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A Duke Energy Company

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April 26, 2001

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Subject: Duke Energy Corporation
Oconee Nuclear Station, Units 1, 2 and 3
Docket Numbers 50-269, 50-270 and 50-287
Supplementary Information Re: Proposed Technical Specification
Amendment - Spent Fuel Storage Racks (TSCR 2000-01)

By letter dated December 28, 2000, Duke Energy Corporation (Duke) submitted a request to revise the Oconee Nuclear Station, Units 1, 2, and 3, Technical Specifications related to controls used to ensure acceptable margins of subcriticality in the Spent Fuel Pools (SFP) to account for Boraflex degradation. By letter dated April 11, 2001, the NRC requested additional information concerning the Duke request.

The enclosure to this letter provides Duke's response to the NRC's information request.

Please contact R. C. Douglas at 864-885-3073 for addition information or questions concerning these submittals.

Very Truly Yours,

W. R. McCollum, Jr.
Site Vice President
Oconee Nuclear Station

Enclosure a/s

cc:

L. A. Reyes
M. C. Shannon
D. E. LaBarge
V. R. Autry

A001

AFFIDAVIT

W. R. McCollum, Jr., states that he is Site Vice President of Duke Energy Corporation; that he is authorized on the part of said corporation to sign and file with the Nuclear Regulatory Commission this amendment to the Oconee Nuclear Station Facility Operating License Nos. DPR-38, DPR-47, and DPR-55 and Technical Specifications; and that all statements and matters set forth therein are true and correct to the best of his knowledge.

W. R. McCollum, Jr., Site Vice President

Subscribed and sworn to me: 4-26-01
Date

Connie M Breazale, Notary Public

My Commission Expires: 2/12/2003
Date

SEAL

RESPONSES TO REQUEST FOR ADDITION INFORMATION

Question 1:

On page 6 of Attachment 6 of the submittal, it is stated that no axial effects are modeled. How are differences between 2-D and 3-D differences in burnup effects biases calculated?

Response:

For the spent fuel pool criticality analysis, assumption 3 on page 6 of Attachment 6 states: "All calculations are performed in 2-D; i.e., no axial effects are modeled. A reactivity bias is included in the overall k_{eff} calculations, to account for differences between 2-D and 3-D modeling." In a supporting calculation for this TS amendment request, a conservative set of biases was developed that accounts for the reactivity difference between a fuel assembly with an explicit axial (3-D) burnup profile and one with a uniform (2-D) profile at the same average burnup. A realistic bounding axial burnup profile was determined by sampling several burnup shapes from recent Oconee reactor operation core-follow calculations. The biases were computed and tabulated as a function of both burnup and initial enrichment. Trends are consistent with those published in the Westinghouse Spent Fuel Rack Criticality Analysis (WCAP-14416-NP-A), although the biases calculated by Duke are generally higher than the biases reported by Westinghouse.

In the total k_{eff} equations for boron credit calculations in the spent fuel pool criticality analysis, the conservative axial bias corresponding to the highest enrichment / burnup storage limit was employed, since, among all enrichment / burnup combinations on the reactivity equivalence curve, the highest yields the largest positive axial bias.
axial bias.

Question 2:

How were the Methodology Biases and Uncertainties listed in Tables 2 - 5 of the submittal calculated?

Response:

The methodology bias and uncertainty in Table 2 of Attachment 6 pertain to use of the SCALE 4.2 / KENO V.a code, and were derived from statistical analysis of calculational results from the PNL critical experiment benchmarks shown in this table. The bias and uncertainty listed in Tables 4 and 5 were developed from evaluations of CASMO-3 / SIMULATE-3 benchmarking to the B&W critical experiments documented in Table 1. The same statistical method was used to generate both sets of biases and uncertainties. The specific equations for determining the methodology bias and uncertainty were taken from YAEC-1622, "Validation of the YAEC Criticality Safety Methodology," January 1988.

Question 3:

It is not clear to the staff whether the boron credit analysis was performed by Westinghouse methodology (Reference 8.1 of Attachment 6 of the submittal), Duke Energy Corporation, or both?

Response:

The main boron credit analysis was performed by Duke Power. The Westinghouse methodology provided the guidance for performing the boron credit analysis, but Duke Power performed the nominal and accident criticality computations that took partial credit for soluble boron, using industry-standard computer codes that are different from those employed in the Westinghouse methodology. As noted in Attachment 6, Section 3.2.1 of the TS submittal, when reactivity equivalencing uncertainties were considered for the boron credit evaluation (in accordance with the Westinghouse methodology), the following four biases and uncertainties were included:

- BP-Pull Bias
- Calculational Burnup Uncertainty
- Measured Burnup Uncertainty
- Axial Burnup Bias

The total reactivity contribution of these biases and uncertainties was accounted for with soluble boron credit, as Table 10 in the TS submittal shows. The Δk values used for the BP-Pull Bias and the Axial Burnup Bias came directly from supporting Duke Power calculations. Though Duke had also performed an analysis of the Calculational Burnup Uncertainty, by comparing reactor operational data to computational predictions, it was decided to use the more conservative estimate provided in Figure 1 of the Westinghouse methodology, which was generated from comparisons of PHOENIX-P to burned fuel isotopic measurements. The Measured Burnup Uncertainty assumption of 4% appears to be quite conservative, especially in light of the recent EPRI report TR-112054 ("Determination of the Accuracy of Utility Spent Fuel Burnup Records" – July 1999), which concludes that Measured Burnup Uncertainties on the order of 2% are justifiable.

Question 4:

Referencing page 13 of Attachment 6 of the submittal concerning reactivity equivalence: A recent study conducted at Oak Ridge National Laboratory titled ORNL/TM-2000/230, "A Critical Review of the Practice of Equating the Reactivity of Spent Fuel to Fresh Fuel in Burnup Credit Criticality Safety analyses for PWR Spent Fuel Pool Storage," and published in NUREG/CR-6683, indicates that the present process of calculating the reactivity equivalence uncertainties is non-conservative. Provide quantitative technical justification for not addressing this issue.

Response:

During the development of the supporting criticality analyses for this TS submittal, the NUREG contract report CR-6683 was released. The main finding in this report is that if a reactivity equivalence (burnup credit) curve is developed assuming pure, unborated water in the SFP, it may be non-conservative to apply that curve to situations in which boron is present in the SFP water. As Table 5 in NUREG/CR-6683 shows, the degree of the non-conservatism increases with increasing burnup and/or boron concentration.

In following the guidance of the Westinghouse methodology, the reactivity equivalence curves for the Oconee SFPs were first determined with no boron in the SFP water, in order to satisfy the first criterion for allowance of soluble boron credit, that $k_{eff} < 1.00$ in unborated water.

For normal storage conditions, to satisfy the second criterion for soluble boron credit, that $k_{eff} < 0.95$ when at least X ppm boron is in the SFP water [with X less than the boron remaining following a worst-case credible dilution event], the supporting calculations for this TS submittal first determined the total additional reactivity penalty for reducing the 95/95 k_{eff} below 0.95, including all burnup-related uncertainties. Then, to ensure the amount of soluble boron credit required to satisfy this second subcriticality criterion was the maximum necessary, computations were carried out at the highest enrichment (5.00 wt % U-235) / burnup combinations on the proposed fuel storage reactivity equivalence curves for the Oconee SFPs.

The calculations for the assembly misload and abnormal water temperature change accidents were also carried out at the highest enrichment / burnup combinations on the proposed fuel storage reactivity equivalence curves. As with the normal fuel storage conditions, this ensured the maximum amounts of additional soluble boron were determined for these accidents. The heavy load drop event required nearly 2220 ppm boron to maintain $k_{eff} < 0.95$, and in the evaluation of this postulated accident each enrichment / burnup combination was explicitly analyzed, since the heavy load drop evaluation considered a wide range of crushed-rack assembly pin pitches to determine the maximum achievable reactivity.

In summary, all of the supporting calculations for the proposed fuel storage burnup limits in this TS submittal have adequately addressed the soluble boron credit non-conservatism concerns noted in NUREG/CR-6683.

Question 5:

On Page 15 of Attachment 6 of the submittal, it is stated, "The revised heavy load drop analysis shows that the minimum spent fuel pool boron concentration (currently 2220 ppm) is sufficient to maintain the maximum k_{eff} ... below 0.95 ...". The statement seems to indicate only that the existing concentration is sufficient to meet the criteria, but does not state the design limit. What is the minimum spent fuel pool design boron concentration necessary to maintain k_{eff} below 0.95? How will sufficient margin be assured during all plant evolutions so that the boron concentration will not decrease to or below the level?

<u>Response</u>:

In the calculation that evaluated the heavy load drop event, the most reactive crushed-rack scenario yielded a 95/95 k_{eff} of 0.9491 with 2220 ppm of boron in the spent fuel pool water. To maintain k_{eff} below 0.95 for the worst-case heavy load drop event, then, it is necessary to have the minimum boron concentration (2220 ppm) available.

The borated water storage tank (BWST), which is the refueling canal water source for refueling operations, is required to be > 2220 ppm, as is the SFP. Both of these minimum concentrations are specified in the COLR. Changes to COLR values are controlled through administrative procedures that require confirmation that such changes do not violate or invalidate limits in existing analyses.

Normally, the boron concentrations in the Oconee SFPs are greater than 2500 ppm. The proposed increase in SFP boron concentration surveillance frequency (from 31 days to 7 days) provides additional assurance that the minimum SFP boron concentration does not decrease below 2220 ppm. A measurement uncertainty for the boron concentration was also included in the heavy load drop analysis. This is the only accident scenario that required close to 2220 ppm to maintain $k_{eff} < 0.95$.