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Michael R. Chisum
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W3F1-2015-0061

August 14, 2015

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

SUBJECT: Supplement to Revise Control Element Assembly Drop Times Associated with Technical Specification 3.1.3.4
Waterford Steam Electric Station, Unit 3
Docket No. 50-382
License No. NPF-38

REFERENCES:

1. Entergy Pre-submittal Meeting Summary for the Revised Control Element Assembly Drop Times [ADAMS Accession Number ML15117A503].
2. Entergy Pre-Submittal Meeting Revised Presentation Slides for Control Element Assembly Drop Times [ADAMS Accession Number ML15113A787].
3. W3F1-2015-0040, License Amendment Request to Revise Control Element Drop Times, July 2, 2015 [ADAMS Accession Number ML15197A106].
4. NRC Letter, Regarding License Amendment Request to Revise Control Element Assembly Drop Times, Unacceptable with Opportunity to Supplement, August 3, 2015 [ADAMS Accession Number ML15205A306].

Dear Sir or Madam:

On April 22, 2015, a Category 1 public meeting was held between the U.S. Nuclear Regulatory Commission (NRC) staff and representatives of Entergy Operations, Inc. (Entergy) and Westinghouse Electric Company (Westinghouse) at the NRC Headquarters. The purpose of the meeting was to discuss the Entergy's license amendment request (LAR) regarding changes to Technical Specification (TS) 3.1.3.4 (CEA Drop Time) and Updated Final Safety Analysis Report (UFSAR) Chapter 15 (Accident Analyses). Reference 1 provides the meeting summary information and Reference 2 provides the meeting presentation information.

As discussed in the public meeting and pursuant to 10 CFR 50.90, Entergy requested an amendment to revise the Control Element Assembly (CEA) drop times associated

with Technical Specification 3.1.3.4 for Waterford Steam Electric Station Unit 3 (Waterford 3) [Reference 3]. The submittal identified that additional information would be useful to the NRC during their review. The NRC staff reviewed the Waterford 3 submittal and concluded that this same additional information was necessary to enable the NRC staff to make an independent assessment regarding the acceptability of the proposed amendment [Reference 4]. This letter provides the supplement information identified in Reference 3 and Reference 4.

This submittal does not alter the no significant hazards consideration or environmental assessment previously submitted by Waterford 3 in letter W3F1-2015-0040 [Reference 3].

If you have any questions or require additional information, please contact John Jarrell, Regulatory Assurance Manager, at 504-739-6685.

I declare under penalty of perjury that the foregoing is true and correct. Executed on August 14, 2015.

Sincerely,

MRC/JPJ/wjs

Attachments:

1. Supplemental Analysis of Proposed Technical Specification Change

cc: Mr. Marc L. Dapas
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Attachment 1 to

W3F1-2015-0061

Supplemental Analysis of Proposed Technical Specification Change

1.0 DESCRIPTION

On April 22, 2015, a Category 1 public meeting was held between the U.S. Nuclear Regulatory Commission (NRC) staff and representatives of Entergy Operations, Inc. (Entergy) and Westinghouse Electric Company (Westinghouse) at the NRC Headquarters. The purpose of the meeting was to discuss the Entergy's license amendment request (LAR) regarding changes to Technical Specification (TS) 3.1.3.4 (CEA Drop Time) and Updated Final Safety Analysis Report (UFSAR) Chapter 15 (Accident Analyses). Reference 5.1 provides the meeting summary information and Reference 5.2 provides the meeting presentation information.

As discussed in the public meeting and pursuant to 10 CFR 50.90, Entergy requested an amendment to revise the Control Element Assembly (CEA) drop times associated with Technical Specification 3.1.3.4 for Waterford Steam Electric Station Unit 3 (Waterford 3) [Reference 5.3]. The submittal identified that additional information would be useful to the NRC during their review. The NRC staff reviewed the Waterford 3 submittal and concluded that this same additional information was necessary to enable the NRC staff to make an independent assessment regarding the acceptability of the proposed amendment [Reference 5.4]. This letter provides the supplement information identified in Reference 5.3 and Reference 5.4.

2.0 BACKGROUND

Waterford 3 letter W3F1-2015-0040 described the CEA drop time increase failure analysis which identified one apparent cause and two possible causes. The apparent cause is the failure mode that Waterford 3 considers most likely. The possible causes are failure modes that could not be eliminated but are considered less likely. The apparent cause of the rise in CEA drop times is the combined effects of major plant modifications that increased the resistance experienced by the CEAs during the insertion from 100% withdrawn to 90% inserted. The first possible cause could be due to a change in Control Element Drive Mechanisms (CEDM) voltage decay time between the original and replacement CEDMs causing a delay in the start of the CEA drop. A second possible cause could be due to the change in as-built manufacturing tolerances in the replacement reactor pressure vessel head (RPVH) resulting in increased friction between the CEA extension shaft and the RPVH and thus slower CEA motion.

The apparent cause and second possible cause are bounded by the change to the CEA drop time and analysis provided in Waterford 3 letter W3F1-2015-0040 [Reference 5.3]. The first possible cause could delay the initial CEA drop and would result in the analysis discussed in Reference 5.3 not being bounding for the first 5% of CEA insertion (refer to Table 3.0-1). The Section 3 analysis reanalyzes the limiting Updated Final Safety Analysis Report (UFSAR) events to bound the first possible cause of the slowed CEA drop times and shows a minimal impact. The Section 3 analyzes the chosen limiting events and increases the CEA holding coil decay time from 0.6 seconds to 0.8 seconds.

All the apparent and possible causes are due to one-time plant modifications and therefore are not expected to further degrade. Since, no further degradation is expected, the action of raising the CEA drop time limit will resolve the lack of CEA drop time margin.

3.0 TECHNICAL ANALYSIS

Table 3.0-1 (CEA Drop Times) provides the revised CEA drop time curves used in the updated evaluations. The three curves are described as to their relation to the Analyses of Record (AOR), W3F1-2015-0040, and the Section 3 re-analysis of the limiting events.

- Table 3.0-1 Curve 1 is the CEA drop times that were used in the AORs. The AORs are those currently presented in the UFSAR. W3F1-2015-0040 describes the AORs that did not credit CEA insertion or used a more conservative CEA insertion curve.
- Table 3.0-1 Curve 2 is the revised CEA drop times that were used in the W3F1-2015-0040 submittal. The Curve 2 CEA drop time increases the drop time by 0.2 seconds for the 10% to 90% insertion points. The 0% insertion point stays the same and the 5% insertion point increases by 0.15 seconds. This curve was chosen to encompass an increase in CEA drop time at 90% insertion.
- Table 3.0-1 Curve 3 is used in the Section 3 reanalysis of the limiting events and increases the 0% to 90% insertion points by 0.2 seconds. This would bound the possible cause of increased CEA holding coil decay time (0.8 second holding coil decay time).

Table 3.0-1. CEA Drop Times

CEA Insertion (%)	Curve 1 AOR Time (Seconds)	Curve 2 Revised Time (Seconds)	Curve 3 Increased Holding Coil Time (Seconds)
0	0.00	0.00	0.00
0	0.60	0.60	**0.80**
5	0.80	**0.95**	**1.00**
10	0.95	**1.15**	**1.15**
20	1.25	**1.45**	**1.45**
30	1.55	**1.75**	**1.75**
40	1.80	**2.00**	**2.00**
50	2.05	**2.25**	**2.25**
60	2.3	**2.50**	**2.50**
70	2.535	**2.75**	**2.75**
80	2.75	**2.95**	**2.95**
90	3.0	**3.20**	**3.20**
100	3.5	3.50	3.50

The requirements of Technical Specification (TS) 3.1.3.4 ensure that actual drop times for CEAs are conservative with respect to the drop time assumed in accident and transient analyses. The W3F1-2015-0040 evaluations previously provided would bound the CEA drop time impact of the apparent cause and second possible cause of the increase in CEA

drop time. The first possible cause was not identified until after Westinghouse had already completed most of the evaluations and analyses using Table 3.0-1 Curve 2. Waterford 3 understood that the apparent cause and possible causes should be bounded by the analysis to ensure TS 3.1.3.4 provides conservative drop time. Waterford 3 provided in W3F1-2015-0040 a commitment to analyze the limiting events with respect to Table 3.0-1 Curve 3 to demonstrate acceptable results. The limiting events were chosen to bound the expected impact of the CEA drop time change due to the possible cause of increased CEA holding coil decay time. By using the limiting events, it can be reasonably concluded that the other UFSAR events can be evaluated and dispositioned under the 10CFR50.59 process with no adverse impact to the conclusions of the submittal.

Waterford 3 letter W3F1-2015-0040 also provided commitments to obtain the CEA drop time curve during the Cycle 21 startup testing and evaluate that the results are conservative with respect to the Table 3.0-1 CEA drop times. The Waterford 3 CEAs insert via gravity and the acceleration of gravity is a constant. It is a reasonable expectation that the Table 3.0-1 average CEA drop time at 90% insertion (3.2 seconds) will bound the test data based upon past surveillances. The apparent cause and possible causes would not result in the CEA motion to deviate beyond the curves presented in Table 3.0-1. Thus, Waterford 3 considers the curve validations to be a prudent action but expects the data to be within the revised analyses.

The limiting events were chosen with respect to peak primary and secondary pressure, minimum DNBR, and fuel failure results.

- The loss of condenser vacuum event was chosen to represent the limiting peak primary and secondary pressure events. The loss of condenser vacuum is one of the limiting peak primary and secondary pressure accidents. The loss of condenser would be representative of this class of events and is appropriate to demonstrate the impact of the Table 3.0-1 Curve 3 CEA drop time change.
- The sheared shaft / seized rotor accident was chosen as the representative loss of flow type event. The sheared shaft / seized rotor accident produces the most rapid thermal degradation for this class of events. The sheared shaft / seized rotor accident violates the DNBR Specified Acceptable Fuel Design Limit (SAFDL) and results in fuel failure. The sheared shaft / seized rotor event is appropriate to demonstrate the impact of the Table 3.0-1 Curve 3 CEA drop time change.
- The CEA ejection accident was chosen as the limiting event with respect to reactivity insertion. The CEA ejection accident results in the fastest reactivity insertion which results in violating the DNBR SAFDL and results in fuel failure. The CEA ejection event is appropriate to demonstrate the impact of the Table 3.0-1 Curve 3 CEA drop time change.

The only change between the W3F1-2015-0040 analyses (Curve 2) and the analyses presented for each of the limiting events (Curve 3) is the 0% and 5% CEA insertion times. The time to reach 90% CEA insertion is the same for both Curve 2 and Curve 3. All other inputs remained the same.

3.1 LOSS OF CONDENSER VACUUM (LOCV)

UFSAR Sections 15.2.1.3 and 15.2.2.3 describe the LOCV event. This analysis demonstrates the change in peak primary and secondary side pressure results for the LOCV event modeling a 0.8 second CEA holding coil delay (Table 3.0-1 Curve 3). The loss of condenser vacuum results and acceptance criteria are listed in Table 3.1-1.

Table 3.1-1. Loss of Condenser Vacuum Results

	FSAR	Table 3.0-1 Curve 1 AOR	Table 3.0-1 Curve 2 Revised Analysis	Table 3.0-1 Curve 3 Increased Holding Coil Analysis	Acceptance Criteria
Peak Primary Pressure	2711 psia	2711 psia	2712 psia	2712 psia	<2750 psia
Peak Secondary Pressure	1181 psia	1180 psia	1180 psia	1180 psia	<1210 psia

The loss of condenser vacuum event is not limiting with respect to DNBR and peak linear heat rate (PLHR). The LOCV results indicate that the impact of the increased CEA holding coil decay (Table 3.0-1 Curve 3) is negligible on the LOCV analysis with respect to the W3F1-2015-0040 analysis (Table 3.0-1 Curve 2) previously submitted in Reference 5.3.

3.2 SHEAR SHAFT / SEIZED ROTOR EVENT

UFSAR Section 15.3.3.1 describes the single reactor coolant pump (RCP) shaft seizure / sheared shaft events. This analysis demonstrates the change in fuel failure and minimum DNBR for the sheared shaft / seized rotor event modeling a 0.8 second CEA holding coil delay (Table 3.0-1 Curve 3). The sheared shaft / seized rotor results and acceptance criteria are listed in Table 3.2-1.

Table 3.2-1. Sheared Shaft / Seized Rotor Results

	FSAR	Table 3.0-1 Curve 1 AOR	Table 3.0-1 Curve 2 Revised Analysis	Table 3.0-1 Curve 3 Increased Holding Coil Analysis	Acceptance Criteria
Minimum DNBR	1.145	1.145	1.131	1.131	NA
Calculated Fuel Failure	15%	<8%	<10.5%	<10.5%	≤15%

The sheared shaft / seized rotor event is not limiting with respect to peak primary and secondary pressures. The sheared shaft / seized rotor results indicate that the impact of the increased CEA holding coil decay (Table 3.0-1 Curve 3) is negligible on the sheared shaft / seized rotor analysis with respect to the W3F1-2015-0040 analysis (Table 3.0-1 Curve 2) previously submitted in Reference 5.3.

3.3 CEA EJECTION EVENT

FSAR Section 15.4.3.2 describes the control element assembly (CEA) ejection events. This analysis demonstrates the change in fuel failure, fuel rod radial average enthalpy, and fuel rod centerline enthalpy results for the CEA ejection event modeling a 0.8 second CEA holding coil delay (Table 3.0-1 Curve 3). The CEA ejection results and acceptance criteria are listed in Table 3.3-1.

Table 3.3-1. CEA Ejection Results

	FSAR	Table 3.0-1 Curve 1 AOR	Table 3.0-1 Curve 2 Revised Analysis	Table 3.0-1 Curve 3 Increased Holding Coil Analysis	Acceptance Criteria
Calculated Fuel Failure	15%	≤11.6%	≤12.1%	≤12.4%	≤15%
Fuel Rods Having Radial Average Fuel Enthalpy ≥ 280 cal/gm	0	0	0	0	0
Fuel Rods Having Centerline Enthalpy ≥ 231.3 cal/gm	0	0	0	0	0

The CEA ejection event is not limiting with respect to peak primary and secondary pressures. The CEA ejection results indicate that the impact of the increased CEA holding coil decay (Table 3.0-1 Curve 3) is minimal on the CEA ejection analysis with respect to the W3F1-2015-0040 analysis (Table 3.0-1 Curve 2) previously submitted in Reference 5.3.

4.0 CONCLUSION

UFSAR limiting accidents were chosen to evaluate the increased CEA drop time impact due to the possible cause of increased CEA holding coil decay time. The only change between the W3F1-2015-0040 analyses (Table 3.0-1 Curve 2) and the Table 3.0-1 Curve 3 analyses presented for each of the limiting events is the 0% and 5% CEA insertion times. The time to reach 90% CEA inserted is the same for both Table 3.0-1 Curve 2 and Table 3.0-1 Curve 3. The analyses demonstrate the change in peak primary pressure, peak secondary pressure, minimum DNBR, fuel failure, fuel rod radial average enthalpy, and fuel rod centerline enthalpy results for the limiting events modeling a 0.8 second CEA holding coil delay are negligible or minimal. All results remain within the acceptance criteria. This means that the W3F1-2015-0040 conclusions remain valid even if the CEA holding coil decay time were to increase to 0.8 seconds.

Based upon the limiting Section 3 events results, it can be reasonably concluded that the other UFSAR events can be evaluated and dispositioned under the 10CFR50.59 process with no adverse impact to the conclusions of the W3F1-2015-0040 submittal.

5.0 REFERENCES

5.1 Entergy Pre-submittal Meeting Summary for the Revised Control Element Assembly Drop Times [ADAMS Accession Number ML15117A503].

5.2 Entergy Pre-Submittal Meeting Revised Presentation Slides for Control Element Assembly Drop Times [ADAMS Accession Number ML15113A787].

5.3 W3F1-2015-0040, License Amendment Request to Revise Control Element Drop Times, July 2, 2015 [ADAMS Accession Number ML15197A106].

5.4 NRC Letter, Regarding License Amendment Request to Revise Control Element Assembly Drop Times, Unacceptable with Opportunity to Supplement, August 3, 2015 [ADAMS Accession Number ML15205A306].

5.5 Waterford Nuclear Generator Station Unit 3, Technical Specifications, Through Amendment 243.