the subcritical condition with a margin of 5 percent, based on a 95/95 probability/confidence level calculation.

The moderator was assumed to be pure water at a temperature of 68 °F and a density of 1.0 gm/cc and the array was assumed to be infinite in the lateral (x and y) extent. The analyses accounted for all the uncertainties due to tolerances in fuel enrichment and density, storage cell inner diameter, storage cell pitch, stainless steel thickness, assembly position, calculation uncertainty, and methodology bias. These uncertainties were appropriately determined at the 95/95 probability/confidence level. The analyses also included a methodology bias (determined from benchmark calculations) as well as a reactivity bias to account for the effect of the normal range of spent fuel pool water temperatures.

Based on the Boraflex degradation assumptions used in the criticality analysis and the result of the review as presented in Section 3.3 SFP, the staff finds the analysis regarding Boraflex degradation to be acceptable.

3.2.3 Reactivity Equivalence

In addition to contributing to maintaining the SFP criticality at a $k_{eff} \leq 0.95$, boron credit is used to compensate for uncertainties associated with the reactivity equivalencing (i. e., burnup related) methods. The concept of reactivity equivalence is predicated upon the reactivity decrease associated with fuel depletion. For burnup credit, a series of reactivity calculations are performed to generate a set of enrichment and fuel assembly discharge burnup ordered pairs that all yield an equivalent k_{eff} when stored in the spent fuel storage racks. K_{eff} contour plots were generated for all the cell configurations for all three regions of the SFP. These curves represent combinations of fuel enrichment and discharge burnup that yield the racks' multiplication factor equivalent to the rack loaded with zero burnup fuel assemblies with maximum allowed enrichments. Uncertainties associated with burnup credit include a reactivity uncertainty applied linearly to the burnup credit requirement to account for calculation and depletion uncertainties. These uncertainties would require additional boron to be added, the amount of which would depend on the cell configuration, that is a 3 out of 4 or 4 out of 4 configuration.

The NRC has previously accepted the use of reactivity equivalencing predicated upon the reactivity decrease associated with fuel depletion. A bias was applied to account for the reactivity increase due to the removal of burnable poison from an assembly after its first cycle of operation. Since most calculations are two-dimensional (i.e., no axial effects are modeled), a reactivity bias is included in the two-dimensional calculations to account for burnup distribution differences between two-dimensional and three-dimensional modeling.

Recently the licensee informed Westinghouse that the 2-D bias calculation methodology, as described in the approved topical report WCAP-14416-NP-A, is non-conservative. Consequently, Westinghouse re-analyzed the 2-D calculation and arrived at the same conclusion as the licensee. Westinghouse informed its customers of this non-conservatism in a "Nuclear Safety Advisory Letter" (NSAL-00-015, dated November 2, 2000). The licensee performed its own calculations for both Oconee and McGuire and showed that its results were more conservative than the updated Westinghouse results. The licensee has appropriately applied its results in determining the required boron credit to achieve a total 95/95 k_{eff} of less than 0.95 for fuel storage at McGuire and Oconee. The minimum burnup requirement for each initial enrichment was generated for each type of storage and each region to yield a curve of acceptable storage. These minimum burnup requirements are shown in TS Table 5 and Figure 5 and 6 of the December 28, 2000, submittal. The staff has reviewed the licensee's recalculated biases and finds them acceptable.

3.2.4 Boron Credit and Accident Conditions

Soluble boron credit is used to provide safety margin by maintaining k_{eff} less than or equal to 0.95 including 95/95 uncertainties. The soluble boron credit calculations determined the amount of boron required for both unrestricted and restricted storage in each region. As previously described, the individual tolerances and uncertainties, and the temperature and methodology biases, were added to the calculated nominal k_{eff} to obtain a 95/95 value. The resulting 95/95 k_{eff} values were less than 0.95, satisfying the NRC acceptance criterion for precluding criticality.

For each storage configuration proposed in the revised TS 3.7.13, a spent fuel rack criticality analysis was performed. Although most accidents will not result in a reactivity increase, three accidents can be postulated for each storage configuration that would increase reactivity beyond the analyzed conditions. The first is a drop or placement of a fuel assembly into the cask loading area. The second is a significant change in the SFP water temperature such as a large makeup to the pool with cold water that causes a decrease in the pool water temperature. The third is the misloading of a fuel assembly into a location for which the restrictions on location, enrichment, burnup, and number of burnable poison rods are not satisfied.

Calculations have shown that the most severe accident would be the misloading of an assembly of the highest reactivity allowed in the SFP (fresh 5.0 wt. % U-235) in place of an assembly of the lowest reactivity (filler assembly). The calculations also showed that to maintain k_{eff} less than or equal to 0.95 following a change in SFP temperature or the misloading/drop of a fuel assembly, the amount of soluble boron required is 1110 ppm in the Unit 1/2 SFP, and 1210 in the Unit 3 SFP, where $\geq$2200 ppm is the minimum boron concentration level.

The TS changes proposed as a result of the revised criticality analysis are consistent with approved methodology and the above evaluation, and thus, the staff finds these TS changes acceptable. The proposed associated Bases changes adequately describe these TS changes and are also acceptable.

3.2.5 Criticality Conclusion

The staff finds the criticality aspects of the proposed Oconee license amendment request are acceptable and meet the requirements of GDC 62 for the prevention of criticality in fuel storage and handling. The analysis assumed credit for soluble boron, as allowed by WCAP-14416-NP-A, and no credit for the Boraflex neutron absorber panels. Therefore, the staff concluded the criticality analysis performed by the licensee conformed to the NRC guidance and the regulatory requirements for criticality analysis of fuel storage at light-water reactor power plants.

4.0 STATE CONSULTATION

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

5.0 ENVIRONMENTAL CONSIDERATION

The amendments change requirements with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve no significant increase in the amounts and no significant change in the types of any effluents that may be released offsite and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding (66 FR 9382). Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

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 amendments will not be inimical to the common defense and security or to the health and safety of the public.

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