

## NRR-PMDAPEm Resource

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**From:** Lingam, Siva  
**Sent:** Wednesday, January 08, 2014 10:50 AM  
**To:** richard.hightower@pgnmail.com  
**Cc:** Quichocho, Jessie; Rosenberg, Stacey; Cheruvenki, Ganesh; Poehler, Jeffrey; Jenkins, Joel; Purtscher, Patrick  
**Subject:** RE: Robinson, Unit 2 PWR Vessel Internal Program Plan for Aging Management - Request for Additional Information (RAIs) (TAC No. ME9633)

In a letter dated March 27, 2013, the NRC staff issued a first set of request for additional information (RAI) as a part of its review of the aging management program (AMP) for the reactor vessel internals (RVI) at H.B. Robinson [Robinson Nuclear Plant (RNP)]. The NRC staff reviewed the licensee's responses to the RAIs and determined that further information on RAI-5(b) and RAI-3 (addressed below) is necessary to complete the safety evaluation.

(1) RAI-5(b)—Licensee's response dated May 23, 2013

In RAI-5(b), the NRC staff requested the licensee provide information on Action Item 7 which is related to the aging degradation in cast austenitic stainless steel (CASS) lower support columns. The relevant aging degradation mechanisms in these columns are: irradiation embrittlement (IE) and thermal embrittlement (TE). RAI-5(b) addressed the susceptibility of the lower support columns to TE, which is affected by the presence delta ferrite in CASS materials. Delta ferrite content greater than 20 percent will increase susceptibility to TE in CASS lower support columns. In its response to the RAI-5(b), in a letter dated May 23, 2013, provided the following response.

The lower support columns were evaluated for their susceptibility to TE by calculating the delta ferrite content. The licensee used certified material test report (CMTR) and the material fabrication specifications containing chemical composition of the CASS materials.

The NRC staff reviewed this response and determined to issue the following RAI.

### **New RAI--**

#### **RAI-5(b)-1 (Action Item 7 of the NRC staff's SE for MRP-227-A):**

**For the CASS lower support columns at RNP Unit 2, provide the ferrite content for each lower support column using CMTRs. Provide the casting method for the column (static or centrifugal), if known. Please provide your response within 30 days from the date of this e-mail.**

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**From:** Lingam, Siva  
**Sent:** Monday, September 23, 2013 10:50 AM  
**To:** Connelly, Scott (Scott.Connelly@duke-energy.com)  
**Cc:** Broadus, Doug; Rosenberg, Stacey; Cheruvenki, Ganesh; Poehler, Jeffrey; Jenkins, Joel; richard.hightower@pgnmail.com; Purtscher, Patrick  
**Subject:** RE: Robinson, Unit 2 PWR Vessel Internal Program Plan for Aging Management - Revised Requests for Additional Information (RAIs) (TAC No. ME9633)

As a result of NRC staff's audit on September 12, 2013 at Rockville Westinghouse office, and the subsequent conference call held on September 18, 2013, among the NRC staff, the licensee and Westinghouse, please note the following revised official RAIs:

#### **RAI-3-1 (Action Item 1 of the NRC staff's SE for MRP-227-A):**

The NRC staff and EPRI met on November 28, 2012 (ADAMS Accession No. ML13014A672), January 22-23, 2013 (ADAMS Accession No. ML13042A048), and February 25, 2013 (ADAMS Accession No. ML13067A262) to facilitate development of a generic approach for resolution of Applicant/Licensee Action Item 1. As discussed in References 1 and 2, the NRC staff requests the licensee to provide the following information related to verification of the applicability of MRP-227-A to RNP. This is the initial RAI for Action Item 1.

1. Do the RNP RVI have non-weld or bolting austenitic stainless steel components with 20% cold work or greater, and if so do the affected components have operating stresses greater than 30 ksi? If so, perform a plant-specific evaluation to determine the aging management requirements for the affected components.
2. Have RNP ever utilized a typical fuel design or fuel management that could make 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-3-2-A:** On September 12, 2013 the NRC staff performed an audit of proprietary documents supporting the licensee's functionality analysis of the lower support columns for MRP-227-A Action Item 7. These documents included WCAP-17254-P, Rev. 1 "Background and Technical Basis Supporting Engineering Flaw Acceptance Criteria for H.B. Robinson Unit 2 Reactor Vessel Internals MRP-227 Primary and Expansion Components," which was cited in the licensee's response to RAI 5(a), and additional reports and a calculation. The NRC staff determined the documents audited do not demonstrate functionality of the lower core support columns for RNP. The NRC staff understands that acceptance criteria in WCAP-17254-P for the lower support columns are based on prevention of fuel assembly damage, which may result in a smaller allowable number of failed columns than the number of columns that could fail without preventing safe shutdown of the reactor. Hence, the NRC staff does not require the licensee to submit WCAP-17254-P on the docket as a part of its response to RAI 3-2 dated August 26, 2013. However, the NRC staff requests that the licensee should provide information that addresses the following essential issues related to the functionality of the cast austenitic stainless steel (CASS) lower support columns:

- (a) Provide the number of lower support columns that could fail and still permit the intended function of the lower core support structure to be fulfilled.
- (b) The analysis must provide reasonable assurance that the allowable number of failed columns from (a) bounds the number of columns that are predicted to experience degradation that would render the column nonfunctional, in the absence of inspection data for the columns.
- (c) Explain how the functionality analysis considered aging degradation mechanisms identified as applicable the columns in MRP-227-A, or justify why these mechanisms are not relevant to the analysis, specifically:
  - a. Loss of fracture toughness due to irradiation embrittlement and thermal embrittlement;
  - b. Cracking due to irradiation-assisted stress corrosion cracking

**RAI-3-3:** In its response to the NRC staff's RAI-3, dated March 27, 2013, the licensee by a letter dated May 23, 2013, stated that Alloy X-750 material that is used for clevis insert bolts did not receive high temperature heat treatment (HTH) and, therefore, this material might be susceptible to primary water stress corrosion cracking (PWSCC). Appendix A to MRP-227-A indicates that failures of Alloy X-750 clevis insert bolts were reported by one Westinghouse-designed plant in 2010. Appendix A to MRP-227-A also stated that the most likely cause for failure was primary water stress corrosion cracking (PWSCC). The only aging mechanism requiring management by MRP-227-A for the clevis insert bolts is wear. The clevis insert bolts are categorized as an "Existing Programs" component under MRP-227-A, with the ASME Code, Section XI Inservice Inspection Program credited for managing aging due to wear only. The ASME Code, Section XI specifies a VT-3 visual inspection for the clevis insert bolts, which may not be adequate to detect cracking before it results in bolt failure. Therefore, the licensee is requested to discuss if it will modify the MRP-227-A inspection requirement for clevis insert bolts to require an inspection that will detect cracking. If the inspection requirement is not modified, provide a technical justification for the adequacy of the existing VT-3 visual inspection requirement to detect cracking before it results in clevis insert bolt failure.

References:

1. Meeting Summary EPRI-Westinghouse January 22-23, 2013, February 21, 2013 (ADAMS Accession No. ML13042A048)
2. 2/25/2013 Summary of Telecom with EPRI and Westinghouse Electric Company, March 15, 2013 (ADAMS Accession No. ML13067A262)

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**From:** Lingam, Siva

**Sent:** Thursday, September 05, 2013 2:16 PM

**To:** [richard.hightower@pgnmail.com](mailto:richard.hightower@pgnmail.com)

**Cc:** Broadbudd, Doug; Rosenberg, Stacey; Cheruvenki, Ganesh; Alexander, Donna ([Donna.Alexander@duke-energy.com](mailto:Donna.Alexander@duke-energy.com)); Poehler, Jeffrey; Jenkins, Joel

**Subject:** Robinson, Unit 2 PWR Vessel Internal Program Plan for Aging Management - Requests for Additional Information (RAIs) (TAC No. ME9633) - Correction to RAI-3-3

As a result of the conference call yesterday, please note the correction in red for RAI-3-3.

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**From:** Lingam, Siva

**Sent:** Tuesday, August 27, 2013 10:36 AM

**To:** [richard.hightower@pgnmail.com](mailto:richard.hightower@pgnmail.com)

**Cc:** Broadbudd, Doug; Rosenberg, Stacey; Cheruvenki, Ganesh; Alexander, Donna ([Donna.Alexander@duke-energy.com](mailto:Donna.Alexander@duke-energy.com))

**Subject:** Robinson, Unit 2 PWR Vessel Internal Program Plan for Aging Management - Requests for Additional Information (RAIs) (TAC No. ME9633)

Please note the following official RAIs for the subject matter. Please provide your responses as early as possible.

REQUEST FOR ADDITIONAL INFORMATION  
ON AGING MANAGEMENT PROGRAM FOR THE  
REACTOR VESSEL INTERNALS AT  
H. R. ROBINSON STEAM ELECTRIC PLANT, UNIT 2  
PROGRESS ENERGY INC.  
DOCKET NUMBER 50-261

By letter dated September 26, 2012 (Agencywide Documents Access and Management (ADAMS) Accession No. ML12278A398), as supplemented by letters dated May 23, 2013 (ADAMS Accession No. ML13156A144) and July 25, 2013 (ADAMS Accession No. ML13219A252), Carolina Power and light Company (currently known as Duke Energy Progress, inc.) (the licensee), submitted an aging management program (AMP) for the reactor vessel internals (RVI) at H.B. Robinson Steam Electric Plant, also known as Robinson Nuclear plant (RNP). The Materials Reliability Program (MRP)-227-A report, "Pressurized Water Reactor Internals Inspection and Evaluation Guidelines," (ADAMS Accession No. ML120170453) and its supporting reports were used as technical bases for developing Robinson's AMP. The Nuclear Regulatory Commission (NRC) staff reviewed this report and issued a final safety evaluation (SE) on December 16, 2011 (ADAMS Accession No. ML11334A009). The NRC staff has developed a third set of RAIs as addressed below, and it includes issues related to Action Item 1 of the staff's SE for the MRP-227-A.

**RAI-3-1 (Action Item 1 of the NRC staff's SE for MRP-227-A):**

The NRC staff and EPRI met on November 28, 2012 (ADAMS Accession No. ML13014A672), January 22-23, 2013 (ADAMS Accession No. ML13042A048), and February 25, 2013 (ADAMS Accession No. ML13067A262) to facilitate development of a generic approach for resolution of Applicant/Licensee Action Item 1. As discussed in References 1 and 2, the NRC staff requests the licensee to provide the following information related to verification of the applicability of MRP-227-A to RNP. This is the initial RAI for Action Item 1.

1. Do the RNP RVI have non-weld or bolting austenitic stainless steel components with 20% cold work or greater, and if so do the affected components have operating stresses greater than 30 ksi? If so,

perform a plant-specific evaluation to determine the aging management requirements for the affected components.

2. Have RNP ever utilized atypical fuel design or fuel management that could make 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-3-2:** In response to staff's RAI-5 (a) dated March 27, 2013 (ADAMS Accession No. ML13079A293), the licensee, by a letter dated May 23, 2013, provided a response which addresses the issue related to neutron embrittlement and irradiation induced stress corrosion cracking in cast austenitic stainless steel (CASS) lower support column bodies at RNP. The licensee stated that plant-specific acceptance criteria, "WCAP-17254-P," were developed by Westinghouse and the acceptance criteria will demonstrate functionality of the CASS lower support column bodies at RNP. MRP-227-A, Section 4.2.7, requires the plant-specific analysis for Licensee Action Item 7 demonstrating that the lower support column bodies will maintain their functionality during the period of extended operation (PEO) to be submitted along with a licensee's submittal to apply the approved version of MRP-227. This analysis was not provided with the licensee's submittal of the RVI Inspection Plan for RNP. Therefore, the NRC staff requests that the licensee submit WCAP-17254-P as part of the RVI AMP, for review and approval. Without an approved analysis, the NRC staff would not have reasonable assurance of the functionality of the lower support columns for the PEO. Therefore, the NRC staff requests the licensee to inspect the lower support column bodies during the initial inspections if WCAP-17254-P showed that these lower support column bodies (expansion components) could not maintain their intended function during PEO, or if the staff could not review and approve the analysis prior to the initial inspections of the relevant primary components.

**RAI-3-3:** In its response to the NRC staff's RAI-3, dated March 27, 2013, the licensee by a letter dated May 23, 2013, stated that Alloy X-750 material that is used for clevis insert bolts did not receive high temperature heat treatment (HTH) and, therefore, this material might be susceptible to primary water stress corrosion cracking (PWSCC). Appendix A to MRP-227-A indicates that failures of Alloy X-750 clevis insert bolts were reported by one Westinghouse-designed plant in 2010. **Appendix A to MRP-227-A also stated that the most likely cause for failure was PWSCC.** ~~A recent metallurgical analysis of bolts removed from this plant confirmed that the bolts cracked due to PWSCC.~~ The only aging mechanism requiring management by MRP-227-A for the clevis insert bolts is wear. The clevis insert bolts are categorized as an "Existing Programs" component under MRP-227-A, with the ASME Code, Section XI Inservice Inspection Program credited for managing aging due to wear only. The ASME Code, Section XI specifies a VT-3 visual inspection for the clevis insert bolts which may not be adequate to detect cracking before it results in bolt failure. Therefore, the licensee is requested to discuss if it will modify the MRP-227-A inspection requirement for clevis insert bolts to require an inspection that will detect cracking. If the inspection requirement is not modified, provide a technical justification for the adequacy of the existing VT-3 visual inspection requirement to detect cracking before it results in clevis insert bolt failure.

#### References:

1. Meeting Summary EPRI-Westinghouse January 22-23, 2013, February 21, 2013 (ADAMS Accession No. ML13042A048).
2. 2/25/2013 Summary of Telecon with EPRI and Westinghouse Electric Company, March 15, 2013 (ADAMS Accession No. ML13067A262).

Siva P. Lingam  
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**Subject:** RE: Robinson, Unit 2 PWR Vessel Internal Program Plan for Aging Management  
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**Sent Date:** 1/8/2014 10:49:56 AM  
**Received Date:** 1/8/2014 10:49:00 AM  
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<b>Sensitivity:</b>	Normal
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