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U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Document Control Desk

Subject: Duke Energy Carolinas, LLC
Oconee Nuclear Station
Docket Numbers 50-269, 270, and 287
Technical Specification Bases (TSB) Change

On August 4, 2010, Station Management approved revisions to TSB 3.7.13, Fuel Assembly Storage, to include additional critical information on evaluation of compliance based on orthogonal regions of fuel assemblies with a minimum regions size of a two-by-two area (except along the SFP wall).

Attachment 1 contains the new TSB pages, Attachment 2 contains the marked up version of the TSB pages.

If any additional information is needed, please contact Reene Gambrell at 864-873-3364.

Sincerely,

TPGillespie

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Attachment 1

B 3.7 PLANT SYSTEMS

B 3.7.13 Fuel Assembly Storage

BASES

BACKGROUND

The spent fuel pool is designed to store either new (nonirradiated) nuclear fuel assemblies, or burned (irradiated) fuel assemblies in a vertical configuration underwater. The shared spent fuel pool between Unit 1 and Unit 2 is sized to store 1312 fuel assemblies. The Unit 1 and Unit 2 spent fuel storage cells are installed in parallel rows with center to center spacing of 10.65 inches. The Unit 3 storage pool is sized to store 825 fuel assemblies. The Unit 3 spent fuel storage cells are installed in parallel rows with center to center spacing of 10.60 inches.

The Oconee spent fuel storage racks contain Boraflex neutron-absorbing panels that surround each storage cell on all four sides (except for peripheral sides). The function of these Boraflex panels is to ensure that the reactivity of the stored fuel assemblies is maintained within required limits. Boraflex, as manufactured, is a silicon rubber material that retains a powder of boron carbide (B_4C) neutron absorbing material. The Boraflex panels are enclosed in a formed stainless steel wrapper sheet that is spot-welded to the storage tube. The wrapper sheet is bent at each end to complete the enclosure of the Boraflex panel. The Boraflex panel is contained in the plenum area between the storage tube and the wrapper plate. Since the wrapper plate enclosure is not sealed, spent fuel pool water is free to circulate through the plenum. It has been observed that after Boraflex receives a high gamma dose from the stored irradiated fuel ($>10^{10}$ rads) it can begin to degrade and dissolve in the wet environment. Thus, the B_4C poison material can be removed, thereby reducing the poison worth of the Boraflex sheets. This phenomenon is documented in NRC Generic Letter 96-04, "Boraflex Degradation in Spent Fuel Pool Storage Racks".

To address this degradation, the Oconee spent fuel storage racks have been analyzed taking credit for soluble boron as allowed in Reference 1. The methodology ensures that the spent fuel rack multiplication factor, k_{eff}, is ≤ 0.95 as recommended in ANSI/ANS-57.2-1983 (Ref. 2) and NRC guidance (Ref. 3). The spent fuel storage racks are analyzed to allow storage of fuel assemblies with enrichments up to a maximum nominal enrichment of 5.00 weight percent (wt %) Uranium-235 while maintaining $k_{eff} \leq 0.95$, including uncertainties, tolerances, biases, and credit for soluble boron. Note that the criticality analysis accounts for a maximum as-built enrichment tolerance of 0.05 wt % U-235. For example, for a specified maximum design enrichment of 5.00 wt % U-235, an as-built

BASES

BACKGROUND (continued)

enrichment up to 5.05 weight percent is acceptable. Soluble boron credit is used to offset uncertainties, tolerances, and off-normal conditions and to provide subcritical margin such that the spent fuel pool k_{eff} is maintained $\leq$ 0.95. The soluble boron concentration required to maintain $k_{eff} \leq 0.95$ under normal conditions is 430 ppm. In addition, sub-criticality of the pool ($k_{eff} < 1.0$) is assured on a 95/95 basis, without the presence of the soluble boron in the pool (excluding certain burnup-related uncertainties described in the criticality analysis). The criticality analysis performed shows that the acceptance criteria for criticality are met for the storage of fuel assemblies when credit is taken for reactivity depletion due to fuel burnup, no credit for the Boraflex neutron absorber panels and storage configurations and enrichment limits Specified by LCO 3.7.13.

Regions are areas in the SFP containing any number of orthogonally arranged storage cells. Three storage configurations are defined for each region; Unrestricted, Restricted and Checkerboard storage. The region (or base storage unit) of Unrestricted fuel may be a minimum of one cell. Regions of cells arranged in Restricted/Filler or Checkerboard/Empty configurations must be at least 2x2 in size. The required storage pattern for Restricted and Checkerboard fuel is illustrated in various Figures of TS 3.7.13.

The storage conditions for each region are described below (note that the boundary conditions apply independently to each storage region):

- Unrestricted storage allows storage in all cells without restriction on the storage configuration.
- Restricted storage allows storage of higher reactivity, slightly burned fuel when restricted to a certain storage configuration with lower reactivity fuel. Restricted Fuel regions (minimum 2x2 array) must be bounded by either i) one row of fuel qualifying as Unrestricted Fuel (including empty cells as necessary), ii) one row of empty cells, or iii) a wall of the spent fuel pool.
- Checkerboard storage allows storage of the highest reactivity fuel when checkerboarded with empty storage cells. Checkerboard Fuel regions (minimum 2x2 array) must be bounded by either i) one row of fuel qualifying as Unrestricted Fuel (including empty cells as necessary), ii) one row of empty cells, or iii) a wall of the spent fuel pool. In addition, at least three of the four faces of each Checkerboard fuel assembly must be adjacent to an empty cell at all boundaries between storage regions.

BASES (continued)

APPLICABLE SAFETY ANALYSES

Most accident conditions do not result in an increase in reactivity of the racks in the spent fuel pool. Examples of these accident conditions are the drop of a fuel assembly on top of a rack, the drop of a fuel assembly between rack modules (rack design precludes this condition), and the drop of a fuel assembly between rack modules and the pool wall. However, four accidents can be postulated which could result in an increase in reactivity in the spent fuel storage pools. The first is a drop or placement of a fuel assembly into the cask loading area. The second is a loss of normal cooling to the spent fuel pool water which causes an

increase in the pool water temperature. The third is the misloading of a fuel assembly into a location in which the restrictions on location, enrichment and burnup are not satisfied. The fourth is a drop of a heavy load onto the spent fuel racks.

For an occurrence of these postulated accidents, the double contingency principle discussed in ANSI N-16.1-1975 and the April 1978 NRC letter (Ref. 4) can be applied. This double contingency principle does not require assuming two unlikely, independent, concurrent events to ensure protection against a criticality accident. Thus, for these postulated accident conditions, the presence of additional soluble boron in the spent fuel pool water (above the 430 ppm required to maintain $k_{eff} \leq 0.95$ under normal storage conditions) can be assumed as a realistic initial condition since not assuming its presence would be a second unlikely event.

Calculations were performed to determine the amount of soluble boron required to offset the highest reactivity increase caused by these postulated accidents, to maintain $k_{eff} \leq 0.95$. It was found that a spent fuel pool boron concentration of 2220 ppm was sufficient to maintain $k_{eff} \leq$ 0.95 for the worst-case postulated criticality-related accident (the heavy load drop event). Specification 3.7.12 ensures the spent fuel pool contains adequate dissolved boron to compensate for the increased reactivity caused by these postulated accidents.

Note that it is plausible that the "loss of normal cooling" accident could occur in conjuction with a spent fuel pool boron dilution event. Criticality calculations show that the soluble boron needed to maintain $k_{eff} \leq .95$ for the "loss of normal cooling" accident (500 ppm) is still less than the boron concentration following the worst-case credible dilution event (825 ppm).

Therefore, maintaining the spent fuel pool boron concentration within the limits specified in the COLR assures k_{eff} is $\leq .95$ for any accident condition.

For normal storage conditions, Specification 4.3.1 c. requires that the spent fuel rack k_{eff} be ≤ 0.95 when flooded with water borated to 430

BASES

APPLICABLE SAFETY ANALYSES (continued)

ppm. A spent fuel pool boron dilution analysis was performed which confirmed that sufficient time is available to detect and mitigate a dilution of the spent fuel pool before the 0.95 k_{eff} design basis is exceeded. The spent fuel pool boron dilution analysis concluded that an unplanned or inadvertent event which could result in the dilution of the spent fuel pool boron concentration to 430 ppm is not a credible event.

The fuel assembly storage and concentration of dissolved boron in the spent fuel pool satisfy Criterion 2 of 10 CFR 50.36 (Ref. 5).

LCO

a. Units 1 and 2

The restrictions on the placement of fuel assemblies within the spent fuel pool serving Units 1 and 2, which have accumulated burnup greater than or equal to the minimum qualified burnups in Table 3.7.13-1 in the accompanying LCO, ensures the k_{eff} of the spent fuel pool will always remain $\leq$ 0.95, assuming the pool to be flooded with water borated to 430 ppm. Fuel assemblies not meeting the criteria of Table 3.7.13-1 shall be stored in accordance with either Figure 3.7.13-1 and Tables 3.7.13-2 and 3.7.13-3 for Restricted/Filler storage, or Figure 3.7.13-2 for Checkerboard storage.

b. Unit 3

The restrictions on the placement of fuel assemblies within the spent fuel pool serving Unit 3, which have accumulated burnup greater than or equal to the minimum qualified burnups in Table 3.7.13-4 in the accompanying LCO, ensures the k_{eff} of the spent fuel pool will always remain $\leq$ 0.95, assuming the pool to be flooded with water borated to 430 ppm. Fuel assemblies not meeting the criteria of Table 3.7.13-4 shall be stored in accordance with either Figure 3.7.13-3 and Tables 3.7.13-5 and 3.7.13-6 for Restricted/Filler storage, or Figure 3.7.13-4 for Checkerboard storage.

APPLICABILITY

This LCO applies whenever any fuel assembly is stored in the spent fuel pool.

BASES (continued)

ACTIONS

A.1

Required Action A.1 is modified by a Note indicating that LCO 3.0.3 does not apply.

If moving fuel assemblies while in MODE 5 or 6, LCO 3.0.3 would not specify any action. If moving fuel assemblies while in MODE 1, 2, 3, or 4, the fuel movement is independent of reactor operation. Therefore, in either case, inability to move fuel assemblies is not sufficient reason to require a reactor shutdown.

When the configuration of fuel assemblies stored in the spent fuel pool is not in accordance with the LCO, immediate action must be taken to make the necessary fuel assembly movement(s) to bring the configuration into compliance with the LCO.

SURVEILLANCE REQUIREMENTS

SR 3.7.13.1

This SR verifies by administrative means that the initial enrichment and burnup of the fuel assembly is in accordance with the appropriate Figure in the accompanying LCO.

REFERENCES

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

2. American Nuclear Society, “American National Standard Design Requirements for Light Water Reactor Fuel Storage Facilities at Nuclear Power Plants,” ANSI/ANS-57.2-1983, October 7, 1983.

3. Nuclear Regulatory Commission, Memorandum to Timothy Collins from Laurence Kopp, “Guidance on the Regulatory Requirements for Criticality Analysis of Fuel Storage at Light Water Reactor Power Plants,” August 19, 1998.

4. Double contingency principle of ANSI N16.1-1975, as specified in the April 14, 1978 NRC letter (Section 1.2) and implied in the proposed revision to Regulatory Guide 1.13 (Section 1.4, Appendix A).

5. 10 CFR 50.36

Attachment #2

Markup of current TSB

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BACKGROUND (continued)

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