

NRR-PMDAPEm Resource

From: George, Andrea
Sent: Friday, December 12, 2014 2:15 PM
To: 'BICE, DAVID B (ANO)'
Cc: 'CLARK, ROBERT W'
Subject: Requests for Additional Information - Reactor Vessel Internals Aging Management Program Plan - ANO, Unit 1 - TAC No. MF4201
Attachments: MF4201 - Formal RAIs.pdf

Mr. Bice,

By letter dated May 20, 2014 (Agencywide Documents Access and Management System (ADAMS) Accession Package No. ML14141A553), Entergy Operations, Inc. (Entergy, the licensee), submitted the Reactor Vessel Internals (RVI) Aging Management Program (AMP) Plan for NRC review and approval. This plan was required to be submitted prior to entering the period of extended operation for ANO, Unit 1, as a result of a license renewal commitment. This plan identifies RVIs which must be included in AMP and identifies the augmented inspection plan for ANO, Unit 1, RVIs.

During its review, the NRC staff has identified further information needed in order to complete its evaluation. Draft RAIs were transmitted to your staff on December 2, 2014, and I was notified that a clarification call is not needed via email. During a phone call with Ms. Pyle, it was agreed that a response to these RAIs would be provided within 60 days, which is February 10, 2015.

Sincerely,

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REQUEST FOR ADDITIONAL INFORMATION

REACTOR PRESSURE VESSEL INTERNALS

AGING MANAGEMENT PROGRAM PLAN

ENTERGY OPERATIONS, INC.

ARKANSAS NUCLEAR ONE, UNIT 1

DOCKET NO. 50-313

By letter dated May 20, 2014, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14141A554), Entergy Operations, Inc. (Entergy, the licensee), submitted an aging management program (AMP) plan for the reactor pressure vessel (RPV) internal and core support structure components at Arkansas Nuclear One (ANO), Unit 1. This AMP plan (referred to as the ANO1 RPV internals AMP) is documented in Structural Integrity Associates, Inc. Report No. 1200459.401, "PWR Internals Aging Management Program Plan for Arkansas Nuclear One, Unit 1," Revision 1, May 2014, which is included as an attachment to the licensee's May 20, 2014 letter. The ANO1 RPV internals AMP was provided in fulfillment of its License Renewal Commitment to provide a report defining an inspection program for the ANO1 RPV internal components to the NRC by May 20, 2014, which is the beginning of the period of extended operation. The ANO1 RPV internals AMP was developed to implement the Electric Power Research Institute Materials Reliability Program (MRP) guidelines described in the MRP-227-A report, "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines," December 2011 (ADAMS Accession No. ML120170453).

The NRC staff has determined that additional information is required in order to complete the review of this program. The staff's request for additional information (RAI) follows:

EVIB-RAI-1: ANO1 RPV Internals Operating Experience

Topical Report Condition 7 of the NRC staff's SE, on MRP-227-A states: "MRP-227, Appendix A shall be updated to include...the Operating Experience Summary." Appendix A of MRP-227-A discussed operating experience under various degradation mechanisms for the RPV internal components of all nuclear steam supply system (NSSS) designs, including Babcock and Wilcox (B&W) plants.

- (a) Identify the MRP-227-A, Appendix A operating experience that was contributed to by ANO, Unit 1.
- (b) Provide any ANO1 plant-specific operating experience relevant to age-related degradation of RPV internal components that was not discussed in Appendix A of MRP-227-A.

Enclosure

EVIB-RAI-2: ANO1 RPV Internals Operating Experience

Section 2.3.10.1 of the ANO1 RPV internals AMP summarizes industry and plant-specific operating experience relevant to aging management of the RPV internals at ANO, Unit 1. Regarding plant-specific operating experience, the licensee states the following:

“Based on the discussions in BAW-2248A and the review of ANO1 operating data using the station information management system, condition reporting system, and licensee event database, cracking of the thermal shield bolting and core barrel bolting fabricated from Alloy A-286 was identified as an issue. These failures were attributed to intergranular stress corrosion cracking (IGSCC), and were not detected by visual examinations.”

- (a) Please discuss whether any other instances of age-related degradation have been identified for other RPV internals components at ANO, Unit 1.
- (b) For the IGSCC of the thermal shield bolting and core barrel bolting fabricated from Alloy-286, please provide the details regarding the inspections which discovered the indications or failures. Specifically, state the examination method, the number of bolts covered in the inspection, and the calendar year when the inspections occurred.
- (c) State the aging management program(s) under which these inspections were conducted (ASME Code, Section XI inservice inspection (ISI) Program, RPV Internals MRP-227-A initial primary components inspections, or other program), or whether the findings were just incidental to other outage/maintenance activities.
- (d) Please discuss any operability assessments that were performed for the cracked bolting, including the consideration of inspection results for the operability analysis, assumptions made for future bolt failures, or minimum bolting pattern analyses. Provide references for these operability reports.
- (e) Please document any component repair/replacement activities for the cracked Alloy A-286 bolting, noting in particular any changes in bolting material specification and/or heat treatment for the repaired configuration.
- (f) Please discuss any subsequent inspections that have been performed (after the discovery of cracking in the original Alloy A-286 thermal shield bolting and core barrel bolting) for the original and/or replacement core barrel and thermal shield bolting during the 40-year license term, including the examination method, frequency and coverage.
- (g) Discuss the subsequent inspection results for the thermal shield and core barrel bolting, noting whether additional degradation was found for these bolts during the 40-year license term. Please discuss whether this additional operating experience supports the MRP-227-A-specified examination method, frequency and coverage for these thermal shield bolting and core barrel bolting components.

EVIB-RAI-3: Aging Management of Susceptible Materials

Historically, the following materials used in the pressurized water reactor (PWR) RPV internal components were known to be susceptible to some of the aging degradation mechanisms that are identified in MRP-227-A. In this context, the NRC staff requests that the licensee confirm that these materials are not currently used in the RVI components at ANO, Unit 1.

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

If one or more of these materials were used in the RVI components at ANO, Unit 1, provide information regarding their proposed inspections and basis to demonstrate that the proposed inspections are consistent with the intent of MRP-227-A.

EVIB-RAI-4: Time-Limited Aging Analyses (TLAAs)

Identify all time-limited aging analyses TLAAs of the RPV internal components that were evaluated for the ANO, Unit 1, License Renewal pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 54.21(c)(1). This would include, for example, cumulative fatigue usage analyses of the internals based on transient cycle count inputs, environmental fatigue, and other plant-specific TLAAs, such as loss of fracture toughness due to neutron irradiation embrittlement. Please indicate whether the MRP-227-A-specified inspection provisions (examination method, frequency, and coverage) for these RPV internal components will coexist with the management of the TLAAs, or if the TLAAs for these components would result in any deviation from the MRP-227-A inspection guidelines. Provide justification if deviation from MRP-227-A is identified for any of the RPV components.

EVIB-RAI-5: MRP-227-A SE Action Item 2

In the response to Applicant/Licensee Action Item 2 from the NRC staff's SE for MRP-227-A, Section 5.2 of the ANO1 RPV internals AMP states that the ANO, Unit 1, RPV internals have three additional components that were not listed in BAW-2248A, "Demonstration of the Management of Aging Effects for the Reactor Vessel Internals," March 2000 (ADAMS Accession No. ML003708443), but were included in the ANO, Unit 1 ASME Code, Section XI ISI Program. These components, which are categorized as "ANO1 Orphan Components" in AMP Table 5-6, "ANO1 Program Enhancement and Implementation Schedule," are:

- RPV level monitoring system (RVLMS) probe supports
- Remaining portions of the surveillance specimen holder tubes (SSHT)
- Thermal shield and thermal shield upper restraint.

Confirm whether these are the only RPV internal components that are applicable to your response to Applicant/Licensee Action Item 2 of the SE for MRP-227-A, specifically in regard to whether Tables 4-1 and 4-2 in MRP-189, Rev. 1 have missed any RPV internal components that should be within the scope of LR in accordance with 10 CFR 54.4.

EVIB-RAI-6: ANO1 RPV Internal Orphan Components

Section 5.2 of the ANO1 RPV internals AMP states that the above orphan components will undergo a future screening and characterization, and based on the screening results, they will be removed from future inspections if they screen out, or added to the primary or expansion categories if they screen in. Further, it is stated that, until that time when the above components are screened and characterized, these components will be inspected during the 10-year ISI intervals based on their aging effects.

- (a) Please identify the calendar year when these orphan components will be screened and characterized.
- (b) Please provide additional details regarding the screening and characterization process for the above orphan components, including whether this process will be consistent with that performed for MRP-189, Rev. 1.

Section 5.2 of the ANO1 RPV internals AMP lists the aging effects for the orphan components and states that, based on a review of these aging affects, the orphan components will be visually inspected (VT-3) during the 10-year ISI inspections.

- (c) Please state whether previous VT-3 or other inspections have been performed for these components, and discuss the results of these inspections if any. Based on the aging effects for the components described in Section 5.2, please justify the adequacy of performing VT-3 visual examinations on a 10-year ISI interval.
- (d) Please state whether the VT-3 examinations are intended as an interim measure for aging management until the screening and characterization is complete.
- (e) Since these components are currently designated to receive a VT-3 examination every 10-year ISI interval and were included in the ANO, Unit 1 ASME Code, Section XI ISI Program, please explain why they are not currently included in Table 5-3, "B&W Plants Existing Program Components from AREVA Guidance," of the RPV internals AMP.

EVIB-RAI-7: ANO1 RPV Internal Orphan Components

Table 5-2, "B&W Plants Expansion Category Components from Table 4-4 of MRP-227-A," of the ANO1 RPV internals AMP currently lists the surveillance specimen holder tube (SSHT) studs/nuts or bolts and their locking devices, under Core Barrel Assembly, as "not applicable to ANO1." Bolt or stud/nut cracking is listed as the aging effect for the SSHTs in this table and in Table 4-4 of MRP-227-A. However, Section 5.2 of the AMP states that for the remaining portions of the SSHTs, cracking and stress relaxation were identified as aging effects for the SSHT bolting. Please discuss whether this discrepancy should be resolved through a modification to Table 5-2.

EVIB-RAI-8: B&W Existing Program Components

Section 5.2 (last paragraph) of the ANO1 RPV internals AMP states that:

"In addition to these components [the orphan components], AREVA has also advised B&W utilities that the vent valve locking devices for the original and modified designs be included as an existing program under MRP-227-A based on recent OE from ONS-1. Based on this recommendation, Table 5-1 [B&W

Plants Primary Components from Table 4-1 of MRP-227-A] was modified and Table 5-3 was added to the list of the existing programs under the current [ASME Code] Section XI [ISI] program.”

Please identify the modification to Table 5-1 of the AMP which addresses the vent valve locking devices, or confirm whether this modification refers to the revision and relocation of “Note 1” from Table 5-1 to Table 5-3 of the AMP.

EVIB-RAI-9: B&W Existing Program Components

Table 5-3 of the ANO1 RPV internals AMP provided the B&W existing program inspection criteria for the core support shield vent valve miscellaneous locking devices for the original and modified design – VT-3 visual examination of the locking devices on the 10-year ISI interval per the requirements of the ASME Code, Section XI. Please state whether these VT-3 examinations were performed as part of the ASME Code, Section XI, 10-year interval inservice inspections during the original 40-year licensed operating term. Please identify and discuss any relevant indications for the ASME Code, Section VT-3 examinations of these items.

EVIB-RAI-10: Technical Specifications (TS) Requirements for Core Support Shield Vent Valve Components

Table 5-3 of the ANO1 RPV internals AMP, “Note 1” describes additional vent valve testing and examinations for leakage and degradation in the valve components, which are to be performed in accordance with the plant’s TS or the inservice testing programs. Please identify the applicable TS requirements and/or inservice testing program requirements for the additional testing and examination of the vent valve components.

EVIB-RAI-11: Completion of Initial Primary Component Inspection for the Core Support Shield Upper Core Barrel Bolts

For the core support shield assembly, upper core barrel bolts and their locking devices, Table 4-1 of MRP-227-A and Table 5-1 of the ANO1 AMP specify that the initial volumetric examination (UT) of the bolts must be performed within two refueling outages from January 1, 2006 or the next 10-year ISI interval, whichever is first. Table 5-1 of the ANO1 AMP states that UT examination of the upper core barrel bolts is to be performed during Refueling Outage 26 (1R26).

- a) Please clarify whether the UT examination of the upper core barrel bolts scheduled for 1R26 is an initial examination or a subsequent examination.
- b) If the initial UT examination of the upper core barrel bolts has already been performed, then please discuss the examination results for these items.
- c) If the initial UT examination of the upper core barrel bolts has not yet been performed, then please justify the performance of this initial examination in 1R26 (which would occur several years after the start of period of extended operation on May 20, 2014) given that MRP-227-A calls for performance of this examination within two refueling outages from January 1, 2006 or the next 10-year ISI interval, whichever is first.

EVIB-RAI-12: Other Initial Primary Component Inspections Performed During the 40-year Licensed Operating Period

Table 4-1 of MRP-227-A and Table 5-1 of the ANO1 RPV internals AMP list the following initial inspection requirements for the B&W primary components, which may require completion prior to entering the period of extended operation:

- Core Barrel Assembly, Lower core barrel bolts and their locking devices – Volumetric (UT) of the bolts during the next 10-year ISI from 1/1/2006.
 - Flow Distributor Assembly, Flow distributor bolts and their locking devices – Volumetric examination (UT) of the bolts during the next 10-year ISI from 1/1/2006.
- a) Please state whether these initial RPV internal component examinations have been completed prior to the end of the current 40-year license per the requirements for primary components in Table 4-1 of MRP-227-A. Briefly discuss the results of these initial examinations if applicable.
- b) If these examinations have not yet been completed please explain how performance of these initial examinations during 1R26 satisfies the examination criteria for B&W primary components in Table 4-1 of MRP-227-A.

EVIB-RAI-13: MRP-227-A SE Action Item 5

Applicant/Licensee Action Item 5 of the NRC staff SE for MRP-227-A requires the licensee to include, as part of their AMP submittal, an explanation of how the proposed acceptance criteria for the physical measurements are consistent with the plants' licensing basis and the need to maintain the functionality of the component under all licensing basis conditions of operation during the period of extended operation.

In the response to Applicant/Licensee Action Item 5, Section 5.5 of the ANO1 RPV internals AMP states that the acceptance criteria for this one time physical measurement shall be an average measured differential height from the top of the plenum rib pads to the RPV seating surface of 0.004 inches relative to the as-built condition in accordance with Table 5-4 of the AMP.

Please elaborate on how the acceptance criterion of 0.004 inches for the average measured differential height from the top of the plenum rib pads to the RPV seating surface, relative to the as-built condition, is consistent with the ANO, Unit 1, licensing basis and the need to maintain the functionality of the component under all licensing basis conditions of operation during the period of extended operation.

EVIB-RAI-14: MRP-227-A SE Action Item 6

Applicant/Licensee Action Item 6 of the NRC staff SE for MRP-227-A requires the licensee to justify the acceptability of each of the inaccessible B&W expansion components for continued operation by performing an evaluation, or propose a schedule for replacement of the components. The inaccessible B&W components are:

- the core barrel cylinder and welds,
- the former plates, and
- the bolting (core barrel-to-former bolts, internal and external baffle-to-baffle bolts, and associated locking devices),

For the above inaccessible components, the licensee provided a regulatory commitment to submit an evaluation, schedule for replacement, or justification for some other alternative process to the NRC by the end of one year from the initial inspection of the linked primary component items, if these inspections indicate aging that meets the expansion criteria for the linked primary components.

As stated in Section 4.2.6 of the MRP-227-A NRC staff SE, the justification for the continued operability of the above inaccessible components for the period of extended operation and, if necessary, schedule for replacement of these components must be provided for NRC review and approval as part of the licensee's application to implement MRP-227-A.

- a) Therefore, in order to complete its evaluation of the ANO1 RPV internals AMP, the NRC staff requests that the licensee provide the information required by Action Item 6 of the MRP-227-A NRC staff SE. Specifically, the staff requests that the licensee justify the acceptability of the inaccessible components for continued operation through the period of extended operation by performing an evaluation and, if necessary, provide a schedule for replacement of the components for staff review and approval.
- b) If the licensee cannot justify the acceptability of the inaccessible components for continued operation through the period of extended operation by performing an evaluation and, if necessary, providing a schedule for replacement of the components, for staff review and approval as part its current application, the staff requests that the licensee propose an alternative process for ensuring the operability of the inaccessible components during the period of extended operation.

EVIB-RAI-15: MRP-227-A SE Action Item 7

Applicant/Licensee Action Item 7 of the NRC staff SE for MRP-227-A requires the licensee to develop plant-specific analyses to be applied for their facilities to demonstrate that RPV internals components that may be fabricated from cast austenitic stainless steel (CASS), martensitic stainless steel or precipitation hardened stainless steel, will maintain their functionality during the period of extended operation, considering possible loss of fracture toughness in these components due to thermal and irradiation embrittlement and limitations on accessibility for inspection and the resolution/sensitivity of the inspection techniques. The action item states that the licensee shall include the plant-specific analysis as part of their submittal to apply MRP-227-A.

In the response to Applicant/Licensee Action Item 7, Section 5.7 of the ANO1 RPV internals AMP provides information indicating that future analytical evaluations will be performed for assessing the effects of reduction in fracture toughness, due to thermal and irradiation embrittlement, on the CASS and precipitation hardened stainless steel RPV internals components at ANO, Unit 1. The ANO, Unit 1, CASS and precipitation hardened stainless steel components requiring these analytical evaluations for demonstrating functionality during the

period of extended operation are:

- CASS Components:
 - Control Rod Guide Tube Assembly Spacer Castings
 - Core Support Shield Assembly Vent Valve Bodies
 - Incore Monitoring Instrumentation Guide Tube Assembly Spider Castings
- Precipitation Hardened Stainless Steel Components:
 - Core Support Shield Assembly Vent Valve Retaining Rings.

The licensee provided regulatory commitments to complete the analytical evaluations of these components 12 months prior to the second refueling outage after entering the period of extended operation.

As stated in Section 4.2.7 of the MRP-227-A NRC Staff SE, the plant-specific analysis of these components required by this action item shall be included as part of licensees' submittals to implement MRP-227-A.

- a) Therefore, in order to complete its evaluation of the ANO1 RPV internals AMP, the NRC staff requests that the licensee provide the information required by Action Item 7 of the MRP-227-A NRC staff SE. Specifically, the staff requests that the licensee provide plant-specific analyses to demonstrate that the above CASS and precipitation hardened stainless steel RPV internal components will maintain their functionality during the period of extended operation, considering possible loss of fracture toughness in these components due to thermal and irradiation embrittlement and limitations on accessibility for inspection and the resolution/sensitivity of the inspection techniques.
- b) If the licensee cannot provide the plant-specific analysis of the CASS and precipitation hardened stainless steel RPV internal components required by Action Item 7 for staff review and approval as part its current application, the staff requests that the licensee propose an alternative process for ensuring that the functionality of these components will be maintained during the period of extended operation, considering possible loss of fracture toughness in these components due to thermal and irradiation embrittlement and limitations on accessibility for inspection and the resolution/sensitivity of the inspection techniques.

EVIB-RAI-16: Refueling Outages and Calendar Years for AMP Implementation Schedule

In order for the NRC staff to verify the adequacy of the program implementation schedule provided in Table 5-6 of the ANO1 RPV internals AMP, please confirm that the length of the ANO, Unit 1, refueling cycle corresponds to 18 months. In addition please specify the projected calendar years corresponding to ANO, Unit 1, refueling outages 1R26 and 1R33.