From: Wengert, Thomas
Sent: Monday, February 24, 2020 11:24 AM
To: Arnold, Timothy
Cc: BICE, DAVID B (ANO); Dixon-Herrity, Jennifer
Subject: ANO-2 Final RAI RE: License Amendment Request to Revise Control Element Assembly Drop Time (EPID L-2019-LLA-0285)
Attachments: ANO-2 - Final RAI Concerning CEA Drop Time LAR.pdf

On February 21, 2020, the U.S. Nuclear Regulatory Commission (NRC) staff sent Entergy Operations, Inc. (Entergy) the draft Request for Additional Information (RAI) identified below. This RAI relates to the license amendment request (LAR) to increase both the individual and average Control Element Assembly (CEA) drop time limits established in ANO-2 technical specification (TS) 3.1.3.4, "CEA Drop Time."

Entergy subsequently informed the NRC staff that the information requested was understood and that no additional clarification of the RAI was necessary. A publicly available version of this final RAI (attached with "Draft" removed) will be placed in the NRC's Agencywide Documents Access and Management System (ADAMS). As agreed, please provide a response to this RAI with 30 days of this correspondence.

From: Wengert, Thomas
Sent: Friday, February 21, 2020 8:59 AM
To: Arnold, Timothy
Cc: BICE, DAVID B (ANO) ; Dixon-Herrity, Jennifer
Subject: ANO-2 Draft RAI RE: License Amendment Request to Revise Control Element Assembly Drop Time (EPID L-2019-LLA-0285)

By letter dated December 18, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19352F266), Entergy Operations, Inc. submitted a license amendment request for Arkansas Nuclear One, Unit-2 (ANO-2). The proposed amendment would increase both the individual and average Control Element Assembly (CEA) drop time limits established in ANO-2 technical specification (TS) 3.1.3.4, "CEA Drop Time."

The U.S. Nuclear Regulatory Commission (NRC) staff has determined that additional information, as described in the attached request for additional information (RAI), is required for the staff to complete its review of this application. This RAI is identified as draft at this time to confirm your understanding of the information that the NRC staff needs to complete the evaluation.

Please contact me if you would like to set up a conference call with the NRC staff to clarify this request for information. In addition, let's discuss the timing for your response to this request.

Tom Wengert
Project Manager – Arkansas Nuclear One
NRR/DORL/LPL4

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Hearing Identifier: NRR_DRMA
Email Number: 448

Mail Envelope Properties (MN2PR09MB4972071F3148E94D3848722A8FEC0)

Subject: ANO-2 Final RAI RE: License Amendment Request to Revise Control Element Assembly Drop Time (EPID L-2019-LLA-0285)
Sent Date: 2/24/2020 11:24:21 AM
Received Date: 2/24/2020 11:24:00 AM
From: Wengert, Thomas

Created By: Thomas.Wengert@nrc.gov

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Tracking Status: None

Post Office: MN2PR09MB4972.namprd09.prod.outlook.com

Files	**Size**	**Date & Time**
MESSAGE	2183	2/24/2020 11:24:00 AM
ANO-2 - Final RAI Concerning CEA Drop Time LAR.pdf	203498	

Options
Priority: Normal
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:

REQUEST FOR ADDITIONAL INFORMATION

BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO THE LICENSE AMENDMENT REQUEST

TO REVISE THE CONTROL ELEMENT ASSEMBLY DROP TIMES

ENTERGY OPERATIONS, INC.

ARKANSAS NUCLEAR ONE, UNIT 2

DOCKET NO. 50-368

By application dated December 18, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19352F266), Entergy Operations, Inc. (Entergy, the licensee) submitted a license amendment request (LAR) to revise the Arkansas Nuclear One, Unit 2 (ANO-2) technical specifications (TSs). The proposed changes to TS 3.1.3.4, "CEA Drop Time," include: an increase in the maximum individual control element assembly (CEA) drop time, from the fully withdrawn position to 90 percent inserted, from ≤ 3.7 seconds to ≤ 3.9 seconds; and an increase in the arithmetic average of all CEA drop times from ≤ 3.2 seconds to ≤ 3.4 seconds. The licensee proposed the changes to establish margin impacted by the installation of new high temperature upper gripper coils (UGCs) associated with the Control Element Drive Mechanism (CEDM) for each CEA.

The U.S. Nuclear Regulatory Commission (NRC) staff reviewed the information in the LAR and has determined that additional information is needed to complete the review.

Regulatory Basis for Request

The following regulatory requirements comprise the basis for the request for additional information:

- General Design Criterion (GDC) 10, in Appendix A to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, requires that the reactor core and associated coolant, control, and protection systems shall be designed with appropriate margin to assure that specified acceptable fuel design limits (SAFDLs) are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences (AOOs).

- GDC 15 requires that the reactor coolant system (RCS) and associated auxiliary, control, and protection system be designed with sufficient margin to assure that the design conditions of the reactor coolant pressure boundary are not exceeded during any condition of normal operation, including AOOs.

- The regulation in 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems [ECCS] for light-water nuclear power plants," requires that a loss of coolant accident analysis must meet the ECCS performance acceptance criteria.

Background

The CEA insertion on a reactor trip signal provides negative reactivity to the core to shut down the unit for numerous design-basis events discussed in the Chapter 15 of the ANO-2 safety analysis report (SAR). The licensee assessed all the SAR Chapter 15 analyses to determine the impact of the proposed CEA drop times changes and identified that the following events would be affected by the changes: (1) SAR Section 15.1.1 - CEA Bank Withdrawal from a Subcritical Condition; (2) SAR Section 15.1.5 - Total Loss of Reactor Coolant Forced Flow; and (3) SAR Section 15.1.7 - Loss of External Load and/or Turbine Trip. The licensee reanalyzed the events to demonstrate their compliance with the applicable SAR Chapter 15 acceptance criteria and provided the results in the LAR for the NRC staff to review and approve.

Request for Additional Information (RAI)

RAI-1 (Computer Codes, Critical Heat Flux (CHF) Correlation, and Initial Conditions)

(a) Confirm that the methods, computer codes and CHF correlations used in the reanalysis are consistent with those used in the analysis of record for each event reanalyzed. If changes were made, identify and justify the changes.

(b) Confirm that the initial conditions (i.e., RCS core inlet temperature, RCS pressure, core flow rate, power level, axial power shape, and total neutron heat flux factor) used in the reanalysis are consistent with those used in the analysis of record for each event reanalyzed. If the initial conditions were different, identify and justify the differences.

RAI-2 (CEA Insertion Reactivity Curve)

ANO-2 SAR Section 15.1.0.2.3, Shutdown CEA Reactivity, indicates that the CEA insertion reactivity curves in SAR Figure 15.1.1.0-1D (representing CEA reactivity vs. insertion time) and Figure 15.1.1.0-1E (representing CEA insertion position vs. insertion time) were used in the transients and accidents analyses applicable to Cycle 13 and subsequent cycles. The curves were developed based on the assumption that the arithmetic average drop time to 90% inserted was 3.2 seconds, of which 0.6 seconds is attributed to holding coil delay time.

(a) Discuss whether the same CEA insertion curves in SAR Figure 15.1.1.0-1D and Figure 15.1.1.0-1E were used in the reanalysis or not.

(b) If the same curves were used, address the acceptability of their use considering that the curves were based on the arithmetic average drop time to 90% inserted of 3.2 seconds vs. 3.4 seconds for the application to the reanalysis.

(c) If different curves were used, provide the curves and discuss their derivation.

(d) Clarify how the CEA insertion curves used in the reanalysis would be bounding throughout the upcoming and subsequent operating cycles.

RAI-3 (Initial Conditions in SAR Table 15.1.1-7 for CEAW Reanalysis)

On page 5 of the enclosure to the LAR, the licensee discussed the reanalysis of the SAR Section 15.1.1 Event - CEA Bank Withdrawal (CEAW) from a Subcritical Condition. The licensee reanalyzed two cases using the initial conditions in SAR Table 15.1.1-7, “Assumptions for the Cycle 16 Uncontrolled CEA Withdrawal from a Subcritical Condition.”

As the title of the table suggests, SAR Table 15.1.1-7 was applicable to the CEAW analysis for the Cycle 16 core, which was the first cycle based on the power uprate conditions. Provide the rationale for selecting the two cases and the associated initial conditions in SAR Table 15.1.1-7 for performing the reanalysis of this CEAW event.

RAI-4 (Reanalysis of SAR Section 15.1.5 - Total Loss of Reactor Coolant Forced Flow (LOF))

For the LOF reanalysis discussed on page 7 of the enclosure to the LAR, the licensee indicated that “an additional 2% DNBR margin of the 7% difference in analysis required overpower margin (ROPM) and COLSS [Core Operating Limits Supervisory System] ROPM was credited” to partially offset the reduced departure from nuclear boiling (DNBR) margin due to the revised CEA drop times.

Discuss how the additional “2% DNBR margin” was modeled in the LOF reanalysis and provide justification.

RAI-5 (Trip Response Times)

In support of the revised CEA drop times, Section 3.1 of the LAR discusses the analysis of the ANO-2 SAR Chapter 15 events and identifies the events that credited various reactor trips. The reactor trips and the associated trip response times discussed in the LAR are summarized as follows:

(1) the core protection calculator (CPC) variable overpower trip (VOPT) with the assumed response of 0.4 seconds for the analysis of the CEAW from critical conditions and the excess heat removal due to secondary system malfunction

(2) the low steam generator level (LSGL) trip with the assumed response time of 1.1 seconds for the analysis of the loss of normal feedwater flow event (LONF) event, the feedwater line break (FLB), and main steam safety valves (MSSVs) out-of-service cases

(3) the high pressurizer pressure trip with the assumed response time of 0.65 seconds for the analysis of the FLB

(4) The CPC RCP shaft speed trip with the assumed response time of 0.4 seconds for the analysis of the steam generator tube rupture (SGTR) event.

(5) The CPC Tsat trip with the assumed response time of 2.45 second for the analysis if the SGTR event

(6) The CPC ΔTcold trip with the assumed response time of 0.4 second for the analysis of the events resulting from the instantaneous closure of a single main steam isolation valve or loss of load to a single steam generator.

The licensee stated that the existing analysis of the above events remained valid for the proposed increase in the CEA drop time of 0.2 seconds (from 3.2 second to 3.4 seconds), because: (1) the response time modeled in the analysis for each trip was greater than the "assumed" response time by at least 0.2 seconds, and (2) the "assumed' response time was greater than the "actual" response time. For example, on page 12 of the enclosure to the LAR the licensee discusses the effects of the revised CEA drop times on the existing analyses of the SGTR accidents, which credited the CPCs RCP shaft speed - Low trip for the SGTRs without alternating current (AC) power available.

The licensee stated that the CPC RCP shaft speed trip modeled a response time of 1.0 seconds as compared to 0.4 seconds for the "assumed" response time. The licensee also stated that the 0.4-second response time continued to ensure the assumed CPC RCP shaft speed trip response time remained greater than the "actual" CPC RCP shaft speed trip response time. The licensee determined that, because the 0.2 seconds of the 0.6-second additional CPC RCP shaft speed trip response time could be applied to offset the 0.2-second increase in the CEA drop time, the existing analysis of the SGTR without AC power available cases remained bounding for the revised CEA drop times conditions.

(a) Provide the "actual" response times for each of the above reactor trips and show that the "actual" response times were equal to or less than the "assumed" response times.

(b) Clarify what was done to ensure that the "actual" response times would not exceed the "assumed" response times throughout the operation of upcoming and future cycles.

RAI-6 (MSLB Mass and Energy Releases for Containment Analysis)

Page 16 of the enclosure to the LAR states, in part, that "the MSLB mass and energy release analysis was confirmed to be negligibly affected by the increase in CEA drop times."

Discuss what was done to confirm that the increase in CEA drop times had a negligible effect on the MSLB mass and energy release analysis.