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Ken Peters
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W3F1-2004-0099

October 18, 2004

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

SUBJECT: Supplement to Amendment Request NPF-38-258, Modify Technical Specification (TS) 5.3.1, Fuel Assemblies and TS 6.9.1.11.1, Core Operating Limits
Waterford Steam Electric Station, Unit 3
Docket No. 50-382
License No. NPF-38

REFERENCES: 1. Entergy letter to the NRC dated June 20, 2004, "License Amendment Request to Modify Technical Specification (TS) 5.3.1, Fuel Assemblies and TS 6.9.1.11.1, Core Operating Limits" (W3F1-2004-0036)

Dear Sir or Madam:

By letter (Reference 1), Entergy Operations, Inc. (Entergy) proposed a change to the Waterford Steam Electric Station, Unit 3 (Waterford 3) Technical Specifications (TSs) to support the cycle 14 core reload.

On August 31, 2004, Entergy received four questions which were determined to need formal response. Entergy's response is contained in the attachment to this letter.

There are no technical changes proposed. The original no significant hazards consideration included in Reference 1 is not affected by any information contained in the supplemental letter. There are no new commitments contained in this letter.

If you have any questions or require additional information, please contact Dana Millar at 601-368-5445.

A001

I declare under penalty of perjury that the foregoing is true and correct. Executed on October 18, 2004.

Sincerely,

KJP/DM/cbh

Attachment: Response to Request for Additional Information

cc: Dr. Bruce S. Mallett
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Attachment

To

W3F1-2004-0099

Response to Request for Additional Information

Response to Request for Additional Information Related to the Modification of Technical Specification (TS) 5.3.1, Fuel Assemblies and TS 6.9.1.11.1, Core Operating Limits

Question 1:

Enclosure 1 to W3F1-2004-0036 provided supplemental information to demonstrate the applicability of the Westinghouse nuclear physics code package to Waterford Unit 3. Figures 2.3-9 through 2.3-20 provide comparisons between plant measurements and the ANC code predictions of Waterford-3 Cycles 11 and 12 radial assembly average power and radial peaking factor (Fr) distributions. These comparisons, however, show large differences between the measured and predicted values for some assemblies. For example, in Figure 2.3-9, assembly T-20 for cycle 11 has a difference of 8.046% in the measured and predicted radial assembly average power; and in Figure 2.3-15, the difference in the Fr for assembly S-20 is 8.97%.

Provide justification for concluding the applicability the Westinghouse nuclear physics package to Waterford-3 in light of these large differences between the measured and the predicted values.

Response 1:

The specific assembly locations cited in the question are core periphery locations whose assembly powers are significantly below core average power. In these instances, small absolute differences in power can become large percent differences. The basis of Westinghouse's neutronic code topical reports has been based on absolute difference (Calculated verses Measured) not percent difference. The assembly absolute power differences and radial power distribution standard deviations as calculated by ANC are within Westinghouse's experience base as documented in previous topical reports, e.g. the INCA/CECOR topical CENPD-153-P Revision 1-P-A.

In Figure 2.3-15, for example, the maximum error for potential limiting assemblies (i.e. those having an assembly power within 10% of the peak assembly power) is 2.5%, which is well within the uncertainty allowance on assembly power of 4.24% used in the safety analysis. When expressed on an absolute normalized power unit basis the maximum error in Figure 2.3-15 is 0.09 power units, which represents 6% of the peak assembly power in the core.

In the current style of low leakage core designs employed at Waterford 3, the peripheral assemblies are not limiting. With respect to the radial peaking factor (Fr) distributions, the value of importance to the safety analyses is the core maximum value.

Question 2:

The staff included several conditions in its acceptance of CENPD-404-P-A for licensing application. Condition 4 stated that until data are available demonstrating the performance of ZIRLO cladding in CENP designed plants, the fuel duty will be limited for each CENP designed plant with some provision for adequate margin to account for variations in core design (e.g., cycle length, plant operating conditions, etc.). The licensee's response to

Condition 4 (on page 8 of Attachment 1 to W3F1-2004-0036) indicated that the maximum modified fuel duty index (mFDI) calculated based on actual 16x16 CE-designed fuel is approximately 590; and the mFDI values of 652 and 712, which are 110% (for the majority of ZIRLO clad fuel pins) and 120% (for a fraction of ZIRLO clad fuel pins in a limited number of assemblies) of 590, respectively, will be used as upper design limits for the Waterford 3 fuel to provide margin to account for core design variations. The response further states that if the mFDI and measured oxide thickness from the CE lead plant utilizing ZIRLO™ correlate as expected or is conservative relative to predictions, Waterford 3 will no longer restrict the mFDI except as required to meet the 100 micron oxide limit.

(A) Explain how the maximum mFDI value of 590 is calculated and why this is the adequate nominal fuel duty limit. The response should include: (1) the values and the source of data regarding the time averaged oxide layer surface temperature (T_{avg}), total irradiation time (Hrs), and total mass evaporation (Mt) used to calculate the maximum mFDI value (see the mFDI formula described in Equation 3-2 of CENPD-404) of 590; and (2) ZIRLO oxide measurements as a function of mFDI from CE fuel designs (e.g., lead test assemblies, fuel batches, etc.) to demonstrate the relative corrosion rate of ZIRLO in a CE fuel design and adequacy of the mFDI limit of 590.

(B) Explain how the 110% and 120% mFDI multipliers are obtained to provide adequate margin for variations in core design, and how they will be applied to the Waterford 3 fuel, i.e., which fuel pins are subject to which mFDI limit values.

(C) The margin provision stated in Condition 4 is intended to account for core design variations to further restrict the fuel duty limit until data are available demonstrating the performance of ZIRLO cladding. Explain why increasing, rather than reducing, the fuel duty limit with the 110% and 120% multipliers, respectively, is not contrary to the intent of Condition 4.

(D) Explain what is meant by the "as expected" correlation between mFDI and measured oxide thickness. Provide the correlation, with basis, used to judge if the measured oxide thickness is as expected or conservative.

(E) The licensee indicated that if the mFDI and measured oxide thickness from the CE lead plant utilizing ZIRLO™ correlate as expected, then Waterford 3 will no longer restrict the mFDI except as required to meet the 100 oxide limit. Please clarify whether the licensee intends to lift the restriction on fuel duty without the NRC's evaluation of the licensee submittal of the appropriate ZIRLO corrosion data from CE fuel design.

Response 2(A):

During NRC review of the ZIRLO™ topical report, the NRC stated that until data are available demonstrating the performance of ZIRLO™ cladding in Combusting Engineering (CE) designed plants, the fuel duty will be limited for each CE designed plant with some provision for adequate margin to account for variations in core design (e.g., cycle length, plant operating conditions, etc.). At the NRC's request the maximum fuel duty was estimated based on past operating experience for CE 16x16 plants using the methodology described in Section 3 of CENPD-404-P-A. This maximum mFDI was estimated to be about 590. To account for variations in core design the NRC and Westinghouse reached an agreement that the mFDI could deviate up to 110% of maximum mFDI based on past operating experience for a majority of ZIRLO™ clad fuel pins and 120% of the maximum for a fraction of core pins. These temporary restrictions are clearly below the ZIRLO™ database maximum mFDI (~900) for Westinghouse plants as shown in Figure 3.4-2 in CENPD-404-P-A. After it is confirmed that the corrosion data for ZIRLO™ cladding in CE plants demonstrates a similar behavior to corrosion data in the Westinghouse ZIRLO™ database the fuel duty restriction will be lifted and the only limit will be the best estimate maximum oxide thickness of 100 microns.

The lead 16x16 CE fuel design plants for ZIRLO™ implementation are Arizona Public Services (APS) Palo Verde Nuclear Generating Station Units 1, 2 and 3 (PCNGS). An mFDI of about 600 was determined to be applicable for the 16x16 CE fuel design and has been approved by the NRC for the PVNGS units[1]. APS committed to restrict the mFDI of each ZIRLO™ clad fuel pin to 110 percent of the maximum fuel pin value previously experienced and up to 120 percent of the maximum fuel pin value previously experienced for fuel pins in a limited number of assemblies (4-8). APS further committed to ensure that the baseline mFDI would remain unchanged during the process of collecting additional data to support increasing the mFDI and that this restriction would be lifted only after consultation with the NRC and the data will be shared with the NRC. The results of the measurements used to demonstrate that the oxide thicknesses are in good agreement with the predicted are expected to be available in the summer of 2005.

Response 2(B):

The 110% and 120% multipliers were determined based on expected deviations in core design which may occur in the future as part of the fuel management process for CE plants. These values were agreed upon with the NRC during the review of the APS ZIRLO™ implementation amendment. Until ZIRLO™ corrosion data is obtained for CE plants, Westinghouse or the licensee will demonstrate by analysis that the mFDI will be less than the 110% and 120% restrictions.

All ZIRLO™-clad fuel pins are subject to the 110% mFDI multipliers, but a fraction of these pins, in a limited number of assemblies, are permitted to have values up to the 120% multiplier. Since these target values are defined by operations constrained by experience, rather than physical or regulatory limits, there is no exact number associated with the number of rods above the 110% threshold. Judgment will be applied to the design evaluation to ensure that the intent of the SER condition is not being challenged.

Response 2(C):

It is recognized that the maximum mFDI for CE plants is near 600 and for Westinghouse plants about 900. To account for expected changes in cycle length, uprated cores, batch

[1] Letter, J. Donohew (NRC) to G. R. Overbeck (APS), "Subject: Palo Verde Nuclear Generating Station, Units 1,2, and 3 - Issuance of Amendments Re: Technical Specification 5.6.5b, Core Operating Limits Report (COLR) and Use of ZIRLO Cladding Material (TAC Nos. MB3373, MB3374, And MB3375)", March 12, 2002

size, etc.; the fuel duty could increase slightly. The NRC allowed Westinghouse/licensees to have some flexibility in core design so these multipliers were greater than 100% however the allowable mFDI is still well below the 900 value from Westinghouse ZIRLO™ database and the predicted best estimate maximum oxide thickness shall always be less than 100 microns.

Response 2(D):

Condition 4 actually says "If the mFDI and measured oxide thickness from the CE lead plant utilizing ZIRLO™ correlate as expected." This means the corrosion data for ZIRLO™ cladding in CE plants will be compared to the Westinghouse ZIRLO™ corrosion database to determine if a similar behavior exists. The statement simply reflects the degree of confidence that Westinghouse has in obtaining consistent results for CE fuel designs. That is, it is expected that the corrosion behavior of ZIRLO™ in CE plants will be similar to that observed in Westinghouse plants. Once ZIRLO™ corrosion data is available for CE plants then this data will be compared to the Westinghouse ZIRLO™ database.

Response 2(E):

Waterford 3 will lift the restriction on fuel duty if the ZIRLO™ corrosion behavior in CE plants is similar to or conservative relative to the Westinghouse ZIRLO™ corrosion data. Entergy intends to lift this restriction, without an NRC evaluation, for the Waterford 3 plant based on the NRC's actions relative to lifting the restriction for the lead 16x16 plant (PVNGS) for ZIRLO™ implementation. Entergy will document its action via 10 CFR 50.59.

Question 3:

In the List of Regulatory Commitments provided in Attachment 3 to W3F1-2004-0036, Commitment Item 2 states that prior to the use of lead test assemblies (LTAs), fuel designs will be analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel design bases and to assure no new or different kind of accident from any accident previously evaluated will be created.

Should the commitment be augmented to state that the use of LTAs will meet all NRC rules and regulations, or an exemption from the rules and regulations will be required?

Response 3:

The commitment should not be augmented. Part of the standard process that is required prior to the use of LTAs in the Waterford 3 core is to ensure that all NRC rules and regulations are satisfied. Waterford 3 plans to use LTAs, which employ optimized ZIRLO™, in the upcoming refueling outage and has already obtained NRC approval by letter dated July 28, 2004 for exemption for the requirements of the affected regulations.

Question 4:

The licensee proposed to revise TS 5.3.1. The existing TS 5.3.1 specified that the reactor core shall contain 217 fuel assemblies with each fuel assembly containing a maximum of 236 fuel rods clad with Zircaloy-4. The specification of the maximum of 236 fuel rods per fuel assembly is deleted in the revised TS 5.3.1.

Provide the basis and justification for the deletion of the maximum of 236 fuel rods per assembly.

Response 4:

10 CFR 50.36 does not include specific guidance related to the details that should be included in the design features section of the TS. Therefore the proposed wording was fashioned following the guidance in NUREG-1432, "Standard Technical Specifications Combustion Engineering Plants" which has been approved by the NRC. The Waterford 3 reactor incorporates a 16 x 16 fuel assembly design with five guide tubes. The guide tubes each displace four fuel rod positions. Therefore, by design a 16 x 16 fuel assembly designed to accommodate 20 fuel rod positions designated for use as CEA guide tubes would have only 236 fuel rods per assembly that could be clad with Zircaloy-4. The fuel assembly design is described in the Waterford 3 Final Safety Analysis Report, Section 4.1. Any change to the design will be evaluated under 10 CFR 50.59 and based on the 10 CFR 50.59 review may require prior NRC approval.