Dave Morey
Vice President
Farley Project

Southern Nuclear
Operating Company
P.O. Box 1295
Birmingham, Alabama 35201
Tel 205.992.5131

SOUTHERN COMPANY
Energy to Serve Your World™

June 30, 1997

Docket Nos.: 50-348
50-364

10 CFR 50.90

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Joseph M. Farley Nuclear Plant
Technical Specifications Change Request
Credit For Boron For Spent Fuel Storage

Ladies and Gentlemen:

In accordance with the provisions of 10 CFR 50.90, Southern Nuclear Operating Company (SNC) proposes to amend the Technical Specifications for Joseph M. Farley Nuclear Plant (FNP) Unit 1 and Unit 2 to incorporate the requirements necessary to change the basis for prevention of criticality in the fuel storage pool. This change eliminates credit for Boraflex as a neutron absorbing material in the fuel storage pool criticality analysis.

General Design Criterion 62 of Appendix A to 10 CFR Part 50 requires the prevention of criticality in the handling and storage of fuel. NRC guidance recommends a 5 percent subcriticality margin. Boraflex is currently used in the FNP spent fuel racks as a nonproductive neutron absorber to reduce the reactivity of the fuel storage pool configuration. The current FNP analyses take credit for the Boraflex to maintain the 5 percent margin. The proposed change will establish an alternative method for maintaining the margin without relying on the Boraflex.

Long term deterioration of Boraflex in fuel storage pool environments has been detected at plants utilizing Boraflex in their fuel storage pools. Consequently, the NRC issued Information Notice 95-38 and Generic Letter 96-04 concerning Boraflex degradation. SNC has reanalyzed the criticality of the fuel storage pool without any credit for the Boraflex. The revised analyses were performed using the methodology developed by the Westinghouse Owner's Group and described in WCAP-14416-NP-A which has been reviewed and approved by the NRC. This methodology allows credit for the soluble boron in the fuel storage pool for providing the 5 percent subcriticality margin.

Aool
1/1

The analyses established burnup and loading patterns for the spent fuel storage racks that will assure that the 5 percent margin is maintained, without reliance on the Boraflex, for fuel that is enriched up to and including 5.0 weight percent U-235. The proposed Technical Specifications changes incorporate the appropriate limiting conditions for operation and surveillance requirements to assure that the fuel storage pool is maintained consistent with the analyses.

The proposed Technical Specifications relative to the control of boron concentration and loading patterns in the fuel storage pool are more restrictive than current FNP requirements. SNC will implement these requirements administratively as a means of assuring compliance with both the requirements of GDC 62 and the 5 percent subcriticality margin regardless of any Boraflex degradation that may occur in the FNP fuel storage pool. Deterioration of Boraflex is accompanied by elevated silica concentrations in the fuel storage pool. The higher silica levels are an operational concern, but reduction of the silica levels is believed to increase the rate of Boraflex degradation. Approval of this change will allow the reduction of silica levels and the elimination of Boraflex coupon surveillance programs which represent operational benefits. Therefore, SNC requests that the NRC approve the requested changes to the Technical Specifications by December 31, 1997.

Attachment I summarizes the basis for the proposed changes to the Technical Specifications. Attachment II provides the supporting significant hazards evaluation pursuant to 10 CFR 50.91. Attachment III contains the revised Technical Specifications pages. Based upon the analysis provided, Southern Nuclear has determined the proposed changes to the Technical Specifications do not involve a significant hazards consideration as defined by 10 CFR 50.92. Southern Nuclear has determined that the proposed license amendment will not significantly affect the quality of the human environment. Attachment IV is the criticality analysis report for the FNP Units 1 and 2 spent fuel storage pools. Attachment V is a report summarizing the FNP spent fuel pool boron dilution analysis, as required by the NRC SER to WCAP-14416-NP-A. The boron dilution report concludes that a loss of boron to the extent that the 5 percent subcriticality margin would be exceeded is not a credible event.

The Plant Operations Review Committee has reviewed and recommended approval of these proposed changes. A copy of these proposed changes is being sent to Dr. Donald E. Williamson, the Alabama State Designee, in accordance with 10 CFR 50.91(b)(1).

As stated above, NRC review and approval of these proposed changes is requested by December 31, 1997. These Technical Specifications changes will be implemented for both Unit 1 and Unit 2 within 30 days of NRC approval.

Mr. D. N. Morey states that he is a vice president of Southern Nuclear Operating Company and is authorized to execute this oath on behalf of Southern Nuclear Operating Company and that, to the best of his knowledge and belief, the facts set forth in this letter and enclosures are true.

If there are any questions, please advise.

Respectfully submitted,

SOUTHERN NUCLEAR OPERATING COMPANY

DN Morey

Dave Morey

Sworn to and subscribed before me this 30th day of June 1997

Martha Gayle Dow
Notary Public

My Commission Expires: November 1, 1997

EFB/clt:boron-ts.doc

Attachments:
- I. Basis for Proposed Changes
- II. Significant Hazards Evaluation
- III. Technical Specifications Changed Pages
- IV. Criticality Analysis
- V. Boron Dilution Analysis

cc: Mr. L. A. Reyes, Region II Administrator
Mr. J. I. Zimmerman, NRR Project Manager
Mr. T. M. Ross, Plant Sr. Resident Inspector
Dr. D. E. Williamson, State Department of Public Health

ATTACHMENT I

FARLEY NUCLEAR PLANT

TECHNICAL SPECIFICATIONS CHANGE REQUEST

SPENT FUEL POOL SOLUBLE BORON CREDIT

<u>BASIS FOR PROPOSED CHANGES</u>

Joseph M. Farley Nuclear Plant Units 1 and 2
Technical Specifications Change Request
for Spent Fuel Pool Soluble Boron Credit

BASIS FOR PROPOSED CHANGES

Proposed Changes

These changes to the Technical Specifications add two new Technical Specifications and associated Bases and revise the Design Features section to make the changes necessary to credit soluble boron in the fuel storage criticality analyses. The proposed changes are described below:

Revisions to the Technical Specifications

1. Revisions to the Table of Contents

The Table of Contents is revised to include two additional Technical Specifications, "Fuel Storage Pool Boron Concentration," specifications 3/4.7.13 and 3/4.7.14 for Units 1 and 2, respectively, and "Fuel Assembly Storage," specifications 3/4.7.14 and 3/4.7.15 for Units 1 and 2, respectively. These specifications are being added to support crediting soluble boron in the fuel storage pool criticality analyses. The Table of Contents is also revised to include two additional Technical Specification Bases, "Fuel Storage Pool Boron Concentration," 3/4.7.13 and 3/4.7.14 for Units 1 and 2, respectively, and "Fuel Assembly Storage," 3/4.7.14 and 3/4.7.15 for Units 1 and 2, respectively. These Bases are being added to support crediting soluble boron in the fuel storage pool criticality analyses.

2. Add Technical Specifications 3/4.7.13 & 3/4.7.14 (Unit 1), and 3/4.7.14 & 3/4.7.15 (Unit 2)

Two Technical Specifications are being added to credit soluble boron in the fuel storage pool criticality analyses and specify enrichment and burnup requirements. These Technical Specifications are "Fuel Storage Pool Boron Concentration," specifications 3/4.7.13 and 3/4.7.14 for Units 1 and 2, respectively, and "Fuel Assembly Storage," specifications 3/4.7.14 and 3/4.7.15 for Units 1 and 2, respectively.

3. Specification 5.6.1.1

Design Features Section 5.6.1.1 is revised to change the 0.95 K_{eff} requirement of "fully flooded with unborated water" to "fully flooded with water borated to 400 ppm," and add a requirement to maintain K_{eff} less than 1.0 if fully flooded with unborated water, and to add the fuel allowable storage configurations of all cell, 2-out-of-4, and burned/fresh storage. In addition, since the revised criticality analyses support the use of all types of Westinghouse fuel at FNP for up to 5.0 nominal w/o, a single enrichment limit of 5.0 w/o for all fuel types is used. The enrichment limit for Westinghouse fuel with standard fuel assembly diameter (e.g., LOPAR) remains 4.25 w/o for the new fuel pit storage racks (specification 5.6.1.2). For Unit 1, a special configuration is established for fuel damaged during operation with baffle jetting.

4. Specification 5.6.1.2

Section 5.6.1.2 is revised to change the nomenclature for fuel stored in the new fuel pit storage racks from "LOPAR fuel assemblies" to "fuel assemblies with Standard Fuel Assembly fuel rod diameter" and from "OFA or VANTAGE-5 fuel assemblies" to "fuel assemblies with Optimized Fuel Assembly fuel rod diameters."

5. Add Bases for Technical Specifications 3/4.7.13 and 3/4.7.14 (Unit 1), and 3/4.7.14 and 3/4.7.15 (Unit 2)

Two Technical Specification Bases are being added to credit soluble boron in the fuel storage pool criticality analyses. These Technical Specifications Bases are "Fuel Storage Pool Boron Concentration," 3/4.7.13 and 3/4.7.14 for Units 1 and 2, respectively, and "Fuel Assembly Storage," 3/4.7.14 and 3/4.7.15 for Units 1 and 2, respectively

Basis

The spent fuel rack criticality analyses have been performed taking credit for the soluble boron contained in the fuel storage pool water and not taking any credit for the Boraflex poison contained in the racks. The criticality analysis is given in Attachment IV. The analyses were performed for fuel enrichments up to and including 5.0 weight percent U-235. In the fuel storage pool criticality analysis, storage configurations have been defined to ensure that the spent fuel rack K_{eff} will be less than 1.0 including uncertainties and tolerances on a 95/95 basis with no soluble boron. Soluble boron credit is used to provide safety margin by maintaining k_{eff} less than or equal to 0.95 including uncertainties, tolerances, and accident conditions in the presence of spent fuel pool soluble boron. Attachment IV includes one configuration, 3-out-of-4, that is not being implemented at this time.

New Technical Specifications 3/4.7.13 (Unit 1) and 3/4.7.14 (Unit 2) establish the new boron concentration requirements for the fuel storage pool water. Since the initial fuel load, soluble boron has been contained in the fuel storage pool, therefore, the new requirement will have little effect on normal pool operations and maintenance.

New Technical Specifications 3/4.7.14 (Unit 1) and 3/4.7.15 (Unit 2) establish the requirements for the fuel storage configurations. The actual fuel storage configuration limitations are given in the Design Features section, 5.6.1.1. Since the new limitations are administrative, they will not have any significant effect on normal pool operations and maintenance.

The changes to the Technical Specifications are included in Attachment III. Attachment II is an evaluation in accordance with 10 CFR 50.92 to demonstrate that these changes to the Technical Specifications do not involve any significant hazards considerations.

Due to potential degradation, Boraflex is being eliminated from the analytical basis for demonstrating compliance with General Design Criteria 62. This has been done by utilizing the methodology in WCAP-14416-NP-A, Rev. 1. The new criticality analyses assume enrichment up to and including 5.0 weight percent U-235. The new fuel pit storage racks enrichment limit for fuel with Standard Fuel Assembly fuel rod diameters will remain 4.25 w/o.

The new criticality analyses take credit for a fraction of the soluble boron normally maintained in the fuel storage pool, checkerboard loading patterns in the spent fuel racks and the effects of burnup. Therefore it is appropriate to establish limiting conditions for operation and surveillance requirements in the Technical Specifications to assure that spent fuel is stored in accordance with the analytical assumptions. The checkerboard patterns and burnup limits are based on analyses performed in accordance with the NRC approved methodology.

A special configuration is established in the Unit 1 Design Features section of the Technical Specifications for certain fuel assemblies that were damaged during operation with baffle jetting. Since these fuel assemblies do not meet the typical checkerboard loading pattern requirements as described above, and since it is not desirable to move these assemblies due to concerns regarding fuel rod debris, this special configuration was established. The configuration consists of the current locations of these assemblies, surrounded by a single row of empty cells. The criticality analysis in Attachment V demonstrates that this configuration is acceptable.

Section 5.6.1.2 of the Technical Specifications is being revised to generalize the nomenclature for fuel assembly types. This change will allow use of other fuel types with the same characteristics important to criticality. Although no such change in fuel type is currently planned, this change will provide flexibility for the future.

ATTACHMENT II

FARLEY NUCLEAR PLANT

TECHNICAL SPECIFICATIONS CHANGE REQUEST

SPENT FUEL POOL SOLUBLE BORON CREDIT

<u>SIGNIFICANT HAZARDS EVALUATION</u>

ATTACHMENT II

SIGNIFICANT HAZARDS EVALUATION

Joseph M. Farley Nuclear Plant
Request to Revise Technical Specifications and Associated Bases
Credit for Boron in the Spent Fuel Pool Criticality Analysis

As required by 10 CFR 50.91 (a)(1), an analysis is provided to demonstrate that the proposed license amendment to credit boron in the spent fuel pool criticality analysis involves no significant hazards consideration.

The proposed amendment adds two new Technical Specifications and associated Bases, and modifies Specification 5.6.1.1 of the FNP Technical Specifications to credit boron in the spent fuel rack criticality analyses.

Background
The proposed amendment incorporates new limitations which credit soluble boron for reactivity control in the spent fuel pool while maintaining the necessary margin of safety. The proposed changes will also eliminate the need to credit the spent fuel rack Boraflex neutron absorber panels in the spent fuel rack criticality analysis.

This submittal proposes to take credit for the soluble boron in the spent fuel pool water to control the subcritical condition of the spent fuel assembly array. The utilization of soluble boron contained in the spent fuel pool provides a direct method of ensuring subcriticality. Credit for soluble boron is currently used in Mode 6 for reactivity control in the reactor vessel during refueling.

The Farley spent fuel storage racks were analyzed utilizing the Westinghouse Spent Fuel Rack Criticality Analysis Methodology described in WCAP-14416-NP-A, Revision 1 (Reference 4). A copy of the Farley spent fuel pool criticality analysis is contained in Attachment IV (CAA-97-138, "Farley Units 1 and 2 Spent Fuel Rack Criticality Analysis Using Soluble Boron Credit", Westinghouse Electric Corp., May, 1997).

In addition to crediting soluble boron in the spent fuel pool criticality analysis the storage configurations evaluated in the spent fuel rack criticality analysis ensure that the spent fuel rack K_{eff} will be less than 1.0 including uncertainties and tolerances on a 95/95 basis, without soluble boron in the storage pool. Soluble boron credit is used to provide safety margin by maintaining K_{eff} less than or equal to 0.95, including uncertainties, tolerances, and accident conditions in the presence of spent fuel pool soluble boron.

The Farley spent fuel racks have been reanalyzed to allow storage of all Westinghouse 17X17 fuel assemblies with nominal enrichments up to 5.0 w/o U-235 utilizing credit for checkerboard configurations, burnup, Integral Fuel Burnable Absorbers, and soluble boron. The analysis does not take any credit for the presence of the spent fuel rack Boraflex neutron absorber panels. The following storage configurations and enrichment limits were evaluated in the Farley Units 1 and 2 spent fuel rack criticality analysis:

Westinghouse 17X17 fuel assemblies with nominal enrichments less than or equal to 2.15 w/o U-235 can be stored in any cell location as shown in Figure 5.6-2 of the proposed technical specifications. Fuel assemblies with initial nominal enrichments greater than these limits must satisfy a minimum burnup requirement as shown in Figure 3.7-1 of the proposed technical specifications.

Westinghouse 17X17 fuel assemblies with nominal enrichments less than or equal to 5.0 w/o U-235 can be stored in a 2 out of 4 checkerboard arrangement as shown in Figure 5.6-2 of the proposed technical specifications. In the 2 out of 4 checkerboard storage arrangement, 2 fuel assemblies can be stored corner adjacent with 2 empty storage cells. There is no burnup or IFBA requirement for this configuration.

Westinghouse 17X17 fuel assemblies can be stored in a burned/fresh checkerboard arrangement of a 2X2 matrix of storage cells as shown in Figure 5.6-2 of the proposed technical specifications. In the burned/fresh 2X2 checkerboard arrangement, three of the fuel assemblies must have an initial nominal enrichment less than or equal to 1.6 w/o U-235, or satisfy a minimum burnup requirement for higher initial enrichments as shown in Figure 5.6-1 of the proposed technical specifications. The fourth fuel assembly must have an initial nominal enrichment less than or equal to 3.9 w/o U-235, or satisfy a minimum Integral Fuel Burnable Absorber requirement for higher initial enrichments to maintain the reference fuel assembly k_∞ less than or equal to 1.455 at 68°F.

In the Farley Unit 1 spent fuel storage pool, eleven damaged Westinghouse 17X17 fuel assemblies can be stored in a 12 storage cell configuration surrounded by empty cells as shown in Figure 5.6-6 of the proposed technical specifications. The eleven fuel assemblies contain a nominal enrichment of 3.0 w/o U-235.

A boron dilution evaluation was performed to ensure that sufficient time is available to detect and mitigate dilution of the spent fuel pool before the 0.95 K_{eff} design basis is exceeded. The boron dilution evaluation included an evaluation of the following plant specific features:

Spent Fuel Pool and Related System Features

- Dilution Sources and Flow Rates
- Boration Sources
- Instrumentation
- Administrative Procedures
- Piping
- Loss of Offsite Power Impact
- Boron Dilution Initiating Events
- Boron Dilution Times and Volumes

The results of the spent fuel pool boron dilution evaluation are summarized in Attachment V. As part of that evaluation, calculations were performed to define the dilution times and volumes for the spent fuel pool. The dilution sources available were compiled and evaluated against the calculated dilution volumes, to determine the potential of a spent fuel pool boron dilution event. The evaluation shows that a large volume of water (approximately 480,000 gallons) is necessary to dilute the spent fuel pool from the proposed Technical Specification limit of 2000 ppm to a soluble boron concentration where a K_{eff} of 0.95 would be approached in the spent fuel pool.

A dilution event large enough to result in a significant reduction in the spent fuel pool boron concentration would involve the transfer of a large quantity of water from a dilution source and a significant increase in spent fuel pool level which would ultimately overflow the pool. The large water volume turnover and resultant overflow of the spent fuel pool would be readily detected and terminated by plant personnel as discussed in Attachment V.

In addition, because of the large quantities of water required, and the low dilution flow rates available at Farley, any significant dilution of the spent fuel pool boron concentration would only occur over a long period of time (hours to days). Detection of a spent fuel pool boron dilution via level alarms and/or visual inspections would be expected long before a dilution sufficient to increase K_{eff} to 0.95 could occur.

The evaluations in Attachment V, which show that the dilution of the spent fuel pool boron concentration from 2000 ppm to 400 ppm is not credible, combined with the 95/95 calculation, which shows that the spent fuel rack K_{eff} will remain less than 1.0 when flooded with unborated water, provide a level of safety comparable to the conservative criticality analysis methodology required by References 1, 2 and 3.

The precedent of crediting soluble boron to provide criticality control in addition to normal reactor operations has already been established. Credit for soluble boron in the spent fuel pool has been previously allowed when considering abnormal or accident conditions. Also, during refueling, soluble boron in the reactor vessel is the only direct control utilized to ensure that the reactor remains subcritical. The use of credit for soluble boron was included in the Westinghouse Spent Fuel Rack Criticality Analysis Methodology described in WCAP-14416-NP-A, Revision 1 (Reference 4). That methodology, which was used for the criticality analysis in Attachment IV, was approved by an NRC Safety Evaluation dated October 25, 1996.

This proposed technical specifications add requirements on the spent fuel pool boron concentration, and the storage of fuel assemblies with differing initial enrichments, burnup, and Integral Fuel Burnable Assembly loadings.

Proposed Changes

1. Revisions to the Index

The Index is revised to include two additional Technical Specifications, (3.7.13 "Fuel Storage Pool Boron Concentration" and 3.7.14 "Fuel Assembly Storage" for Unit 1) and (3.7.14 "Fuel Storage Pool Boron Concentration" and 3.7.15 "Fuel Assembly Storage" for Unit 2) that are being added to support crediting soluble boron in the spent fuel rack criticality analysis.

2. Add Technical Specifications 3.7.13 and 3.7.14 for Unit 1, and 3.7.14 and 3.7.15 for Unit 2

Two additional Technical Specifications, (3.7.13 "Fuel Storage Pool Boron Concentration" and 3.7.14 "Fuel Assembly Storage" for Unit 1) and (3.7.14 "Fuel Storage Pool Boron Concentration" and 3.7.15 "Fuel Assembly Storage" for Unit 2) that are being added to support crediting soluble boron in the spent fuel rack criticality analysis.

3. Revision to Specification 5.6.1.1

Specification 5.6.1.1 a. is added to require that the spent fuel pool K_{eff} be less than 1.0 when flooded with unborated water.

Current Specification 5.6.1.1 a. is revised to reflect that the spent fuel pool K_{eff} be less than or equal to 0.95 when flooded with water borated to 400 ppm.

Current Specification 5.6.1.1 d. is revised to reflect the maximum nominal enrichment of 5.0 w/o U-235 assumed in the spent fuel rack criticality analysis.

Specification 5.6.1.1 e. is added to reflect that fuel assemblies in the "acceptable range" of new Figure 3.7-1 are allowed unrestricted storage in the spent fuel racks.

Specification 5.6.1.1 f. is added to reflect that fuel assemblies in the "unacceptable range" of new Figure 3.7-1 are allowed to be stored in compliance with new Figures 5.6-1 through 5.6-5. In addition, the fuel assemblies with nominal enrichments greater than 3.9 w/o U-235 shall contain sufficient Integral Fuel Burnable Absorbers.

Specification 5.6.1.1 g. is added for Unit 1 to reflect the configuration of damaged fuel assemblies evaluated in the Unit 1 spent fuel rack criticality analysis.

4. Revision to Specification 5.6.1.2

Current Specification 5.6.1.2 c. is revised to reflect an editorial change to generalize the nomenclature of the various types of Westinghouse fuel.

Analysis

The design basis for preventing criticality in the spent fuel pool is that, including uncertainties, there is a 95% probability at a 95% confidence level that the K_{eff} of the fuel storage assembly array will be less than 0.95 with full density moderation. This proposed license amendment includes an exception to the additional standard condition which states that the spent fuel pool water is assumed to be unborated.

The Farley spent fuel storage racks were analyzed utilizing the NRC approved Westinghouse Spent Fuel Rack Criticality Analysis Methodology described in WCAP-14416-NP-A, Revision 1 Reference 4). For the storage of fuel assemblies in the spent fuel storage racks, the acceptance criteria for criticality requires the effective neutron multiplication factor, K_{eff}, be less than or equal to 0.95, including uncertainties. The criticality analysis performed for the FNP spent fuel storage racks shows that the acceptance criteria for criticality is met for the storage of Westinghouse 17 x17 fuel assemblies under both normal and accident conditions with soluble boron credit, no credit for the spent fuel rack Boraflex neutron absorber panels and the storage configurations and enrichment limits described above.

This license amendment request proposes crediting soluble boron in the spent fuel pool criticality analysis to ensure that K_{eff} is less than or equal to 0.95, and storage configurations are defined using 95/95 K_{eff} calculations to ensure that the spent fuel rack K_{eff} will be less than 1.0 with no credit for soluble boron or Boraflex panels in the racks. Soluble boron credit provides significant negative reactivity in the criticality analysis to provide subcritical margin such that the spent fuel pool K_{eff} is maintained less than or equal to 0.95. Soluble boron credit and storage configurations were also used to offset the reactivity increase when ignoring the presence of the spent fuel rack Boraflex neutron absorber panels.

New Technical Specification 3.7.13 for Unit 1 and 3.7.14 for Unit 2 establish a boron concentration requirement for the water contained in the spent fuel pool. Since soluble boron has always been contained in the spent fuel pool water, the new requirement will have little effect on normal spent fuel pool operations and maintenance.

New Technical Specifications 3.7.14 for Unit 1 and 3.7.15 for Unit 2 establish the requirements for the storage of fuel assemblies. Since the fuel pool storage requirements are administrative, the new limitations will have minimal effect on normal pool operations and maintenance.

In the event of failure of a spent fuel pool cooling pump, or loss of cooling to a spent fuel pool heat exchanger, the second spent fuel pool cooling train provides 100 percent backup capability, thus ensuring continued cooling of the spent fuel pool. However, even if a loss of spent fuel pool cooling were to occur, there is sufficient soluble boron to prevent K_{eff} from exceeding 0.95.

Based on the results of the revised criticality analysis (Attachment IV), a spent fuel pool boron concentration of 850 ppm would maintain the spent fuel storage rack $K_{eff} < 0.95$, while compensating for the increased reactivity which could result from a mispositioned fuel assembly, which bounds a loss of

spent fuel pool cooling event. A spent fuel pool boron concentration limit of 2000 ppm has been conservatively chosen for proposed Technical Specification 3.7.13 for Unit 1 and 3.7.14 for Unit 2 to be consistent with the boron concentration normally maintained in the spent fuel pool. Since soluble boron has always been contained in the spent fuel pool, the new requirement will have minimal effect on normal pool operations and maintenance. The proposed limit of 2000 ppm will maintain the spent fuel storage rack $K_{eff} < 0.95$ when fuel assemblies are stored in accordance with the configurations specified by Specifications 5.6.1.1. e., 5.6.1.1 f. for both Units 1 and 2, and 5.6.1.1 g (for Unit 1).

The proposed 7 day frequency for sampling the boron concentration in the spent fuel pool in new Technical Specifications 3.7.13 for Unit 1 and 3.7.14 for Unit 2 is consistent with the requirement contained in NUREG-1431. Because significant reductions in spent fuel pool boron concentration will result in significant increases in pool volume or significant changes in the sources of non-borated water to the pool, any significant reductions in the pool boron concentration would be readily detected during normal operator rounds or by the pool level instrumentation. Sampling and verification of the spent fuel pool boron concentration on a 7 day frequency will provide adequate assurance that smaller and less readily identifiable boron concentration reductions are not taking place.

Spent fuel pool systems, instrumentation, and supporting systems are not modified as a result of the proposed license amendment. Operations involving spent fuel pool water cooling and cleanup do not change. Prior to the implementation of the license amendment allowing credit for soluble boron in the spent fuel pool criticality analysis, current administrative controls on spent fuel pool boron concentration and water inventory will be evaluated and procedures will be upgraded as necessary to ensure that the spent fuel pool boron concentration is formally controlled during both normal and accident situations. The procedures will ensure that the proper provisions, precautions, and instructions to control the spent fuel pool boron concentration and water inventory are in place.

The Farley spent fuel rack criticality analysis also addressed postulated accidents in the spent fuel pool. The accidents that can occur in the spent fuel pool and their consequences are not significantly affected by taking credit for the soluble boron present in the pool water as a major subcriticality control element.

The criticality analysis confirmed that most spent fuel pool accident conditions will not result in an increase in K_{eff} of the spent fuel racks. Examples of such accidents are the drop of a fuel assembly on top of a rack, between rack modules, between rack modules and the pool wall, and the drop or placement of a fuel assembly into the cask loading area. At Farley, the spent fuel assembly rack configuration is such that it precludes the insertion of a fuel assembly between rack modules or between rack modules and the pool wall. A dropped fuel assembly can only land on the top of the racks.

From a criticality standpoint, the dropped fuel assembly accident assumes a fuel assembly in its most reactive condition is dropped onto the spent fuel racks. The rack structure pertinent for criticality is not excessively deformed. Previous accident analysis with unborated water showed that a dropped fuel assembly which comes to rest horizontally on top of the spent fuel rack has sufficient water separating it from the active fuel height of stored fuel assemblies to preclude neutronic interaction. For the borated water condition, the interaction is even less since the water contains boron, an additional thermal neutron absorber.

However, accidents can be postulated for each storage configuration which could result in an increase in reactivity beyond the analyzed condition. The first postulated accident would be a loss of the spent fuel pool cooling system. The second accident would be dropping a fuel assembly into an already loaded cell, and the third accident would be the misloading of a fuel assembly into a cell for which the restrictions on location, enrichment, or burnup are not satisfied.

The loss of normal cooling to the spent fuel pool water causes an increase in the temperature of the water passing through the stored fuel assemblies. This causes a decrease in water density which would result in

a decrease in reactivity when Boraflex neutron absorber panels are present in the racks. However, since Boraflex is not considered to be present and the spent fuel pool water has a high concentration of boron, a density decrease results in a decrease in boron density which causes a positive reactivity addition.

For the accident of dropping of a fuel assembly into an already loaded cell, the upward axial leakage of that cell will be reduced; however, the overall effect on rack reactivity will be insignificant. Furthermore, the neutronic coupling between the dropped fuel assembly and the already loaded fuel assembly will be very low due to several inches of fuel assembly nozzle structure which would separate the active fuel regions. Therefore, this accident would be bounded by the misload accident.

A fuel assembly misload accident relates to the use of restricted storage locations based on fuel assembly initial enrichment, burnup, and Integral Fuel Burnable Absorber requirements. Special administrative controls are placed on the patterning and region loading of assemblies into these restricted locations. The misloading of a fuel assembly constitutes not meeting the enrichment, burnup or Integral Fuel Burnable Absorber requirements of that restricted location. The result of the misloading is to add positive reactivity, increasing K_{eff} toward 0.95.

The amount of soluble boron required to offset each of these postulated accidents was evaluated for all of the storage configurations evaluated in the criticality analysis described above. That evaluation established the amount of soluble boron necessary to ensure that the spent fuel rack K_{eff} will be maintained less than or equal to 0.95 should a loss of spent fuel pool cooling or a fuel assembly misload occur. The amount of soluble boron necessary to mitigate either of these events (850 ppm) is bounded by the spent fuel pool boron concentration limit contained in proposed Technical Specifications 3.7.13 for Unit 1 and 3.7.14 for Unit 2. Based on the double contingency principle, the margin for accident conditions included in the proposed Technical Specifications boron concentration limit does not have to account for both a loss of cooling event and a misload event occurring at the same time.

The radiological consequences of a dropped assembly accident in the spent fuel pool do not change because of the presence of soluble boron in the spent fuel pool water. The current FSAR accident analysis (Section 15.4.5.1) assumes that a high burnup fuel assembly is dropped onto the top of the racks, all fuel rods in the dropped assembly rupture releasing the gap radioactive gases. A large fraction of the halogen gases are entrained in the pool water limiting the off-site exposures.

Calculations were performed (Attachment V) in order to define the dilution time and volumes for the spent fuel pool. The dilution sources available at Farley were compiled and evaluated against the calculated dilution volume, to determine the potential of a spent fuel pool dilution event. The evaluations show that a large volume of water (approximately 480,000 gallons) is necessary to dilute the spent fuel pool to a soluble boron concentration where criticality would be approached in the spent fuel pool.

Proposed Specification 5.6.1.1 b. requires that the spent fuel rack K_{eff} be less than or equal to 0.95 when flooded with water borated to 400 ppm. The dilution analysis (Attachment V) concluded that large volumes of water are necessary to dilute the spent fuel pool water from the proposed 2000 ppm Technical Specification limit to less than the boron concentration limit of 400 ppm. The availability of such large water supplies on site is limited. In addition, the transferability of the available water supplies to the pool is very low due to the small number of possible flow paths and in many cases impossible due to the physical arrangement of the spent fuel pool relative to the supplies.

A boron dilution event large enough to result in a significant reduction in the spent fuel pool boron concentration will involve the transfer of a large quantity of water from a dilution source and a significant increase in spent fuel pool level which would ultimately result in pool overflow. Such a large water volume turnover, and the likely overflow of the spent fuel pool, would be readily detected and terminated by plant personnel.

In addition, because of the low dilution flow rates available at Farley during normal plant operations (Attachment V), and the large quantities of water required, any significant dilution of the spent fuel pool would only occur over a long period of time (hours to days). Detection of a spent fuel pool dilution via level alarms and/or visual inspections would be expected long before a significant dilution would occur.

Therefore, it is highly unlikely that any dilution event in the spent fuel pool could result in the reduction of the spent fuel pool boron concentration to less than the 400 ppm design basis limit.

The spent fuel pool dilution analysis assumes thorough mixing of all the non-borated water added to the spent fuel pool. It is unlikely, with cooling flow and convection from the spent fuel decay heat, that thorough mixing would not occur. However, if mixing was not adequate, it would be conceivable that a localized pocket of non-borated water could form somewhere in the spent fuel pool. This possibility is addressed by the calculation in Attachment IV, which shows that the spent fuel rack K_{eff} will be less than 1.0 on a 95/95 basis with the spent fuel pool filled with non-borated water. Thus, even if a pocket of non-borated water formed in the spent fuel pool, K_{eff} would not be expected to exceed 1.0 anywhere in the pool.

Conclusion

The combination of the following provide a level of safety comparable to the conservative criticality analysis methodology required by References 1, 2, and 3:

1. The 95/95 K_{eff} calculation, which shows that the spent fuel rack K_{eff} will remain less than 1.0 when flooded with unborated water.

2. The proposed Technical Specifications which will ensure that the spent fuel pool boron concentration and storage configuration will be maintained consistent with the assumptions in the criticality analysis, thus maintaining the required margin to criticality.

3. The criticality analysis for the Farley spent fuel racks which was performed utilizing the methodology in Reference 4 and in accordance with the requirements specified in the October 25, 1996 NRC Safety Evaluation which found the methodology in Reference 4 acceptable.

Determination of Significant Hazards Considerations

The proposed changes to the Technical Specifications have been evaluated to determine whether they constitute a significant hazards consideration as required by 10 CFR 50, Section 50.90 using the standards provided in Section 50.92. This analysis is provided below:

1. The proposed amendment will not involve a significant increase in the probability or consequences of an accident previously evaluated.

There is no significant increase in the probability of a fuel assembly drop accident in the spent fuel pool when considering the presence of soluble boron in the spent fuel pool water for criticality control. The handling of the fuel assemblies in the spent fuel pool has always been performed in borated water.

The consequences of a fuel assembly drop accident in the spent fuel pool are not affected when considering the presence of soluble boron.

Although the probability of misloading an assembly in the spent fuel racks may increase due to new assembly placement constraints, there is no significant increase in the probability of an accidental misloading of spent fuel assemblies into the spent fuel pool racks that will cause a criticality accident when considering the presence of soluble boron in the pool water for criticality control. Sufficient soluble boron will be maintained in the spent fuel pool to maintain k_{eff} below 0.95 following a postulated single misload. Fuel assembly placement will continue to be controlled pursuant to approved fuel handling procedures and will be in accordance with the Technical Specification spent fuel rack storage configuration limitations. The addition of the spent fuel pool storage configuration surveillance in proposed new Technical Specifications 3.7.14 for Unit 1 and 3.7.15 for Unit 2 will provide increased assurance that a spent fuel pool inventory verification will be completed in a timely manner (7 days) after the relocation or addition of fuel assemblies in the spent fuel storage pool.

There is no significant increase in the consequences of the accidental misloading of spent fuel assemblies into the spent fuel pool racks because criticality analyses demonstrate that the pool will remain subcritical following an accidental misloading if the pool contains an adequate boron concentration. The proposed new Technical Specifications limitations will ensure that an adequate spent fuel pool boron concentration will be maintained.

In the event of failure of a spent fuel pool cooling pump, or loss of cooling to a spent fuel pool heat exchanger, the second spent fuel pool cooling train provides 100 percent backup capability, thus ensuring continued cooling of the spent fuel pool. However, even if a loss of spent fuel pool cooling were to occur, there is sufficient soluble boron to prevent K_{eff} from exceeding 0.95.

There is no significant increase in the probability of the loss of normal cooling to the spent fuel pool water when considering the presence of soluble boron in the pool water for subcriticality control since a high concentration of soluble boron has always been maintained in the spent fuel pool water.

A loss of normal cooling to the spent fuel pool water causes an increase in the temperature of the water passing through the stored fuel assemblies. This causes a decrease in water density which would result in a decrease in reactivity when Boraflex neutron absorber panels are present in the racks. However, since Boraflex is not considered to be present, and the spent fuel pool water has a high concentration of boron, a density decrease causes a positive reactivity addition. However, the additional negative reactivity provided by the proposed 2000 ppm boron concentration limit, above that provided by the concentration required to maintain K_{eff} less than or equal to 0.95 (400 ppm), will compensate for the increased reactivity which could result from a loss of spent fuel pool cooling event. Because adequate soluble boron will be maintained in the spent fuel pool water, there is no significant increase in the consequences of a loss of normal cooling to the spent fuel pool.

Therefore, based on the conclusions of the above analysis, the proposed changes will not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. The proposed amendment will not create the possibility of a new or different kind of accident from any accident previously analyzed.

Spent fuel handling accidents are not new or different types of accidents, they have been analyzed in Section 15.4.5 of the Final Safety Analysis Report.

Criticality accidents in the spent fuel pool are not new or different types of accidents, they have been analyzed in the Final Safety Analysis Report and in Criticality Analysis reports associated with specific licensing amendments for fuel enrichments up to 5.0 weight percent U-235.

Proposed new Technical Specifications 3.7.13 for Unit 1 and 3.7.14 for Unit 2 on the spent fuel pool boron concentration do not represent new concepts. The boron concentration in the spent fuel pool has always been maintained near at the limit of the RWST boron concentration for refueling purposes. These new proposed Technical Specifications establish new boron concentration requirements for the spent fuel pool water consistent with the results of the revised criticality analysis (Attachment IV).

Since soluble boron has always been maintained in the spent fuel pool water, the implementation of this new requirement will have little effect on normal pool operations and maintenance. The implementation of the proposed new limitations on the spent fuel pool boron concentration will only result in increased sampling to verify boron concentration. This increased sampling will not create the possibility of a new or different kind of accident.

Because soluble boron has always been present in the spent fuel pool, a dilution of the spent fuel pool soluble boron has always been a possibility. However, it was shown in the spent fuel pool dilution evaluation (Attachment V) that a dilution of the Farley spent fuel pool which could reduce the spent fuel storage rack K_{eff} to less than 0.95 is not a credible event. Therefore, the implementation of new limitations on the spent fuel pool boron concentration will not result in the possibility of a new kind of accident.

Proposed new Technical Specifications 3.7.14 for Unit 1 and 3.7.15 for Unit 2, and 5.6.1.1. e., 5.6.1.1 f., and 5.6.1.1. g. (for Unit 1) specify the requirements for the spent fuel rack storage configurations, and do not represent new concepts. These proposed new spent fuel pool storage configuration limitations are consistent with the assumptions made in the spent fuel rack criticality analysis, and will not have any significant effect on normal spent fuel pool operations and maintenance and will not create any possibility of a new or different kind of accident. Verifications will continue to be performed to ensure that the spent fuel pool loading configuration meets specified requirements.

As discussed above, the proposed changes will not create the possibility of a new or different kind of accident. There is no significant change in plant configuration, equipment design or equipment. The accident analysis in the Final Safety Analysis Report remains bounding.

3. The proposed amendment will not involve a significant reduction in the margin of safety.

The proposed Technical Specification changes and the resulting spent fuel storage operating limits will provide adequate safety margin to ensure that the stored fuel assembly array will always remain subcritical. Those limits are based on a plant specific criticality analysis (Attachment IV) performed in accordance the Westinghouse spent fuel rack criticality analysis methodology described in Reference 4.

The criticality analysis utilized credit for soluble boron to ensure K_{eff} will be less than or equal to 0.95 under normal circumstances, and storage configurations have been defined using a 95/95 K_{eff} calculation to ensure that the spent fuel rack K_{eff} will be less than 1.0 with no soluble boron.

Soluble boron credit is used to provide safety margin by maintaining K_{eff} less than or equal to 0.95, including uncertainties, tolerances, and accident conditions in the presence of spent fuel pool soluble boron.

The loss of substantial amounts of soluble boron from the spent fuel pool which could lead to exceeding a K_{eff} of 0.95 has been evaluated (Attachment V) and shown to be not credible.

The evaluations in Attachment V, which show that the dilution of the spent fuel pool boron concentration from 2000 ppm to 400 ppm is not credible, combined with the 95/95 calculation, which shows that the spent fuel rack K_{eff} will remain less than 1.0 when flooded with unborated water, provide a level of safety comparable to the conservative criticality analysis methodology required by References 1, 2, and 3.

Therefore, the proposed changes in this license amendment will not result in a significant reduction in the plant's margin of safety.

Conclusion

Based on the evaluation above, and pursuant to 10 CFR 50, Section 50.91, Southern Nuclear Operating Company has determined that operation of the Farley Nuclear Plant in accordance with the proposed license amendment request does not involve any significant hazards considerations as defined by NRC regulations in 10 CFR 50, Section 50.92.

References

1. USNRC Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, LWR Edition, NUREG-0800, June 1987.

2. USNRC Spent Fuel Storage Facility Design Bases (for Comment) Proposed Revision 2, 1981, Regulatory Guide 1.13.

3. ANS, Design Requirements for Light Water Reactor Spent Fuel Storage Facilities at Nuclear Power Stations, ANSI/ANS-57.2-1983

4. WCAP-14416-NP-A, "Westinghouse Spent Fuel Rack Criticality Analysis Methodology", Revision 1, November 1996.