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Waterford 3

10 CFR 50.90

W3F1-2018-0059

October 18, 2018

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

SUBJECT: Response to NRC Request for Additional Information Regarding License Amendment Request to Update the Results for the Inadvertent Loading of a Fuel Assembly into the Improper Position (Fuel Assembly Misload) Event
Waterford Steam Electric Station, Unit 3 (Waterford 3)
Docket No. 50-382
License No. NPF-38

REFERENCES:
1. W3F1-2018-0011, License Amendment Request to Update the Results for the Inadvertent Loading of a Fuel Assembly into the Improper Position (Fuel Assembly Misload) Event, March 8, 2018 [NRC ADAMS Accession Number ML18099A096].

2. NRC Letter, Waterford Steam Electric Station, Unit 3 - Request for Additional Information Regarding License Amendment Request to Revise Section 15.4.3.1 of the Waterford 3 Updated Final Safety Analysis Report to Account for Fuel Misload (EPID L-2018-LLA-0058), September 25, 2018 [NRC ADAMS Accession Number ML18262A041].

Dear Sir or Madam:

By letter dated March 8, 2018 (Reference 1), Entergy Operations, Inc. (Entergy) requested an amendment to revise the Waterford Steam Electric Station, Unit 3 (Waterford 3) Updated Final Safety Analysis Report (UFSAR), Section 15.4.3.1, to update the results for an inadvertent loading of a fuel assembly into the improper position.

By letter dated September 25, 2018 (Reference 2), the NRC staff informed Entergy that they have reviewed the license amendment request and have determined that additional information is required to complete the review. A clarification call between the NRC and Entergy was previously held on September 18, 2018.

The enclosure to this letter provides the responses to the NRC request for additional information.

This letter contains no new regulatory commitments.

If you have any questions or require additional information, please contact John V. Signorelli, Acting Regulatory Assurance Manager, at (504) 739-6032.

I declare under penalty of perjury that the foregoing is true and correct. Executed on October 18, 2018.

Sincerely,

JD/JVS/mpp/mmz

Enclosure: Response to NRC Request for Additional Information Regarding License Amendment Request to Update the Results for the Inadvertent Loading of a Fuel Assembly into the Improper Position (Fuel Assembly Misload) Event

cc: Mr. Kriss Kennedy, Regional Administrator
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Enclosure to

W3F1-2018-0059

Waterford Steam Electric Station, Unit 3

Response to NRC Request for Additional Information Regarding License Amendment Request to Update the Results for the Inadvertent Loading of a Fuel Assembly into the Improper Position (Fuel Assembly Misload) Event

(2 pages)

Request for Additional Information 1

Section 3.1, "Selecting the Worst Undetectable Misload," of the LAR indicates that an initial survey of a large number of potential misloads from several representative and potential future loading patterns is performed by comparing assembly reactivity, peaking factors, and proximity to incore detectors to determine several potential candidates for the worst undetectable misload. All candidates from this initial survey are then explicitly analyzed.

Please explain (or reference an approved methodology that explains) how candidates for the worst undetectable misload event may be reliably identified from the vast number of possibilities. If the specific methodology used has not been previously approved by the NRC staff, then expand upon and further justify the method used to identify the candidates for the worst undetectable fuel misload.

Entergy Response

The method of screening the possible adverse fuel assembly misloads is the same as that used in the Waterford 3 Analysis of Record (AOR) as well as that approved by the NRC for Palo Verde Nuclear Generating Station (LAR Reference 7). The initial screening involved comparing the k-infinity differences between two possible misloaded assemblies. Beginning of Cycle (BOC) and Middle of Cycle (MOC) k-infinity differences were calculated for the proposed misloads using the ANC code.

The Δk-infinity at BOC is used to identify worst case undetectable fuel assembly misloads. The Δk-infinity at MOC is used to identify fuel assembly misloads with the highest Required Overpower Margin (ROPM). MOC is chosen since the ROPM limit is generally set at MOC, just after burnable absorber burnout. If a misload is undetectable at BOC, but has a low ROPM at MOC it is not considered limiting. Likewise, if a misload has a high ROPM at MOC, but is highly detectable at BOC it is also not considered limiting.

Additional consideration was given for the assemblies immediately adjacent to the nominal ANC depletion peak radial peaking factor (Fr) locations throughout the cycle. For these locations, the Δk-infinity and interchange difference between the peak Fr adjacent assembly and every sub-region in the core were calculated using BOC k-infinity values. The maximum ANC Fr calculated from the base misload case is also a good indicator of the maximum ROPM, and as such was used as a screening parameter in order to ensure the worst undetectable misload would be captured.

Based on the above considerations and assuming up to 25% incore instrument (ICI) failure at startup, per the Technical Requirements Manual (TRM), the worst undetectable fuel assembly misloads were identified and examined for this analysis.

Request for Additional Information 2

Section 3.2, "Determining Fuel Pin Failure," of the LAR states, in part:

> The amount of fuel failure that occurs as a direct result of DNB [departure from nucleate boiling] is determined by counting the number of fuel rods that have a power greater than the radial peaking factor that is greater than the CECOR measured value by an amount corresponding to a decrease in OPM (overpower margin] equivalent to the ROPM (required overpower margin] (as determined by CETOP).

Please clearly restate or explain the above quotation. In particular, the phrase "that have a power greater than the radial peaking factor that is greater than the CECOR measured value" compares a rod power to a radial peaking factor, makes consecutive "greater than" comparisons, and discusses "CECOR measured values" in the context of candidate misloads that could derive from several representative and "potential future loading patterns." As such, the meaning of the above statement cannot reasonably be inferred from the information available to the NRC staff.

Entergy Response

The Core Operating Limit Supervisor System (COLSS) assures that the core always maintains sufficient DNB overpower margin (OPM) during normal operation to prevent fuel failure from Condition II transients to a 95/95 confidence level. The amount of margin that must be reserved for Condition II transients (ROPM) is pre-determined and is one of the COLSS setpoints. The COLSS uses the CECOR measured planar radial peaking factor (Fxy) in its online calculation of the DNB OPM. If a core misload were to occur, some of the effects of the misload would be seen in the CECOR measured Fxy. The CECOR measured Fxy is input into COLSS which would cause a decrease in DNB OPM. This means that only the decrease in DNB OPM associated with the unseen increase in Fxy would need to be accommodated by available margin to prevent fuel failure.

The CETOP code is used to correlate ROPM with an increase in Fxy to calculate the OPM associated with different values of Fxy. These CETOP calculations are used to determine the Fxy that would be equivalent to the current reserved Waterford ROPM value. Any fuel rod having a Fxy greater than the reserved COLSS ROPM calculated Fxy could have a DNBR below the 95/95 DNBR limit. The Waterford misload analysis has assumed that the value of Fxy installed into COLSS for a core operating with a postulated misload would be the value that CECOR would measure for that core assuming that 25% of the incore detectors were inoperable. Thus, the analysis assumed that all fuel rods having an Fxy greater than reserved COLSS ROPM calculated Fxy would be below the 95/95 DNBR limit. To conservatively account for postulated DNB propagation, it was assumed all the rods in any assembly having at least one rod with an Fxy greater than the reserved COLSS ROPM calculated Fxy would be counted as failed.