September 23, 2004

Mr. J. A. Stall
Senior Vice President, Nuclear and
Chief Nuclear Officer
Florida Power and Light Company
P.O. Box 14000
Juno Beach, Florida 33408-0420

SUBJECT: ST. LUCIE PLANT, UNIT 1 - ISSUANCE OF AMENDMENT REGARDING SPENT FUEL POOL SOLUBLE BORON CREDIT (TAC NO. MB6864)

Dear Mr. Stall:

The Commission has issued the enclosed Amendment No. 193 to Renewed Facility Operating License No. DPR-67 for the St. Lucie Plant, Unit No. 1. This amendment consists of changes to the Technical Specifications in response to your application dated November 25, 2002, as supplemented by letters dated May 14, 2003, September 29, 2003, and March 25, 2004.

This amendment permits St. Lucie Unit 1 to credit soluble boron, fuel loading restrictions, and control element assemblies in the spent fuel pool criticality analyses and eliminate the need to credit Boraflex neutron absorbing material for reactivity control.

Based on discussions with the St. Lucie staff, this amendment is to be implemented by September 30, 2005. This will allow the changes in fuel pool configurations needed to implement the amendment to be accomplished as part of the preparations for the SL1-20 Refueling Outage.

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

Sincerely,

/RA/

Brendan T. Moroney, Project Manager, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-335

Enclosures:
1. Amendment No. 193 to DPR-67
2. Safety Evaluation

cc w/enclosures: See next page

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FLORIDA POWER & LIGHT COMPANY

DOCKET NO. 50-335

ST. LUCIE PLANT UNIT NO. 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 193
Renewed License No. DPR-67

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

   A. The application for amendment by Florida Power & Light Company (the licensee), dated November 25, 2002, as supplemented by letters dated May 14, 2003, September 29, 2003, and March 25, 2004, 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, Renewed Facility Operating License No. DPR-67 is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and by amending paragraph 3.B to read as follows:

    B. <u>Technical Specifications</u>

    The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 193, 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 by September 30, 2005.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Michael L. Marshall, Jr., Acting Chief, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance: September 23, 2004

ATTACHMENT TO LICENSE AMENDMENT NO. 193

TO RENEWED FACILITY OPERATING LICENSE NO. DPR-67

DOCKET NO. 50-335

Replace the following pages of the Appendix "A" Technical Specifications with the attached pages. The revised pages are identified by amendment number and contain vertical lines indicating the area of change.

Remove Pages	Insert Pages
VIII	VIII
3/4 9-11	3/4 9-11
5-5	5-5
5-6	5-6
5-6a	5-6a
5-6b	5-6b
...	5-6c
...	5-6d
...	5-6e

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 193 TO

RENEWED FACILITY OPERATING LICENSE NO. DPR-67

FLORIDA POWER AND LIGHT COMPANY

ST. LUCIE PLANT, UNIT NO. 1

DOCKET NO. 50-335

1.0 INTRODUCTION

By letter dated November 25, 2002 (Ref. 1), as supplemented by letters dated May 14, 2003, September 29, 2003, and March 25, 2004 (Refs. 2, 3, and 4), Florida Power and Light Company (FPL, the licensee) requested that the U.S. Nuclear Regulatory Commission (NRC) approve a license amendment to permit St. Lucie Unit 1 to credit soluble boron, fuel-loading restrictions, and control-element assemblies in the spent fuel pool (SFP) criticality analyses and eliminate the need to credit Boraflex neutron absorbing material for reactivity control. The proposed amendment would revise Technical Specification (TS) 3.9.11, "Storage Pool Water Level," and TS 5.6.1, "Fuel Storage - Criticality."

The licensee's supplementary submittals dated May 14, 2003, September 29, 2003, and March 25, 2004, did not affect the original proposed no significant hazards determination, or expand the scope of the request as noticed in the *Federal Register* on January 7, 2003 (68 FR 806).

2.0 REGULATORY EVALUATION

2.1 System Description

The St. Lucie TSs currently permit the licensee to store 1706 fuel assemblies in the SFP. The licensee uses 17 stainless steel storage racks in two regions to hold the assemblies. Region 1 consists of four racks with the capacity to hold 342 fuel assemblies. A 10.12-inch nominal center-to-center pitch, which includes a flux-trap water gap, separates individual cells in the Region 1 racks. Region 2 consists of the remaining 13 racks with a capacity for 1364 additional fuel assemblies. The Region 2 racks have an 8.86-inch nominal center-to-center pitch, with no flux-trap water gap. The larger pitch and the presence of a flux-trap permit Region 1 racks to store either fresh or irradiated fuel, while TS 5.6.1.b restricts Region 2 racks to the storage of irradiated fuel meeting specific requirements. Additionally, both regions' racks currently contain a Boraflex panel insert which is credited in the SFP criticality analyses.

By Amendment No. 192 (Ref. 11), FPL was authorized to install a new fuel storage rack in the cask loading pit. This rack would be used for temporary storage of spent fuel assemblies to allow refueling outage fuel offloads and nonoutage fuel shuffles, and to store new fuel prior to loading it into the reactor. This rack would be constructed using a neutron absorbing material called Boral, which is different from the Boraflex used in the existing racks.

2.2 Regulatory Requirements and Review Documents

Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Appendix A, "General Design Criteria (GDC) for Nuclear Power Plants," provides a list of the minimum design requirements for nuclear power plants. According to GDC 62, "Prevention of criticality in fuel storage and handling" (Ref. 5), the licensee must prevent criticality in the fuel handling and storage system by physical systems or processes, preferably by use of geometrically safe configurations.

Section 50.68 of 10 CFR, "Criticality accident requirements" (Ref. 6), provides NRC regulatory requirements for maintaining subcritical conditions in SFPs in lieu of meeting the requirements of 10 CFR 70.24 for radiation monitoring. Since the licensee currently uses 10 CFR 50.68, the staff has reviewed the proposed changes against the appropriate parts of that section. As set forth in section 50.68(b)(4), the acceptance criteria for prevention of criticality in the spent fuel storage racks loaded with the maximum reactivity are the following:

1. The effective multiplication factor (k_{eff}) shall be less than 1.0 if flooded with unborated water, which includes an allowance for uncertainties at a 95 percent probability, 95 percent confidence (95/95) level; and

2. k_{eff} shall be less than or equal to 0.95 if flooded with borated water, which includes an allowance for uncertainties at a 95/95 level.

The NRC has defined acceptable methodologies for performing SFP criticality analyses in three documents:

1. NUREG-0800, Standard Review Plan, Section 9.1.2, "Spent Fuel Storage," Draft Revision 4 (Ref. 7);

2. Proposed Revision 2 to Regulatory Guide 1.13, "Spent Fuel Storage Facility Design Basis" (Ref. 8); and

3. Memorandum from L. Kopp (NRC) to T. Collins (NRC), "Guidance on the Regulatory Requirements for Criticality Analysis of Fuel Storage at Light-Water Reactor Power Plants" (Ref. 9).

Since the early 1990s, the NRC and the nuclear power industry have been aware of degradation problems related to Boraflex panel inserts used in nuclear power plant SFPs. In 1996, the NRC published Generic Letter (GL) 96-04, "Boraflex Degradation in Spent Fuel Pool Storage Racks." This GL provided information describing the Boraflex degradation mechanism and requested licensees to assess the capability of the Boraflex to maintain a 5-percent subcriticality margin and to submit a plan for action if the subcriticality margin could not be maintained because of current or projected Boraflex degradation. In its October 22, 1996, response to GL 96-04, the licensee committed to periodic sampling of the Boraflex in the St. Lucie Unit 1 SFP.

3.0 TECHNICAL EVALUATION

3.1 Description of Proposed Technical Specification Changes

The following is a descriptive list of the proposed changes to the TSs:

1. TS 3/4.9.11: This section is renamed "Spent Fuel Storage Pool" and the current TS 5.6.1.a.3 requirement to maintain the SFP boron concentration greater than or equal to 1720 parts per million (ppm) is added to Limiting Condition for Operation (LCO) 3.9.11. Additionally, a new Action statement is added to be effective when boron concentration drops below the LCO limit, and a new surveillance requirement is added to verify SFP boron concentration at least once per 7 days. (The TS index is revised to reflect the new section title. Also, the TS 3/4.9.11 Bases will be revised to reflect changing the section title and adding the SFP boron concentration LCO in accordance with the licensee's TS Bases control program.)

2. TS 5.6.1.a.1: This section is revised to maintain k_{eff} less than 1.0 when the racks are flooded with unborated water, rather than the current requirement to maintain it less than or equal to 0.95 when the racks are flooded with unborated water.

3. TS 5.6.1.a.3: The SFP boron concentration requirement is moved to TS 3.9.11 and this section is replaced with a new requirement to maintain k_{eff} less than or equal to 0.95 when the racks are flooded with water containing 500 ppm boron, which includes allowance for biases and uncertainties as described in the St. Lucie Unit 1 Updated Final Safety Analysis Report (UFSAR), Section 9.1.

4. TS 5.6.1.a.4: The Boraflex neutron absorber requirement is removed and replaced with a requirement that enriched fuel assemblies meet the new k_{eff} limits according to new TS 5.6.1.c.

5. TS 5.6.1.a.5: A new specification that provides storage requirements for vessel flux reduction assemblies.

6. TS 5.6.1.a.6: A new specification that identifies the criteria to be used when positioning other fissile material within the fuel storage racks.

7. TS 5.6.1.b: This section is deleted and replaced with a new section that describes the Region 1 cask pit storage rack neutron absorbing material (Boral).

8. TS 5.6.1.c: A new specification that prescribes the maximum fuel assembly planar average initial U-235 enrichment for all spent fuel storage racks, and imposes the restrictions on loading Region 1 and Region 2 SFP storage racks found in new Figures 5.6-1 and 5.6-2 and new Tables 5.6-1 and 5.6-2. The text of Section 5.6.1.c also recognizes that the proposed Region 1 cask pit rack is

designed to accommodate the storage of any fuel enriched to less than or equal to 4.5 maximum weight percent, including fresh fuel.

9. Figure 5.6-1: The existing figure is deleted and replaced with new Figure 5.6-1, “Allowable Region 1 Storage Patterns and Fuel Alignments,” and Figure 5.6-2, “Allowable Region 2 Storage Patterns and Arrangements.” The new figures describe the checkerboard loading patterns and restrictions imposed by TS 5.6.1.c.

10. New Tables 5.6.1, “Minimum Burnup as a Function of Enrichment for Non-Blanketed Assemblies,” and 5.6.2, “Minimum Burnup as a Function of Enrichment for Blanketed Assemblies,” are added. The new tables define the minimum burnup requirements for the seven new spent fuel types called out in new Figures 5.6-1 and 5.6-2.

3.2 Criticality Analysis

In determining the acceptability of FPL’s amendment request, the staff reviewed three aspects of the licensee’s analyses: 1) the computer codes employed, 2) the methodology used to calculate the maximum k_{eff}, and 3) the storage configurations and limitations proposed. For each part of the review the staff evaluated whether the licensee’s analyses and methodologies provided reasonable assurance that adequate safety margins in accordance with NRC regulations were developed and could be maintained in the St. Lucie Unit 1 SFP.

3.2.1 Computer Codes

The licensee performed the analysis of the reactivity effects for the St. Lucie Unit 1 SFP racks with the MCNP4a code, a continuous energy three-dimensional Monte Carlo code. The code used the ENDF/B-V and ENDF/B-VI cross section libraries. The MCNP4a code was benchmarked against criticality experiments under conditions which bound the ranges of variables in the rack designs. The critical benchmark experiments considered the effects of varying fuel enrichment, boron-10 loading, lattice spacing, fuel pellet diameter, and soluble boron concentration. The experimental data are sufficiently diverse to establish that the method bias and uncertainty will apply to St. Lucie storage rack conditions. The licensee determined the MCNP4a code calculation (methodology) bias is 0.0009 with a 95/95 bias uncertainty of plus or minus 0.0011.

In addition to using the MCNP4a code to perform the criticality analyses, the licensee employed the CASMO-4 code to perform the fuel depletion analyses. The licensee used this two-dimensional multigroup transport theory code to determine the isotopic composition of the spent fuel and determine the reactivity effect of the fuel, rack, and control element assembly (CEA) tolerances. From this code, the licensee determined the reactivity effect (delta-k) for each manufacturing tolerance of the fuel assemblies and storage racks.

The staff reviewed the licensee’s application of the codes to determine whether each could reasonably calculate the appropriate parameters necessary to support the maximum k_{eff} analyses. The staff concludes that the licensee’s use of the MCNP4a code for calculation of the nominal k_{eff} was appropriate since it was benchmarked against experimental data that bounds the proposed assembly and rack conditions for the St. Lucie Unit 1 SFP. Additionally, the staff finds that the licensee's use of the CASMO-4 code is acceptable for determining the delta-k for each manufacturing tolerance and performing the fuel depletion analyses.

3.2.2 Methodology

In accordance with the guidance contained in Refs. 7, 8, and 9, the licensee performed criticality analyses of its SFP. The licensee employed a methodology which combines a worst-case analysis based on the bounding fuel, rack, and CEA conditions, with a sensitivity study using 95/95 analysis technique. The major components in this analysis were a calculated k_{eff} based on the limiting fuel assembly, SFP temperature and code biases, and a statistical sum of 95/95 uncertainties and worst-case delta-k manufacturing tolerances.

In performing its criticality analysis, the licensee first calculated a k_{eff} based on nominal conditions using the MCNP4a code. The licensee determined this k_{eff} from the limiting (highest reactivity) fuel assemblies stored in the SFP. The licensee analyzed the two types of assemblies currently stored in the St. Lucie Unit 1 SFP. These assemblies are the Framatome 14 x 14 (FR 14x14) assembly and the Combustion Engineering 14 x 14 (CE 14x14) assembly. The licensee performed its reactivity analyses for various enrichments, cooling times, burnups, and the bounding cladding thicknesses. In performing these calculations, the licensee assumed appropriately conservative conditions, such as an infinite radial checkerboard array and a 30-centimeter water reflector in both axial directions. The licensee identified the bounding assemblies as FR 14x14 with a cladding thickness of 0.028 inches for Region 1 and CE 14x14 with a cladding thickness of 0.026 inches for Region 2. Each of these assemblies served as the nominal assembly for all further calculations that the licensee performed in its respective SFP region.

At the staff's request, the licensee provided additional information (Ref. 3) to demonstrate that the limiting assembly type had been identified for each region of the SFP. The licensee's original submittal (Ref. 1) stated that the limiting assembly was identified prior to the consideration of tolerance or manufacturing uncertainties. To demonstrate that the limiting assembly was correctly identified once all the uncertainties were appropriately considered, the licensee examined the effect on the infinite multiplication factor of fuel tolerances for nonbounding assemblies in the storage racks. Specifically, the licensee analyzed the placement of a CE 14x14 assembly in the Region 1 rack and a FR 14x14 assembly in the Region 2 rack, each with bounding tolerances considered. The licensee's analysis showed that when the effects of tolerances are considered, the previously identified limiting assemblies remain bounding.

In order to account for the effect of the normal allowable range of SFP water temperatures, the licensee added the methodology bias as well as a reactivity bias to the calculated k_{eff}. As stated in the description of the MCNP4a code, the licensee determined the methodology bias from the critical benchmark experiments. For each of the proposed storage configurations, the licensee analyzed the reactivity effects of the SFP water temperature. For assemblies which do not contain CEAs, the licensee determined that the SFP moderator temperature coefficient of reactivity is positive. Therefore, the licensee added a reactivity bias corresponding to the maximum design basis normal SFP temperature of 150 degrees Fahrenheit (°F). Likewise, for assemblies containing CEAs, the licensee determined that the SFP moderator temperature coefficient of reactivity is negative. The licensee calculated the reactivity bias associated with a temperature decrease to the maximum density of water, 4 degrees Celsius (°C).

Conservatively, the licensee added the higher reactivity bias associated with assemblies which do not contain CEAs to the calculated k_{eff} of assemblies containing CEAs.

Finally, to determine the maximum k_{eff}, the licensee performed a statistical combination of the reactivity effects for uncertainties and manufacturing tolerances. The uncertainties included the bias uncertainty and the MCNP4a uncertainty. The licensee determined both of these uncertainties to a 95/95 threshold, which is consistent with the requirements of 10 CFR 50.68. In Ref. 2, the licensee provided, at the request of the staff, a comprehensive list of the manufacturing tolerances considered as well as the reactivity effects. For each tolerance, the licensee used the CASMO-4 code to calculate a delta-k between the nominal condition and the most limiting tolerance condition. By using the most limiting tolerance condition, the licensee calculated the highest reactivity effect possible. This results in a conservative margin since the tolerances will always bound the actual parameters. Once the reactivity effects for each of the tolerances were determined, the licensee statistically combined each of the manufacturing tolerances with the 95/95 uncertainties. The staff reviewed the licensee's methodology for calculating the reactivity effects associated with uncertainties and manufacturing tolerances, as well as the statistical methods used to combine these values. The staff finds the licensee's methods conservative and acceptable.

3.2.3 Proposed Storage Configurations

According to the licensee, the primary purpose of the amendment request was to gain the staff's approval for new storage configurations within the SFP storage racks. The licensee's proposed storage configurations are divided into five permissible checkerboard (2X2) storage patterns based on seven fuel assembly classifications. TS Figures 5.6-1 and 5.6-2 (Ref. 1) depict each of the patterns and provide the limitations for each. Additionally, the figures describe the allowable rack interface alignments, fresh fuel storage configurations, wall-interface storage patterns, and inter-rack storage requirements.

The licensee's proposed storage patterns depend on proper classification of spent fuel assemblies into seven categories based on initial enrichment, burnup, and cooling time. Tables 5.6-1 and 5.6-2 (Ref. 1) provide numerical data used to calculate the minimum burnup as a function of initial enrichment and cooling time. The licensee classifies each fuel type based the extent to which it meets the three criteria (enrichment, burnup, and cooling time). To demonstrate the acceptability of the data presented in the tables, the licensee performed numerous confirmatory calculations based on the tabular values. The results showed that the k_{eff} was less than 1.0 in all cases without crediting soluble boron. Additionally, the confirmatory calculations, in combination with the conservative assumptions, ensure that the results bound the actual variance in conditions found in the SFP.

In addition to classifying the assemblies based on their fuel depletion characteristics, the licensee also considered the effects of axial blankets in its analyses. The spent fuel in the St. Lucie Unit 1 SFP consists of assemblies with natural (0.71 weight percent U-235) and low enriched (2.6 weight percent U-235) blankets on the ends. These blankets affect the axial burnup distribution of the assembly. To account for these variations, the licensee performed calculations for the various axial burnup and enrichment variations and compared the results to a case with an assumed axially constant burnup and enrichment (Ref. 1). The licensee used these results in its development of the burnup versus enrichment curves (TS Tables 5.6-1 and

5.6-2). The licensee conservatively performed the calculations with both a uniform and nonuniform axial burnup and enrichment distribution and selected the higher of the resulting reactivity values (Ref. 1). Additionally, the licensee assumed enriched blankets in all blanketed calculations for added conservatism. The staff reviewed the licensee's methodology for accounting for axial blankets in its development of the burnup curves. The staff finds that the licensee's approach provides an appropriately conservative methodology to account for axial burnup of blanketed and nonblanketed assemblies.

Since the licensee places considerable emphasis on burnup credit in its SFP criticality analyses, the staff requested the licensee to provide additional information that demonstrated proper controls existed to ensure the minimum burnup limits were met. In Ref. 2, the licensee stated that the controls used for determining the actual spent fuel assembly burnups were currently in place for determining burnup for existing SFP requirements as well as fuel reload analyses. The licensee calculates fuel assembly burnup for core reloads based on predicted in-core power distributions. The licensee will use the same techniques for calculating assembly burnup to meet the proposed SFP restrictions. Since the licensee will use the same techniques for calculating assembly burnup for the SFP as those used in core reload analyses, which have previously been reviewed and approved by the staff, the staff finds this approach acceptable for ensuring minimum burnup limits are met.

In addition to crediting fuel assembly burnup, the licensee has proposed to credit the cooling time for fuel assemblies. The licensee's cooling time credit accounts for the decay of longer-life fissile and fissionable nuclides such as plutonium-241. The licensee uses the CASMO-4 code to calculate the reactivity credit available as a function of the decay of these nuclides. The licensee used the same methodology in its amendment for soluble boron credit for St. Lucie Unit 2 (Ref. 10). As an added margin of conservatism, the licensee stated in its amendment request that interpolation between the values of cooling time listed on Tables 5.6-1 and 5.6-2 will not be permitted (i.e., shorter cooling times will be used.) Since the staff has previously reviewed and approved (Ref. 10) the same approach for this licensee and added conservatism exists, the staff finds the licensee's method of crediting cooling time acceptable for its amendment.

One of the licensee's storage patterns credits the presence of CEAs placed in a 2-of-4 checkerboard configuration. The presence of these CEAs provides additional negative reactivity. In accordance with the guidance in Ref. 8, the staff requested the licensee provide detailed information describing the controls used to prevent inadvertent removal of a CEA from one of the stored assemblies. The licensee provided additional information (Ref. 3) that demonstrated it had considered the effects of the following phenomena that might adversely affect the negative reactivity worth of the CEAs credited in the SFP criticality analyses: 1) cladding wear, 2) unrecoverable cladding strain, 3) irradiation assisted stress corrosion cracking, and 4) absorber depletion. The licensee demonstrated that it had appropriate controls, procedures, and analyses to both understand and preclude these phenomena from affecting the SFP criticality analyses.

In addition to considering the physical properties of the credited CEAs, the licensee provided additional information which demonstrated that inadvertent removal of a CEA from a storage location specified by the loading pattern was unlikely, as well as bounded by other criticality accidents. The licensee described the fuel-handling procedures and controls in place to ensure that assemblies loaded into locations for which the loading pattern specifies a CEA are moved into and out of their storage locations with the CEA already inserted. Next, the licensee stated that the CEA handling tool's physical design limits the potential to inadvertently mistake it for the spent fuel handling tool. Additionally, the spent fuel handling tool is neither designed nor used to handle CEAs. Procedures are in place to control the use of each piece of equipment, and do not provide for such use of the spent fuel handling tool. Finally, load cell circuitry enables the operator to monitor the weight of the fuel assemblies during hoisting and placement operation, thereby providing positive means to prevent inadvertent snagging and removal of a CEA during the grappling and ungrappling process.

Additionally, the licensee performed an analysis of the misloading of an assembly into a location intended to contain a CEA. The licensee assumed that the misloaded assembly was a fresh fuel assembly enriched to 4.5 weight percent uranium-235 and did not contain a CEA. These conditions provide a conservative estimate of the reactivity effect of the misloading event. For this event, the licensee considered all of the worst-case manufacturing and tolerance uncertainties as it had done for the steady-state analyses. The result of the analysis shows that 965 ppm of soluble boron is necessary to maintain a k_{eff} of 0.945. The licensee compared these results to those of the limiting assembly misload elsewhere in the SFP. That analysis calls for 1090 ppm of soluble boron to achieve a k_{eff} of 0.94. The licensee's analysis of the misloading of a fresh fuel assembly into a location intended to hold a spent fuel assembly containing a CEA is bounded by the limiting assembly misloading event.

In addition to the conservative assumptions already described, the licensee included other conservative assumptions in its calculation of the maximum k_{eff} values for the SFP. These assumptions include the following: 1) neutron absorption in minor structural members is neglected, 2) any absorber rods present in a fuel assembly are modeled instead as fuel rods, and 3) for the moderator temperature during fuel depletion, the highest core average value found at any axial location was used. All of these assumptions result in higher predicted fuel reactivities. The staff reviewed each of the assumptions used in the licensee's analyses and agrees that each provides more conservative results and is consistent with the staff's guidance.

In addition to the five standard storage patterns proposed, the licensee evaluated a number of special storage conditions to determine their acceptability. These special conditions include all potential interface configurations, fresh fuel storage patterns, storage of nonactinide material, and storage of Vessel Flux Reduction Assemblies (VFRAs). In analyzing the various potential interface conditions, the licensee considered the interactions between different storage patterns within the same rack, the interactions of storage patterns in adjacent racks, and the interactions of assemblies located adjacent to walls. The licensee included the acceptable patterns and required limitations in its proposed TS 5.6.1.a. Also, the licensee analyzed configurations for the storage of fresh fuel in the Region 2 racks. The licensee developed and analyzed two storage patterns acceptable for storage of fresh fuel assemblies. In each of these patterns, the fresh fuel assemblies directly face four empty cells. The licensee also evaluated the storage of nonactinide materials in the SFP. The licensee's analysis confirmed that storage of nonactinide material in cells where fuel storage was restricted was acceptable provided the nonactinide material did not occupy more than 75 percent of the cell volume. Finally, the licensee evaluated the storage of VFRAs within the racks. The licensee's analysis of these low reactivity (0.3 percent depleted uranium) assemblies showed that their storage in locations designated for storage of any other fuel assembly is bounded by the proposed TS storage configuration. At the staff's request, the licensee provided additional information (Ref. 2) that clarified the acceptable storage locations for VFRAs as any cell that is not required by the proposed TSs to remain empty. The staff reviewed each of the special storage conditions proposed by the licensee and either found the analyses performed acceptable in accordance with 10 CFR 50.68 or agreed with the licensee that these conditions are permissible because other analyses are bounding.

The licensee calculated maximum k_{eff} values for each of the proposed SFP storage cases. The licensee's results show the maximum k_{eff} of 0.9968 for an unborated case. Additionally, the licensee calculated the soluble boron concentration necessary under normal conditions to yield a maximum k_{eff} of 0.94. The analysis determined that the concentration of boron sufficient to maintain k_{eff} less than or equal to 0.94 is 443 ppm. The licensee's analysis of the soluble boron case provides an additional conservative margin since the regulatory limit for k_{eff}, as contained in 10 CFR 50.68, is 0.95. Also, the licensee added an additional conservative margin to TS 5.6.1.a by requiring the k_{eff} to be less than or equal to 0.95 when flooded with water containing 500 ppm of boron. For accident condition analysis, the calculations indicate that a soluble boron concentration of 1090 ppm is adequate to assure the maximum k_{eff} does not exceed 0.95. The staff reviewed the licensee's criticality analyses of both unborated and borated cases and finds, based on the above, that each meets the requirements of 10 CFR 50.68 and GDC 62.

3.2.4 Conclusion

The staff reviewed the effects of the proposed changes using the appropriate requirements of 10 CFR 50.68 and GDC 62. For the reasons set forth above, the staff finds that the licensee's amendment request provided reasonable assurance that under both normal and accident conditions the licensee would be able to safely operate the plant and comply with the NRC regulations. Therefore, based on the above criticality analysis, the staff finds the licensee's amendment request acceptable.

3.3 Boron Dilution Analysis

The proposed amendment would eliminate the reliance on Boraflex neutron absorbing material in the St. Lucie Unit 1 SFP. The licensee states that eliminating reliance on Boraflex will avoid future operating and maintenance burdens associated with potential loss of storage capacity and potential replacement of storage racks.

3.3.1 Evaluation

A boron dilution analysis was performed to demonstrate that an inadvertent dilution event would not reduce the SFP boron concentration to a value less than the minimum called for by the criticality analysis. Through the criticality analysis, the licensee set the minimum soluble boron concentration in the proposed TS at 500 ppm to maintain the SFP at k_{eff} less than or equal to 0.95 for nonaccident conditions. The licensee analyzed the potential dilution sources, times, and volumes that may jeopardize the minimum boron concentration. The deterministic dilution event calculations were performed from an initial boron concentration of 1720 ppm to a minimum soluble boron concentration of 500 ppm.

The dilution sources analyzed by the licensee include the primary make-up water system, demineralized and service water systems, resin flush line/resin fill connection, fire protection system, and intake cooling water system. Dilution scenarios analyzed also include a pipe break and precipitation. The most credible dilution scenarios involve the primary water system. The primary water tank (PWT) capacity is 150,000 gallons. Emptying this tank would dilute the SFP to a concentration of 1038 ppm boron. To dilute the SFP to 500 ppm would require continuous make-up to the primary water tank from the site water treatment plant. The first dilution scenario includes the misalignment of two manually-operated valves. The maximum flow is 90 gallons per minute (gpm) through a 2-inch line. Assuming continuous make-up to the PWT, it would take at least 67 hours to reduce the SFP boron concentration to 500 ppm. The second scenario is a rupture of the primary water piping near the SFP with off-site power available. The maximum flow rate was conservatively analyzed at 135 gpm. At continuous flow, at least 45 hours would be needed to dilute the SFP to a 500 ppm boron concentration. All other dilution sources have smaller flow rates and, therefore, longer dilution times. The staff performed independent calculations that verified the licensee's analyses.

There are alarms in the control room (e.g., high SFP level and low PWT level) that would alert personnel to the event. Even if the alarms in the control room did not alert personnel, an overflow of the SFP would be readily noticed. Plant operations personnel rounds are required once per day and security personnel rounds are required twice per day in the fuel-handling building. The licensee concluded that a dilution to 500 ppm boron is not a credible event for the St. Lucie Unit 1 SFP. Based on its review and independent calculations, as described above, the staff finds that the boron dilution analysis is acceptable.

In addition to maintaining the TS boron concentration of 1720 ppm, the licensee proposes to maintain a TS 7-day surveillance requirement. The surveillance requirement ensures that low-flow, long-term dilution events, such as a leak in the component cooling water heat exchanger, would be detected.

3.3.2 Conclusion

Based on the boron dilution analysis and the processes and programs described above, the staff concludes that the proposed amendment to credit soluble boron for SFP criticality control is acceptable. The staff finds that the combination of alarms, personnel rounds, and revised TS requirements will ensure that sufficient time is available to detect and mitigate a dilution event prior to the SFP boron concentration decreasing below the minimum acceptable value of 500 ppm.

3.4 Commitment for Boraflex Monitoring

Boraflex is used in the spent fuel storage racks for nonproductive absorption of neutrons. Shrinkage, gap formation and dissolution of the Boraflex poison material in the spent fuel racks are phenomena addressed in several generic communications from the staff. The St. Lucie Unit 1 Boraflex surveillance program provides for condition monitoring of the Boraflex through inspection of Boraflex sample coupons (a surveillance program originally implemented in June 1989). The goals of this program are to provide Boraflex coupon test data that could be used for monitoring the performance of the Boraflex panels installed in both the Region 1 and Region 2 storage racks, and to predict problems with Boraflex panels so that the need for remedial actions could be determined and implemented. The methods used by the licensee to assess the condition of the Boraflex were a one-time-only Boraflex gamma dose estimate, followed by periodic blackness tests. This procedure confirms the physical presence of the Boraflex panels in terms of gap formation, gap distribution, and gap growth. Degradation of the

Boraflex in the racks could result in an increase in the reactivity of the spent fuel configuration. Since the proposed amendment eliminates credit for Boraflex, the staff reviewed and evaluated the change in commitments to GL 96-04 to cease condition monitoring of the Boraflex.

The licensee justified its request to stop crediting Boraflex by performing criticality and accident analyses to allow crediting soluble boron and fuel placement methodology to maintain the effective neutron multiplication factor of the SFP at 0.95 or less. The licensee's request, for which the analyses were performed, applies to all 17 SFP storage rack modules that contain Boraflex. It does not apply to the licensee's Region 1 cask pit rack which was analyzed and approved by amendment No. 192 (Ref. 11). The proposed changes are acceptable to the staff, as described in the preceding sections. Therefore, the staff concludes that the commitments to Boraflex monitoring pursuant to GL 96-04 will no longer be necessary following implementation of the proposed amendment.

4.0 STATE CONSULTATION

Based upon a letter dated May 2, 2003, from Michael N. Stephens of the Florida Department of Health, Bureau of Radiation Control, to Brenda L. Mozafari, Senior Project Manager, NRC, the State of Florida does not desire notification of issuance of license amendments.

5.0 ENVIRONMENTAL CONSIDERATION

These amendments change a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes surveillance requirements. 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 (68 FR 806, dated January 7, 2003). Accordingly, these 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 these 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 amendment will not be inimical to the common defense and security or to the health and safety of the public.

7.0 REFERENCES

1. Letter from D. E. Jernigan (FPL) to NRC, "Proposed License Amendment, Spent Fuel Pool Soluble Boron Credit," dated November 25, 2002, ADAMS Accession No. ML023450373.

2. Letter from W. Jefferson, Jr. (FPL) to NRC, “RAI [Request for Additional Information] Response for Spent Fuel Pool Soluble Boron Credit,” dated May 14, 2003, ADAMS Accession No. ML031390240.

3. Letter from W. Jefferson, Jr. (FPL) to NRC, “RAI Response for Proposed Amendment, Spent Fuel Pool Soluble Boron Credit,” dated September 29, 2003, ADAMS Accession No. ML032740110.

4. Letter from W. Jefferson, Jr. (FPL) to NRC, “Additional Information for Proposed Spent Fuel Pool Soluble Boron Credit Amendment,” dated March 25, 2004, ADAMS Accession No. ML040890422.

5. Title 10 *Code of Federal Regulations*, Part 50 Appendix A, General Design Criteria 62, “Prevention of criticality in fuel storage and handling.”

6. Title 10 CFR Section 50.68, “Criticality accident requirements.”

7. NUREG-0800, Standard Review Plan, Section 9.1.2, “Spent Fuel Storage,” Draft Revision 4, April 1996.

8. Proposed Revision 2 to Regulatory Guide 1.13, “Spent Fuel Storage Facility Design Basis,” December 1981.

9. NRC Memorandum from L. Kopp to T. Collins, “Guidance on the Regulatory Requirements for Criticality Analysis of Fuel Storage at Light-Water Reactor Power Plants,” dated August 19, 1998.

10. Letter from W. C. Gleaves (NRC) to T. F. Plunkett (FPL), “St. Lucie, Unit 2 - Issuance of Amendment Regarding Spent Fuel Pool Storage Capacity; Soluble Boron Credit (TAC No. MA0666),” dated May 6, 1999, ADAMS Accession No. ML013610012.

11. Letter from B. T. Moroney (NRC) to J. A. Stall, “St. Lucie, Units 1 and 2 - Issuance of Amendments Regarding the Addition of Spent Fuel Pool Cask Pit Storage Racks and the Increase in Spent Fuel Pool Storage Capacity (TAC Nos. MB6627 and MB6628),” dated July 9, 2004, ADAMS Accession No. ML041910257

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