



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

July 7, 2016

Mr. Peter P. Sena, III  
President  
PSEG Nuclear LLC – N09  
P.O. Box 236  
Hancocks Bridge, NJ 08038

SUBJECT: SALEM NUCLEAR GENERATING STATION, UNIT NOS. 1 AND 2 – REQUEST FOR ADDITIONAL INFORMATION RE: AGING MANAGEMENT PROGRAM PLAN FOR REACTOR VESSEL INTERNALS (CAC NOS. MF5149 AND MF5150)

Dear Mr. Sena:

By letter dated August 11, 2014,<sup>1</sup> PSEG Nuclear, LLC (the licensee) submitted to the U.S. Nuclear Regulatory Commission (NRC) two reports that document the Salem Nuclear Generating Station (Salem), Unit Nos. 1 and 2, reactor vessel internals (RVI) aging management program (AMP). Topical Report MRP-227-A, "Pressurized Water Reactor Internals Inspection and Evaluation Guidelines," December 2011,<sup>2</sup> and its supporting reports, were used as the technical bases for developing the Salem, Unit Nos. 1 and 2, AMPs. By letter dated March 31, 2015,<sup>3</sup> the NRC staff issued a request for additional information (RAI) regarding the AMPs. By letters dated May 28, 2015, and March 23, 2016,<sup>4</sup> the licensee provided responses to the staff's RAI.

The NRC staff has determined that additional information is needed to complete its review of the submittal. The specific questions are found in the enclosed RAI. The draft questions were sent via electronic transmission on June 8, 2016, to Mr. Paul Duke of your staff. The draft questions were sent to ensure they were understandable, the regulatory basis was clear, and to determine if the information was previously docketed. On July 7, 2016, Mr. Duke indicated that the licensee will submit a response within 90 days of the date of this letter.

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<sup>1</sup> Agencywide Documents Access and Management System (ADAMS) Accession No. ML14224A667

<sup>2</sup> ADAMS Package Accession No. ML120170453

<sup>3</sup> ADAMS Accession No. ML15069A181


<sup>4</sup> ADAMS Accession Nos. ML15148A426 and ML16083A194, respectively

P. Sena

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If you have any questions, please contact me at 301-415-1603 or by e-mail at [Carleen.Parker@nrc.gov](mailto:Carleen.Parker@nrc.gov).

Sincerely,

A handwritten signature in black ink, appearing to read "Carleen J. Parker". The signature is written in a cursive style with a long horizontal line extending to the right.

Carleen J. Parker, Project Manager  
Plant Licensing Branch I-2  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. 50-272 and 50-311

Enclosure:  
Request for Additional Information

cc w/enclosure: Distribution via Listserv

REQUEST FOR ADDITIONAL INFORMATION

AGING MANAGEMENT PROGRAM PLAN FOR REACTOR VESSEL INTERNALS

PSEG NUCLEAR LLC

EXELON GENERATION COMPANY, LLC

SALEM NUCLEAR GENERATING STATION, UNITS 1 AND 2

DOCKET NOS. 50-272 AND 50-311

By letter dated August 11, 2014,<sup>1</sup> PSEG Nuclear, LLC (the licensee) submitted to the U.S. Nuclear Regulatory Commission (NRC) two reports that document the Salem Nuclear Generating Station (Salem), Unit Nos. 1 and 2, reactor vessel internals (RVI) aging management program (AMP). Topical Report MRP-227-A, "Pressurized Water Reactor Internals Inspection and Evaluation Guidelines," December 2011,<sup>2</sup> and its supporting reports, were used as the technical bases for developing the Salem, Unit Nos. 1 and 2, AMPs. By letter dated March 31, 2015,<sup>3</sup> the NRC staff issued a request for additional information (RAI) regarding the AMPs. By letters dated May 28, 2015, and March 23, 2016,<sup>4</sup> the licensee provided responses to the staff's RAI.

The NRC has staff determined that additional information, as described below, is required to complete its review of the Salem, Unit Nos. 1 and 2, AMPs. Note that the RAI numbering scheme is continued from the March 31, 2015, RAI.

**RAI-8**

By letter dated May 28, 2015, the licensee indicated in its response to **RAI-7(b)** that the industry is investigating an alternate primary link for the lower support column bodies (LSCs). The current primary link for the LSCs is the control rod guide tube (CRGT) lower flanges. Because the CRGT lower flanges receive a lower neutron fluence than the LSCs, the CRGT lower flanges, as a primary link for the LSCs, is not a good indicator of the amount of irradiation assisted stress corrosion cracking and irradiation embrittlement (IE). Since only irradiation assisted stress corrosion cracking and IE are addressed, pursuing an alternate primary link is not an adequate resolution to demonstrating functionality of the LSCs through the period of extended operation (PEO) if the LSCs are made of cast austenitic stainless steel (CASS). In Section 6.2.7, "SE Applicant/Licensee Action Item 7: Plant-Specific Evaluation of CASS Materials," of Attachment 1 of its submittal, the licensee assumed that 73 of the Salem, Unit No. 1, CASS LSCs are susceptible to thermal embrittlement (TE) because the certified material test reports for those LSCs could not be located. Because the LSCs are assumed to be susceptible to TE, the functionality of the LSCs that addresses TE (and irradiation embrittlement) through the PEO must be demonstrated.

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<sup>1</sup> Agencywide Documents Access and Management System (ADAMS) Accession No. ML14224A667

<sup>2</sup> ADAMS Package Accession No. ML120170453

<sup>3</sup> ADAMS Accession No. ML15069A181

<sup>4</sup> ADAMS Accession Nos. ML15148A426 and ML16083A194, respectively

The NRC staff determined in a summary assessment<sup>5</sup> that the flaw tolerance analysis contained in report PWROG-14048-P, Revision 0, "Functionality Analysis: Lower Support Columns," utilized conservative assumptions to demonstrate that the likelihood of failure of LSCs is low during the PEO. Accordingly, it is reasonable to infer that the functionality of the LSCs will be maintained during the PEO if the likelihood of failure of the LSCs is shown to be low.

Therefore, the NRC staff requests the licensee to demonstrate how the flaw tolerance analysis in PWROG-14048-P is applicable to the 73 Salem, Unit No. 1, CASS LSCs that are assumed to be susceptible to TE using plant-specific parameters (such as LSC geometry and number of LSCs) and conditions (such as loading conditions and LSC stresses). If the licensee determines that PWROG-14048-P is not applicable to the 73 Salem, Unit No. 1, CASS LSCs, or chooses not to apply it, please identify the approach used to demonstrate that the functionality of the LSCs will be maintained during the PEO.

### **RAI-9**

Table 6-2 of Attachments 1 and 2 in the licensee's submittal lists RVI components that are made of (or potentially made of) CASS. The licensee stated in its submittal that the following RVI components are potentially made of CASS, and therefore, are conservatively assumed as CASS.

1. 17 x 17 Guide Tube Lower Guide Plates/Cards
2. Upper Instrumentation Conduit and Supports – Gussets, Clamps, Supports, and Thermocouple Stop
3. Upper Support Column – Mixing Bases

Items 1 and 2 above are addressed in the licensee's evaluation of Applicant/Licensee Action Items 1 and 2 of MRP-227-A in the licensee's submittal (please note that there is an additional staff concern regarding the "17 x 17 Guide Tube Lower Guide Plates/Cards," as discussed in **RAI-10** below). However, the licensee has not addressed the "Upper Support Column – Mixing Bases" (Item 3). Furthermore, the NRC staff noted that "Upper Support Column – Mixing Bases" is not an RVI component listed in MRP-191 (Reference 1), which is the basis for the MRP-227-A component categorization methodology. The staff is aware, however, that Table 7-2, "Categorization of Westinghouse Reactor Internals Components," of MRP-191 lists a component called "Column bases" in the upper support column assembly.

Please state whether the Salem, Unit Nos. 1 and 2, "Upper Support Column – Mixing Bases" are equivalent to "Column bases" in Table 7-2 of MRP-191. If they are equivalent, no further response is required. If not, the staff requests the licensee to address the CASS "Upper Support Column – Mixing Bases" by indicating the MRP-227-A component category it belongs to ("Primary," "Expansion," "Existing," or "No Additional Measures") and the basis for this determination. If the resulting category is "Primary," "Expansion," or "Existing," please indicate the Examination Method, Examination Cover, and appropriate link consistent with Tables C-1, C-2, or C-3 of Attachments 1 and 2 in the licensee's submittal.

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<sup>5</sup> ADAMS Accession No. ML15334A462

## RAI-10

In Section 6.2.7 of Attachments 1 and 2 of the licensee's submittal, the licensee determined that the Salem, Unit Nos. 1 and 2, CRGT guide cards could potentially be made of CASS material, and therefore, the CRGT guide cards were conservatively assumed as CASS. Furthermore, the ferrite content was assumed to be above the threshold for TE screening established in the Grimes letter (Reference 2). Although the MRP-227-A component categorization places the CRGT guide cards in the "Primary" inspection category, MRP-227-A presumes that the CRGT guide cards are made of wrought stainless steel material, consistent with MRP-191, and are, therefore, inspected only for wear in the MRP-227-A inspection program for "Primary" components. Since the Salem, Unit Nos. 1 and 2, CRGT guide cards were assumed as CASS, and therefore, potentially susceptible to TE, they could be susceptible to non-ductile cracking due to lower fracture toughness resulting from TE.

The NRC staff requests the licensee to evaluate the susceptibility of the Salem, Unit Nos. 1 and 2, CRGT guide cards to non-ductile cracking due to lower fracture toughness and discuss how the functionality of the Salem, Unit Nos. 1 and 2, CRGT guide cards will be maintained during the PEO. Please include a discussion of the effects of IE on the assumed CASS CRGT guide cards, taking into account the neutron exposure limits for embrittlement established in the staff guidance issued on June 11, 2014,<sup>10</sup> since wrought stainless steel CRGT guide cards do not screen in for IE in MRP-191. If the licensee determines that the VT-3 examination in Table C-1, "MRP-227-A Primary Inspection and Monitoring Recommendations for Westinghouse-Designed Internals," of Attachments 1 and 2 of the submittal is adequate for managing the Salem, Unit Nos. 1 and 2, CRGT guide cards that are assumed to be susceptible to non-ductile cracking, please provide the explanation.

## RAI-11

In Section 5.10, "GALL Revision 2 Element 10: Operating Experience," of Attachments 1 and 2 of the licensee's submittal, the licensee provided a summary of the operating experience of RVI degradation at Salem, Unit Nos. 1 and 2. The AMP element in Section 5.10 of Attachments 1 and 2 of the licensee's submittal indicates that licensees are expected to review subsequent operating experience for impact on its AMP. With respect to the recent degraded baffle-former bolts at Salem, Unit No. 1, reported in accordance with Title 10 of the *Code of Federal Regulations*, Section 50.72 (Event Notification No. 51902; May 3, 2016), please discuss the following:

- a) The impact on the MRP-227-A inspection implementation schedule for the Salem, Unit No. 1, baffle-former bolts in Section 7, "Program Enhancement and Implementation Schedule," of Attachment 1 of the licensee's submittal. Please include a discussion of the re-inspection schedule and the justification of the re-inspection frequency, the re-inspection method, and the re-inspection coverage.
- b) The potential impact on MRP-227-A inspection program planned for the Salem, Unit No. 2, baffle-former bolts in Section 7, "Program Enhancement and Implementation Schedule," of Attachment 2 of the licensee's submittal. If there is no impact, please provide the justification.

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<sup>10</sup> ADAMS Accession No. ML14163A112

REFERENCES

1. Electric Power Research Institute Technical Report, November 2006, "Materials Reliability Program: Screening, Categorization, and Ranking of Reactor Internals Components for Westinghouse and Combustion Engineering PWR Design (MRP-191)" (ADAMS Accession No. ML091910130).
2. Letter from Christopher I. Grimes (NRC) to Douglas J. Walters (Nuclear Energy Institute), May 19, 2000, "License Renewal Issue No. 98-0030, 'Thermal Aging Embrittlement of Cast Austenitic Stainless Steel Components'" (ADAMS Accession No. ML003717179).

P. Sena

- 2 -

If you have any questions, please contact me at 301-415-1603 or by e-mail at [Carleen.Parker@nrc.gov](mailto:Carleen.Parker@nrc.gov).

Sincerely,

*/RA/*

Carleen J. Parker, Project Manager  
Plant Licensing Branch I-2  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

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