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0CAN102401 10 CFR 50.55a

October 16, 2024

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

Subject: Response to Request for Additional Information - Proposed Alternatives ANO1-ISI-24-01 and ANO2-ISI-24-01 for Examinations of Steam Generator Pressure-Retaining Welds and Full Penetration Welded Nozzles

Arkansas Nuclear One – Units 1 and 2
NRC Docket Nos. 50-313 and 50-368
Renewed Facility Operating License Nos. DPR-51 and NPF-6

References:

1. Entergy letter to NRC, "Proposed Alternatives ANO1-ISI-24-01 and ANO2-ISI-24-01 for Examinations of Steam Generator Pressure-Retaining Welds and Full Penetration Welded Nozzle," ML24158A389, (0CAN062402) dated June 6, 2024

2. NRC email to Entergy, "Final Request for Additional Information – Arkansas Nuclear One - Proposed Alternatives for Examinations of SG Pressure Retaining Welds and Full Penetration Welded Nozzles - EPID-L-2024-0038," (0CNA092402),dated September 23, 2024

In accordance with 10 CFR 50.55a(z)(1), Entergy Operations, Inc. (Entergy), requested Nuclear Regulatory Commission (NRC) approval of proposed alternatives for Arkansas Nuclear One, Unites 1 and 2 (ANO-1 & 2) (Reference 1). Specifically, the proposed alternatives are to defer the in-service inspection (ISI) examinations for select examination categories and item numbers for the steam generators (SG) at ANO-1 and ANO-2 from the current American Society of Mechanical Engineers (ASME) Code, Section XI 10-year requirements to the end of licensed operating life, which is scheduled to end on May 20, 2034, and July 17, 2038, respectively. Entergy received a Request for Additional Information (RAI) from the NRC (Reference 2). The Enclosure to this letter provides Entergy's response to the RAI.

This letter contains one new regulatory commitment. This commitment is summarized in the attachment to the enclosure.

If there are any questions or if additional information is needed, please contact Riley Keele, Manager, Regulatory Assurance, Arkansas Nuclear One, at 479-858-7826.

Respectfully,

Philip Couture

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PC/rwc

Enclosure: Response to Request for Additional Information

Attachment: Summary of Regulatory Commitments

cc: NRC Region IV Regional Administrator
NRC Senior Resident Inspector – Arkansas Nuclear One
NRC Project Manager – Arkansas Nuclear One

Enclosure

0CAN102401

Response to Request for Additional Information

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

BACKGROUND

By letter dated June 6, 2024 (Agencywide Documents Access and Management System Accession No. ML24158A389), in accordance with 10 CFR 50.55a(z)(1), Entergy Operations, Inc. (Entergy, the licensee) requested Nuclear Regulatory Commission (NRC) approval of proposed alternatives for Arkansas Nuclear One, Units 1 and 2 (ANO-1 and ANO-2, respectively). Alternative Requests ANO1-ISI-24-01 and ANO2-ISI-24-01 are to defer the in-service inspection (ISI) examinations for select examination categories and item numbers for the steam generators (SG) at ANO-1 and ANO-2 from the current American Society of Mechanical Engineers (ASME) Code, Section XI 10-year requirements to the end of licensed operating life, which is scheduled to end on May 20, 2034, and July 17, 2038, respectively.

The proposed alternatives are based on two Electric Power Research Institute (EPRI) topical reports (TR), "Technical Bases for Inspection Requirements for PWR Steam Generator Feedwater and Main Steam Nozzle-to-Shell Welds and Inside Radius Sections" 3002014590 (TR 14590) (ML19347B107) and "Technical Bases for Inspection Requirements for PWR Steam Generator Class 1 Nozzle-to-Vessel Welds and Class 1 and Class 2 Vessel Head, Shell, Tube sheet-to-Head and Tube sheet-to-Shell Welds" 3002015906 (TR 15906) (ML20225A141).

To complete its review, the Nuclear Regulatory Commission (NRC) staff requests for additional information as shown below.

REGULATORY BASIS

The SG pressure-retaining welds and nozzles at the subject units are ASME Code Class 1 and Class 2 components, whose inservice inspections (ISIs) are performed in accordance with the applicable edition of Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," of the ASME Code, as required by 10 CFR 50.55a(g).

The regulations in 10 CFR 50.55a(g)(4) state, in part, components that are classified as ASME Code Class 1, 2, and 3 must meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, to the extent practical within the limitations of design, geometry, and materials of construction of the components.

The regulations in 10 CFR 50.55a(z) state, in part, that alternatives to the requirements in paragraphs (b) through (h) of 10 CFR 50.55a may be used when authorized by the NRC if the licensee demonstrates that: (1) the proposed alternative would provide an acceptable level of quality and safety, or (2) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Question 1 - RAI-1

Issue

On its cover letter dated June 6, 2024, the licensee stated that the end of the fourth ISI interval for ANO-2 was March 25, 2021. On Page 6 of the Enclosure, the licensee stated that for ANO-2, "…[t]he new SG welds and components received the required PSI examinations followed by ISI examinations through the first period of the current fifth inspection interval…"

Table 2-6 of the Enclosure, Attachment 2 provides the dates of the past SG weld and nozzle inner radius examination at ANO-2. Based on the dates of inspections in Table 2-6 and dates of the end of the fourth ISI interval, it seems that the latest inspections were performed in the fourth, not fifth, ISI interval for SG welds at ANO-2. It seems that no inspections of the SG welds were performed in the fifth ISI interval at ANO-2.

Request

(a) Clarify whether any SG welds in the scope of the Alternative Request were examined during the first period (or any period up to the present) of the fifth ISI interval at ANO-2. As part of the discussion, please provide the beginning date and end date of third, fourth, fifth and sixth 10-year ISI intervals at ANO-2.

Response

Entergy has not performed any inspections of the SG welds within the scope of this request in the fifth 10-year interval at ANO-2. The intent of the statement regarding the fifth 10-year interval was to define where ANO-2 is in the interval, not that any examinations were performed in the fifth 10-year interval. Table 2-6 defines when examinations have been completed.

The second 10-year inspection interval concluded on March 26, 2000.

The third 10-year inspection interval for ANO-2 was completed March 25, 2010.

The fourth 10-year inspection interval, originally scheduled to end March 25, 2020, was extended by 12 months per ASME, Section XI, IWA-2430(c)(3) and concluded on March 25, 2021.

The fifth 10-year inspection interval commenced on its original start date and ran concurrent with the 3rd period, fourth 10-year interval extension. The fifth 10-year inspection interval is divided into inspection periods consistent with Table IWB-2412-1. The inspection periods are scheduled as follows:

1st Period:	From March 26, 2020, to March 25, 2024 (4 Years)
2nd Period:	From March 26, 2023, to March 25, 2027 (4 Years)
3rd Period:	From March 26, 2027, to March 25, 2030 (3 Years)

The sixth 10-year interval is scheduled to start March 26, 2030.

Question 2 - RAI-2

Issue

The licensee referenced probabilistic fracture mechanics (PFM) and deterministic fracture mechanics analyses in TR 14590 and TR 15906 to support the proposed elimination of the SG welds and nozzle inner radius examinations. The NRC staff notes that leveraging PFM analyses to define the basis for risk-informing inspection requirements requires knowledge of both the current and future behavior of the material degradation and the associated uncertainties applicable to the subject SG welds. Confidence in the results of these analyses hinges on the assurance that the PFM model adequately represents, and will continue to represent, the degradation behavior in the subject SG welds.

The NRC staff has determined that, when considering proposed elimination of examinations, adequate performance monitoring through inspections is needed to ensure that the assumptions of the PFM model remain valid, and that novel or unexpected degradation is detected and dispositioned in a timely fashion. Further, the staff has communicated concepts that licensees can implement on a fleet-wide basis to develop a performance monitoring plan and bolster the technical basis for alternative requests (see presentation slide packages dated January 30, 2023, and April 27, 2023, at ML23033A667 and ML23114A034, respectively). A recent precedent regarding performance monitoring of SG welds could be found in the NRC's safety evaluation dated September 25, 2023 (ML23256A088). On June 27, 2024, the NRC staff made a presentation regarding the concept of performance monitoring of components as part of the risk-informed materials assessment project (ML24193A005).

Table 1-5 of the Enclosure, Attachment 1 provides the dates of the SG weld and nozzle inner radius examinations after the new SGs were installed at ANO-1. Table 2-6 of Enclosure, Attachment 2 provides the dates of the SG weld and nozzle inner radius examination after the new SGs were installed at ANO-2. On pages 5 and 6 of the Enclosure, the licensee stated that the operating licenses for ANO-1 and ANO-2 expire in years 2034 and 2038, respectively.

Based on the dates of the latest examination as shown in Tables 1-5 and 2-6 and the year when the operating license expires, the NRC staff has identified the following SG welds that will be in operation for an extended period without an examination.

For ANO-1, welds 03-104, 03-117, 03-118, and 03-115IR.

For ANO-2, welds 04-004, 03-005, 04-005, 03-006, 04-006, 03-007, 04-007, 04-001, 04-002, and 04-002IR.

Request

(a) Describe a performance monitoring that could be implemented to examine ANO-2 SG welds in the fifth ISI interval to ensure that the PFM model adequately represents, and will continue to represent, the degradation behavior in the subject components commensurate with the duration of the requested alternative.

Response

ANO-2 and Waterford are both Combustion Engineering (CE) plant designs. The performance monitoring plan provided will encompass both ANO-2 and Waterford. Entergy has previously submitted an alternative for Waterford (Reference 6) that addresses these inspections at Waterford. In a response to a request for additional information (Reference 1), Waterford further expanded on the performance monitoring plan. The Waterford RAI response is outlined below.

A total of six welds will be selected for examination. As committed in Reference 1, five of the six welds will be selected from Waterford: B2.40, C1.20, C1.30, C2.21 and C2.22. One B3.130 weld will be selected from ANO-2. This performance monitoring plan will examine 6 of 15 components totaling 40% of the entire population of the welds of interest. This is consistent with the precedence provided in Reference 2.

ANO-2 will select one B3.130 weld to be examined prior to 20 years between examinations. This is currently scheduled to occur during the sixth 10-year interval, second period. This is identified as a new NRC Commitment in the Attachment to this Enclosure. No ANO-2 SG weld within the scope of this request will be inspected in the ANO-2 fifth 10-year interval.

Item No.	Component ID	Exam Date	Interval/Period	Future Exam Schedule	Outage Current Schedule	Approximate Years Between Exams
B3.130	03-005 04-005 03-006 04-006 03-007 04-007	Last examined between 2014 and 2015.	4th Interval/2nd Period	6th Int/2nd Period	2035	19

Waterford has included five items in the performance monitoring plan, one of each item number requiring examination, that are scheduled to be completed in less than 20 years. Below is an excerpt from the recent Waterford RAI response.

Waterford performance monitoring plan (Reference 1):

Table 1 – Inspection History - Monitoring Plan

Item No.	Comp ID	Exam Date	Interval/Period/Outage	Future Exam Schedule	Outage Current Schedule	Approximate Years Between Exams
C2.21	04-073	4/30/2017	3rd / 3rd / 1RF21	5th Int / 3rd Per	2035	18
C2.22	04-074	4/28/2017	3rd / 3rd / 1RF21	5th Int / 3rd Per	2035	18
C1.30	04-075	10/6/2020	4th / 1st / 1RF23	6th Int / 1st Per	2039	19
C1.20	04-068	4/29/2017	3rd / 3rd / 1RF21	5th Int / 3rd Per	2035	18
B2.40	04-076	5/4/2017	3rd / 3rd / 1RF21	5th Int / 3rd Per	2035	18

Request

(b) Explain how this performance monitoring will provide, over the extended examination interval, (1) direct evidence of the presence and extent of degradation, (2) validation and confirmation of the continued adequacy of the PFM model; and (3) timely detection of novel or unexpected degradation.

Response

1) The performance monitoring plan provided above includes sampled inspections using ASME Section XI examination methods that will provide direct evidence of the presence and extent of any degradation over the extended examination interval for these welds.

2) The ANO-2 operating history is validation and confirmation of the conservative nature of the PFM and deterministic fracture mechanics (DFM) models used in the EPRI Technical Reports 3002015906 (Reference 3) and 3002014590 (Reference 4) which were referenced in ANO2-ISI-24-01 (Reference 5). This also shows that the models will predict future behavior conservatively. The proposed performance monitoring plan includes sampling of examinations across the remainder of the ANO-2 and Waterford current operating licenses.

3) The performance monitoring schedule described above will provide timely detection of any novel or unexpected degradation in these components. The performance monitoring plan provided above includes sampled inspections using ASME Section XI exam methods that will provide direct evidence of the presence and extent of any degradation over the extended examination interval for these welds.

Request

(c) If through this performance monitoring, indications are detected that exceed the acceptance standards of the ASME Code, Section XI, IWB-3500, confirm that they will be evaluated as required by the ASME Code, Section XI (which includes requirements for successive inspections and additional examinations) and describe other actions (if any) specified in the plant's corrective action program to ensure that the integrity of the component is adequately maintained.

Response

If, during the performance monitoring schedule described above, indications are detected that exceed the applicable ASME Code, Section XI acceptance standards of IWB-3500, then the indications will be addressed as required by ASME Code Section XI, and the Entergy Corrective Action Program (CAP). The additional examination and successive inspection requirements of ASME Code, Section XI, also apply during the current outage. The number of additional examinations shall be the number required by ASME Section XI, IWB-2430.

Request

(d) If through this performance monitoring, indications are detected that exceed the acceptance standards of the ASME Code, Section XI, IWB-3500, scope expansion may be appropriate to assess extent of condition. Furthermore, if this performance monitoring plan or industry-wide operating experience indicates that a new or novel degradation mechanism is possible in SG welds or nozzle inner radii, scope expansion may be appropriate to ensure that no such mechanism is occurring in the subject plants. Discuss the detailed scope expansion plans for these scenarios.

Response

As stated above, if indications are detected that exceed the applicable ASME Code, Section XI acceptance standards of IWB-3500, then the indications will be addressed as required by ASME Code Section XI, and Entergy's CAP. The additional examination and successive inspection requirements of ASME Code, Section XI, also apply during the current outage. The number of additional exams shall be the number required by ASME Section XI, IWB-2430.

In addition to ASME Section XI, Entergy utilizes CAP to review and evaluate industry Operating Experience (OE) to determine the appropriate actions required based upon the specific OE. If the OE indicates that a new or novel degradation mechanism is possible in SG welds or nozzle inner radii, the appropriate examinations will be performed or considered to ensure that no such mechanism is occurring in the subject plants.

REFERENCES

1. Entergy (Waterford) letter to the NRC, "Response to Request for Additional Information - Proposed Alternative WF3-RR-24-02 for Examinations of Steam Generator Pressure-Retaining Welds and Full Penetration Welded Nozzles," ML24268A295, dated September 24, 2024.
2. NRC letter to Constellation Energy Generation, LLC, "Braidwood Station, Units 1 and 2; Byron Station, Units Nos 1 and 2; Calvert Cliffs Nuclear Power Plant, Units 1 and 2; and R. E. Ginna Nuclear Power Plant – Issuance of Relief RE: Proposed Alternative Request Associated with Steam Generator Examination (EPIDS L-2023-LLR-0053, L-2023-LLR-0054, L-2023-LLR-0055, L-2023-LLR-0056)," ML24179A326, dated July 23, 2024.
3. EPRI Technical Report 3002015906, "Technical Bases for Inspection Requirements for PWR Steam Generator Class 1, Nozzle-to-Vessel Welds and Class 1 and Class 2 Vessel Head, Shell, Tube sheet-to-Head and Tube sheet-to-Shell Welds." (TR 15906) (ML20225A141), 2019.
4. EPRI Technical Report 3002014590, "Technical Bases for Inspection Requirements for PWR Steam Generator Feedwater and Main Steam Nozzle-to-Shell Welds and Inside Radius Sections." (TR 14590) (ML19347B107), 2019.
5. Entergy letter to NRC, "Proposed Alternatives ANO1-ISI-24-01 and ANO2-ISI-24-01 for Examinations of Steam Generator Pressure-Retaining Welds and Full Penetration Welded Nozzle," ML24158A389, dated June 6, 2024.
6. Entergy (Waterford) letter to the NRC, "Proposed Alternative WF3-RR-24-02 for Examinations of Steam Generator Pressure-Retaining Welds and Full Penetration Welded Nozzles," ML24078A376, dated March 18, 2024

Enclosure, Attachment

0CAN102401

Summary of Regulatory Commitments

SUMMARY OF REGULATORY COMMITMENTS

This table identifies actions discussed in this letter for which Entergy commits to perform. Any other actions discussed in this submittal are described for the NRC's information and are **not** commitments.

COMMITMENT	TYPE (Check one)		SCHEDULED COMPLETION DATE (If Required)
	ONE-TIME ACTION	CONTINUING COMPLIANCE	
ANO-2 will select one B3.130 weld (03-005, 04-005, 03-006, 04-006, 03-007, or 04-007) to be examined prior to 20 years between examinations	X		Prior to 20 years between examinations. This is currently scheduled to occur during the sixth 10-year interval, second period.