



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

May 9, 2017

ANO Site Vice President  
Arkansas Nuclear One  
Entergy Operations, Inc.  
1448 S.R. 333  
Russellville, AR 72802

SUBJECT: ARKANSAS NUCLEAR ONE, UNIT 2 – REQUEST FOR ADDITIONAL  
INFORMATION REGARDING REACTOR VESSEL INTERNALS AGING  
MANAGEMENT PROGRAM PLAN REVIEW (CAC NO. MF8155)

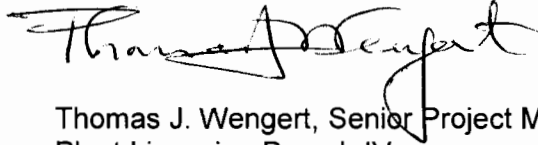
Dear Sir or Madam:

By letter dated July 18, 2016, Entergy Operations, Inc. (Entergy) submitted the Reactor Vessel Internals (RVI) Aging Management Program (AMP) for Arkansas Nuclear One, Unit 2 (ANO-2). The RVI AMP was submitted to fulfill license renewal Commitment Nos. 15 and 19, which are described in the ANO-2 Updated Final Safety Analysis Report, Sections 18.1.23 and 18.1.24, respectively.

The U.S. Nuclear Regulatory Commission staff has reviewed Entergy's application and, based upon this review, determined that additional information is needed, as set forth in the enclosure. On April 12, 2017, a draft version of the request for additional information (RAI) was sent to Mr. Robert Clark of your staff to ensure that the request was understandable, the regulatory basis for the request was clear, and to determine if the requested information had been previously docketed. On April 27, 2017, a teleconference was held to clarify the request. At the conclusion of the conference call, Mr. Clark stated that Entergy would submit its response within 120 days of the date of this letter.

If you have any questions, please contact me at (301) 415-4037 or by e-mail at [Thomas.Wengert@nrc.gov](mailto:Thomas.Wengert@nrc.gov).

Sincerely,

A handwritten signature in black ink, appearing to read "Thomas J. Wengert". The signature is fluid and cursive, with a prominent loop at the end of the last name.

Thomas J. Wengert, Senior Project Manager  
Plant Licensing Branch IV  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket No. 50-368

Enclosure:  
Request for Additional Information

cc w/encl: Distribution via Listserv

REQUEST FOR ADDITIONAL INFORMATION

REACTOR VESSEL INTERNALS AGING MANAGEMENT PROGRAM PLAN

ENTERGY OPERATIONS, INC.

ARKANSAS NUCLEAR ONE, UNIT 2

DOCKET NO. 50-368

By letter dated July 18, 2016 (Agencywide Documents Access and Management System (ADAMS) Package Accession No. ML16202A168), Entergy Operations, Inc. (the licensee) submitted the Reactor Vessel Internals (RVI) Aging Management Program (AMP) for Arkansas Nuclear One, Unit 2 (ANO-2). The RVI AMP is submitted to fulfill license renewal (LR) Commitment Nos. 15 and 19, which are described in the ANO-2 Updated Final Safety Analysis Report, Section 18.1.23, "Reactor Vessel Internals Cast Austenitic Stainless Steel (CASS) Program," and Section 18.1.24, "Reactor Vessel Internals Stainless Steel Plates, Forgings, Welds, and Bolting Program," respectively. These two LR commitments were submitted by letter dated September 10, 2004 (ADAMS Accession No. ML042660110), in support of the ANO-2 license renewal application (LRA) dated October 14, 2003 (ADAMS Accession No. ML032890492). The ANO-2 LRA was reviewed and approved by the U.S. Nuclear Regulatory Commission (NRC) staff in NUREG-1828, "Safety Evaluation Report Related to the License Renewal of the Arkansas Nuclear One, Unit 2," dated June 2005 (ADAMS Accession No. ML051730233). Appendix A, "Commitments for License Renewal," of NUREG-1828 provides the commitments, their implementation schedule, and source references.

The NRC staff has determined that additional information is required in order to complete the review of the ANO-2 RVI AMP. The staff's request for additional information (RAI) follows:

**RAI-1** Action Item 1 - Applicability of Failure Modes, Effects, and Critical Analysis and Functionality Analysis Assumptions

Background

Section 4.2.1, "Applicability of FMECA [Failure Modes, Effects, and Critical Analysis] and Functionality Analysis Assumptions," of the NRC's safety evaluation (SE) (ADAMS Accession No. ML11308A770) for Electric Power Research Institute (EPRI) Topical Report, Materials Reliability Program (MRP)-227-A (ADAMS Accession No. ML120170453), "Material Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines," describes plant-specific Applicant/Licensee Action Item 1.

Section 5.1 "SE Section 4.2.1, Applicant/Licensee Action Item 1 (Applicability of FMECA and Functionality Analysis Assumptions)," and Section 1.8.4.1, "MRP-227-A Applicability to ANO-2," of the Attachment to the ANO-2 RVI AMP submittal, "PWR [Pressurized-Water Reactor] Internals Aging Management Program Plan for Arkansas Nuclear One, Unit 2" (ADAMS Accession No. ML16202A167), discuss the applicability to MRP-227-A and the licensee's assessment of its compliance with Action Item 1.

In order to resolve the generic issue of the information needed from licensees to resolve Action Item 1, Westinghouse Commercial Atomic Power (WCAP) report WCAP-17780-P, "Reactor Internals Aging Management MRP-227-A Applicability for Combustion Engineering and Westinghouse Pressurized Water Reactor Designs" (ADAMS Accession No. ML13183A373; not publicly available, proprietary information), and EPRI MRP Letter 2013-025, "MRP-227-A Applicability Template Guideline" (ADAMS Accession No. ML13322A454), were developed. An NRC staff evaluation (ADAMS Accession No. ML14309A484) assessed MRP Letter 2013-025 and the technical basis contained in WCAP-17780-P, and concluded that if a licensee demonstrates that its plant complies with the guidance in MRP Letter 2013-025, there is reasonable assurance that the Inspection and Evaluation (I&E) guidance of MRP-227-A will be applicable to the specific plant.

MRP Letter 2013-025 provides two plant-specific questions to be addressed by licensees to demonstrate compliance with MRP-227-A, as it relates to Action Item 1. In its application, the licensee did not provide the ANO-2 plant-specific information to answer Question 2 in MRP Letter 2013-025.

### Request

Provide the plant-specific response to Question 2 in MRP Letter 2013-025:

Question 2: [Has ANO-2 ever utilized] atypical fuel design or fuel management that could render the assumptions of MRP-227-A, regarding core loading/core design, non-representative for that plant [including power changes/uprates]?

If so, describe how the differences were reconciled with the assumptions of MRP-227-A or provide a plant-specific aging management program for affected components, as appropriate.

### **RAI-2** Action Item 2 – PWR Vessel Internal Components within the Scope of License Renewal

#### Background

Table 4-5, "Components and Materials for [Combustion Engineering] CE-Designed Plants," of MRP-191 (ADAMS Accession No. ML091910130), "Materials Reliability Program: Screening, Categorization, and Ranking of Reactor Internals Components for Westinghouse and Combustion Engineering PWR Design (MRP-191)," provides a generic list of RVI components and the materials of construction for CE-designed plants.

The materials listed below have been used in the fabrication of PWR RVI components. The materials listed below are susceptible to some of the aging degradation mechanisms that are identified in MRP-227-A.

- Nickel base alloys - Inconel 600 and weld metals - Alloy 82 and 182 and Alloy X-750;
- Stainless steel type 347 material (excluding baffle-former bolts);
- Precipitation hardened stainless steel materials - 17-4 and 15-5;
- Type 431 stainless steel materials.

Plant-specific material and design variations must be considered when applying MRP-191, Table 4-5 to plant-specific cases. Additionally, RVI components that are categorized as "Existing Programs" components need to be inspected for the applicable plant-specific aging effects.

#### Request

Identify any locations that these materials are used in the ANO-2 RVIs, including the American Society of Mechanical Engineers Boiler and Pressure Vessel (ASME) Code Section XI components. If these materials are used in the RVI components at ANO-2, provide the information regarding their proposed inspections and basis to demonstrate that the proposed inspections are consistent with the intent of MRP-227-A. Provide any relevant operating experience (OE) associated with the aging degradation mechanisms that are identified in MRP-227-A for these components.

#### **RAI-3** Condition 7 - Updating of MRP-227 Appendix A

#### Background

Topical Report Condition 7 of the NRC staff's SE on MRP-227-A states, in part: "... MRP-227, Appendix A shall be updated to include ... the Operating Experience Summary." Appendix A of MRP-227-A discusses OE under various degradation mechanisms for the RPV internal components of all nuclear steam supply system designs, including CE plants.

Section 2.3.10.1, "ANO-2 Operating Experience," and Section 3.7, "ANO-2 Unit Operating Experience," of the ANO-2 RVI AMP submittal discuss the OE relevant to the age-related degradation of the ANO-2 RVI. Section 2.3.10.1 states that extensive industry and ANO-2 OE has been reviewed during the development of the RVI AMP.

#### Request

Provide a summary of any ANO-2 plant-specific OE relevant to age-related degradation of RVI components, including the plant-specific OE contained in Appendix A of MRP-227-A. Describe the actions taken to address this OE.

#### **RAI-4** Action Item 3 - Evaluation of the Adequacy of Plant-Specific Existing Programs

#### Background

The MRP-227-A SE, Section 4.2.3, "Evaluation of the Adequacy of Plant-Specific Existing Programs" states, in part, that applicants/licensees of CE plants are required to justify the acceptability of an existing program, or to identify changes to manage the aging of CE thermal shield positioning pins and CE in-core instrumentation (ICI) thimble tubes for the period of extended operation.

Section 5.3 "SE Section 4.2.3, Applicant/Licensee Action Item 3 (Evaluation of the Adequacy of Plant-Specific Existing Programs)," of the ANO-2 RVI AMP submittal states that "ANO-2 complies with Applicant/Licensee Action 3 through management and replacement of in-core instrumentation thimble tubes as described in [ANO-2 Engineering Request, ER-ANO-2003-0399-003, Rev. 0, "NCP for ANO-2 ICI Thimble Tube Replacement," March 9,

2006].” Furthermore, Sections 2.3.10.1 and 3.7 indicate that in CE-designed plants, zirconium-base alloy thimbles exhibited growth due to irradiation and that this thimble growth was a major aging management issue, and the thimbles were subsequently replaced. The licensee stated that ANO-2 has monitored the growth of the Zircaloy section of the thimble tube due to the high level of neutron radiation exposure and replaced ICI thimble tubes.

It is not clear if the licensee continues to monitor the replacement thimble tubes that were installed and will continue to manage the effects of age-related degradation for the replacement in-core instrumentation thimble tubes during the period of extended operation.

### Request

Clarify whether the replacement in-core instrumentation thimble tubes will be managed during the period of extended operation.

- If yes, explain the details regarding the inspection method and the associated acceptance criteria, and the frequency of inspection. Further, justify that these actions are adequate to manage the applicable aging effects.
- If no, justify that inspections during the period of extended operation are not necessary to manage age-related degradation.

Confirm whether the material of the replacement ICI thimble tubes are consistent with the material assessed in MRP-191, Table 4-5. If not, justify that no additional aging effects require management during the period of extended operation, other than loss of material due to wear, for these replacement ICI thimble tubes.

### **RAI-5** Physical Measurements Acceptance Criteria

#### Background

MRP-227-A Section 4.2.5, “Application of Physical Measurements as Part of I&E Guidelines for B&W [Babcock & Wilcox], CE, and Westinghouse RVI Components,” states, in part, that applicants/licensees shall identify plant-specific acceptance criteria to be applied when performing the physical measurements for distortion in the gap between the top and bottom core shroud segments in CE units with core barrel shrouds assembled in two vertical sections. The applicant/licensee shall include its proposed acceptance criteria and an explanation of how the proposed acceptance criteria are consistent with the plant’s licensing basis and the need to maintain the functionality of the component being inspected under all licensing basis conditions of operation during the period of extended operation, as part of their submittal to apply the approved version of MRP-227.

Section 5.5, “SE Section 4.2.5, Applicant/Licensee Action Item 5 (Application of Physical Measurements as part of I&E Guidelines for B&W, CE, and Westinghouse RVI Components),” of the Attachment to the ANO-2 RVI AMP submittal states that ANO-2 has a core barrel shroud assembled in two vertical sections and that, prior to performing the VT-1 examination, ANO-2 will develop acceptance criteria that are consistent with the licensing basis to ensure that the core shroud remains capable of performing its required functions.

The licensee’s response did not identify the proposed acceptance criteria and an explanation of how the proposed acceptance criteria is consistent with its licensing basis, such that the

component maintains its functionality under all licensing basis conditions of operation during the period of extended operation.

Request

Provide the acceptance criteria for the VT-1 examination used for the physical measurement of the distortion in the gap between the top and bottom core shroud segments in CE unit, ANO-2, with core barrel shrouds assembled in two vertical sections. Justify that this acceptance criteria is consistent with the licensing basis to ensure that the core shroud remains capable of performing its required functions.

If the acceptance criteria is not yet developed, discuss the method for determining the acceptance criteria and justify this acceptance criteria will be consistent with the licensing basis to ensure that the core shroud remains capable of performing its required functions.

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DATED: MAY 9, 2017

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**ADAMS Accession No.: ML17123A297**

**via e-mail**

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