NRR-PMDAPEm Resource

From: Rankin, Jennivine
Sent: Friday, November 15, 2013 2:47 PM
To: Robert.Roehler@aps.com
Cc: Thomas.N.Weber@aps.com; Ronald.Barnes@aps.com; Burkhardt, Janet
Subject: Request for Additional Information: Relief Request regarding axial flaw indications (MF3051)
Attachments: Palo Verde 3 BMI RAI final.docx

Mr. Roehler,

By letter dated November 8, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13317A070), Arizona Public Service Company (APS, the licensee) submitted for U.S. Nuclear Regulatory Commission (NRC) approval a relief request pursuant to Title 10 of the *Code of Federal Regulations* (CFR) 50.55a(a)(3)(i). This relief request proposes an alternative to the ASME Code requirements of Section XI related to axial flaw indications identified in the Unit 3 reactor vessel bottom mounted instrumentation nozzle.

Based on a review of the submittal, the NRC staff has determined that the following request for additional information (RAI) is required in order to complete its review. The RAIs were discussed with you on November 15, 2013. It was agreed that a response to these RAIs would be provided by November 18, 2013. If circumstances result in the need to revise the requested response date, please contact me at (301) 415-1530 or via email at jennivine.rankin@nrc.gov.

Thank you,
Jennie Rankin
Division of Operating Reactor Licensing

Hearing Identifier: NRR_PMDA
Email Number: 924

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From: Rankin, Jennivine

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Options
Priority: Standard
Return Notification: No
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Sensitivity: Normal
Expiration Date:
Recipients Received:

REQUEST FOR ADDITIONAL INFORMATION BY

THE OFFICE OF NUCLEAR REACTOR REGULATION REGARDING

ATTACHMENT 2, "FLAW FRACTURE MECHANICS EVALUATION TO SUPPORT RESTART"

TO RELIEF REQUEST 51

FOR THE REMNANT FLAW IN THE J-GROOVE WELD

IN THE BOTTOM MOUNTED INSTRUMENT NOZZLE NO. 3

PALO VERDE NUCLEAR GENERATING STATION, UNIT 3

ARIZONA PUBLIC SERVICE COMPANY

DOCKET NO. 50-530

RAI-1

Section 4.1 of Attachment 2 reported that the nil-ductility reference temperature (RT_{NDT}) of -60 °F for the RPV bottom head is from Reference 1 of this Attachment. Please confirm that this value is from the Certified Material Test Report for the RPV bottom head. If not, please justify the use of this RT_{NDT} value in this application.

RAI-2

A typical flaw evaluation in accordance with the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI requires consideration of emergency and faulted conditions in addition to the normal condition (e.g., Appendix A of the ASME Code, Section XI). The applied stresses for the flaw evaluation in Section 4.4 of Attachment 2 to Relief Request 51 are for the normal conditions only. Please address the flaw evaluation under the emergency and faulted conditions.

RAI-3

Appendix A to Attachment 2 documented the thermal stresses during cooldown which were obtained using a 2-dimensional axisymmetric finite element model (FEM). The NRC staff needs further clarification regarding the FEM results to gain confidence in the FEM model:

- Please confirm that the results shown in Figures A-1 to A-5 and Table A-3 are 1-dimensional, i.e., the results (temperature and stresses) are the same for all points at inner diameter (ID), outer diameter (OD), or any surface that is defined by a specific depth of the bottom head. Demonstrate that the 1-dimensional results are realistic in this application.

- Please confirm that the temperature difference-time plot (right figure) in Figure A-2 is a plot of the maximum thermal gradient mentioned in Paragraph A.2 Item 4. If it is not, explain the significance of this parameter. Regardless of the confirmation, please identify the location (depth) where this temperature difference-time plot was obtained and explain the physical meaning of such a unique shape of the temperature difference-time plot.

RAI-4

Section 4.4 of Attachment 2 states, "Residual plus operating stresses are obtained from Reference [7]." Demonstrate that the residual stresses used in the flaw evaluation are consistent with what were approved by the NRC staff in published safety evaluations (SEs), NUREGs, or other NRC documents. If this cannot be demonstrated, please provide Reference 7 to support this review.

RAI-5

Table 4-3 of Attachment 2 presents the hoop stresses at different depths of the RPV wall for the steady state (SS), cooldown (CD), and their combined effect. The NRC staff has the following requests:

- Identify the loads that were considered in the SS condition (i.e., any of the three: pressure, steady state thermal load, and residual stresses). Repeat the similar identification for the CD condition.

- Confirm that the thermal state associated with the SS condition is the starting point of the CD condition.

- The stress pattern for the SS condition (Column 2 of Table 4-3 under SS) is very unusual. Please provide the corresponding stress components due to pressure, thermal, and residual stresses for each position (or depth) in Table 4-3. Explain the unusual zigzag stress pattern to demonstrate that it is not caused by modeling errors.

- If residual stresses are not included in the SS condition, confirm that residual stresses are considered in the subsequent applied stress intensity factor (K) or applied J calculations (Tables 6-1 and 6-2 do not show explicitly the contribution due to residual stresses).

RAI-6

Section 4.1.4 of Attachment 2 presents the generic J-R curve used in the elastic plastic fracture mechanics (EPFM) evaluation. This J-R curve is based on the J model from Appendix D to NUREG-0744, Vol. 2, Rev. 1, "Resolution of the Task A-11 Reactor Vessel Materials Toughness Safety Issue," 1982. The generic J-R curve models for various low upper-shelf RPV materials are presented in RG 1.161, "Evaluation of Reactor Pressure Vessels with Charpy Upper-Shelf Energy Less Than 50 FT-LB," 1995. Please provide J-R curves based on both approaches to demonstrate that your J-R curve based on NUREG-0744, Vol. 2, Rev. 1 is not significantly different from the RG 1.161 model. Provide correction and reassess your final conclusion if the difference is significant. Please note that the database underlying the J-R model for RPV base metals in RG 1.161 contains not just low upper-shelf energy materials.

RAI-7

Table 6-2 of Attachment 2 provides results for a number of parameters which were calculated during the EPFM evaluation. Please provide the flow stress σ_f at the operating temperature of 565 °F and a sample calculation for the applied tearing modulus T_{app} appeared in Column 9 of this table.

Note: There are no RAIs regarding Attachment 1. If there are any RAIs related to Relief Request 51 (i.e., not Attachment 1 or Attachment 2), it will be provided to the licensee on Monday, November 18, 2013.