## NRR-PMDAPEm Resource

**From:** Wilkins, Lynnea
**Sent:** Friday, November 08, 2013 3:45 PM
**To:** HANSHER, BILL R (bhansher@oppd.com)
**Cc:** Sebrosky, Joseph; EDWARDS, MICHAEL L (medwards@oppd.com)
**Subject:** DRAFT: Fort Calhoun RAI Re: Leak Before Break LAR (TAC MF2559)

Bill,

By letter dated August 5, 2013, Omaha Public Power District (the licensee) submitted for Nuclear Regulatory Commission (NRC) review and approval a license amendment request relating to the plant-specific leak-before-break (LBB) analysis for the reactor coolant system (RCS) primary loop piping at Fort Calhoun Station, Unit 1. The licensee submitted the plant-specific LBB analysis to satisfy one of its commitments as part of its license renewal application before the period of extended operation, which began at midnight on August 9, 2013. The licensee's LBB analysis is documented in Westinghouse report, WCAP-17262-P, Revision 1. The NRC staff notes that it approved the RCS primary loop piping at Ft Calhoun for LBB under a generic application on February 1, 1984.

The NRC staff has reviewed your submittal and has determined that the information specified in the Request for Additional Information (RAI) below is needed for the staff to complete its evaluation.

Please contact me if a clarifying teleconference is needed for the attached RAIs.

Thanks
Lynnea

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<u>REQUEST FOR ADDITIONAL INFORMATION</u>

<u>LICENSE AMENDMENT REQUEST 13-06</u>

<u>LEAK BEFORE BREAK APPLICATION FOR</u>

<u>REACTOR COOLANT PRIMARY LOOP PIPING</u>

<u>FORT CALHOUN STATION UNIT 1</u>

<u>OMAHA PUBLIC POWER DISTRICT</u>

<u>DOCKET NUMBER 50-285</u>

RAI 1

The Westinghouse report, WCAP-17262-P, identified several nickel-based Alloy 82/182 welds in the RCS primary loop piping. The industry operating experience has shown that primary stress corrosion cracking (PWSCC) is an active degradation mechanism in Alloy 82/182 weld material. Standard Review Plan 3.6.3 specifies that LBB cannot be applied to piping that experiences an active degradation mechanism. On page 5 of the Enclosure to the August 5, 2013 letter, the licensee stated that mitigation will be implemented to minimize PWSCC at the reactor vessel nozzle locations which have nickel-based Alloy 82/182 welds.

1. Please discuss the type of mitigation that will be implemented and when the mitigation will be implemented.

2. Please provide the weld number for each of the Alloy 82/182 welds in the RCS primary loop piping.

3. Please discuss previous inspection history and results of these welds, including whether the ultrasonic examinations of these welds achieve essentially 100-percent coverage of required volume. (4) Discuss future inspections of the Alloy 82/182 welds.

RAI 2

Cracks caused by PWSCC or fatigue may occur in the Alloy 82/182 weld. The PWSCC crack morphology is different from the fatigue crack morphology. Therefore, calculating the leak rate from a PWSCC crack would be different from that of a fatigue crack. It appears that WCAP-17262-P (page 6-1) calculates the leak rate based on fatigue crack morphology. It appears that WCAP-17262-P also considered PWSCC crack morphology in the leak rate calculation as discussed on Page 6-3 of WCAP-17262-P.
Please confirm that PWSCC crack morphology was used in the leakage rate calculation for the Alloy 82/182 weld and fatigue crack morphology was used in the leakage rate calculation for the cast austenitic stainless steel pipe.

RAI 3

Section 2.1 of WCAP-17262-P briefly touched upon PWSCC in Alloy 82/182. Please assess and discuss in detail:

1. The impact of PWSCC on the RCS primary loop piping in light of existing Alloy 82/182 welds;

2. How PWSCC will be minimized until the Alloy 82/182 welds are mitigated; and

3. How structural integrity of the unmitigated Alloy 82/182 welds will be maintained.

RAI 4

The licensee calculated two different sets of flaw sizes at Location 1 which is the joint connecting the cast austenitic stainless steel pipe to the carbon steel reactor vessel nozzle by an Alloy 82/182 weld. For the cast austenitic stainless steel pipe, the licensee calculated a leakage crack size and critical crack size of 5.28 inches and 35.27 inches, respectively. For the Alloy 82/182 weld, the licensee calculated a leakage crack size and critical crack size X and Y inches (proprietary information).

1. Please provide detailed drawings of the Location 1 configuration, including the nozzle, weld, safe end, and pipe. The drawing should include dimensions for wall thickness, outside or inside diameter, and material specifications of the nozzle, weld, safe end and pipe. The as-built dimensions are preferable; however, the design dimensions are acceptable. If a safe end is joined with the nozzle, provide its width and the center to center distance between the alloy 82/182 weld and the safe end-to-pipe weld. Provide a detailed configuration drawing at Location 6 also.

2. Please discuss the differences in the parameters used that resulted in two sets of crack sizes at Location 1 (assuming the same methodology was used).

3. Please explain why the leakage and critical crack sizes derived for the Alloy 82/182 weld at Location 1 were not included in Tables 6-1, 7-1, 7-2 of WCAP-17262-P as part of analytical results.

RAI 5

The NRC staff plans to perform an independent calculation and requests the following information for Locations 1 and 6 that were analyzed in WCAP-17262-P:

1. Please provide the primary membrane stress and bending stress for Locations 1 and 6.
2. For the Alloy 82/182 weld in Location 1, discuss whether the weld residual stresses were included in the calculations. If yes, provide the weld residual stresses. If not, provide justification
3. Please provide Ramberg-Osgood exponents. (n) and coefficient (alpha) for the pipe and Alloy 82/182 weld materials, if Ramberg-Osgood equation was used in the flaw evaluations.
4. Please discuss whether the fluid is saturated or subcooled before exiting the leakage crack.

RAI 6

Section 2 of WCAP-17262-P discusses operating experience of stress corrosion cracking and fatigue without providing the operating experience of the RCS primary loop piping at Fort Calhoun. Please provide any prior occurrences of fatigue cracking or PWSCC cracking in the RCS primary loop piping.

RAI 7

In selecting the critical location for analysis, the licensee used axial forces, moments and stresses in Tables 3-1 and 3-2 in WCAP-17262-P. The licensee selected Locations 1 and 6 to perform the flaw analysis. Based on values in Tables 3-1 and 3-2 it appears that Locations 3 and 4 have higher loads and stresses than that of Location 6. Please discuss why Locations 3 and 4 were not also selected for the flaw analysis.

**Hearing Identifier:** NRR_PMDA
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**Recipients:**
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