



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

December 24, 2009

Mr. Eric McCartney, Vice President
Carolina Power & Light Company
H. B. Robinson Steam Electric Plant,
Unit No. 2
3581 West Entrance Road
Hartsville, South Carolina 29550

SUBJECT: H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT 2 - REQUEST FOR
ADDITIONAL INFORMATION REGARDING REVIEW OF REFUELING
OUTAGE 25 INSPECTIONS OF THE REACTOR VESSEL NOZZLE
DISSIMILAR METAL BUTT WELDS (TAC NO. ME0233)

Dear Mr. McCartney:

By letter dated December 8, 2008, Carolina Power & Light Company (the licensee), also known as Progress Energy Carolinas, Inc., submitted to the Nuclear Regulatory Commission the results of inspections conducted during refueling outage 25 on dissimilar metal butt welds in the reactor vessel nozzles.

In order for the staff to complete its review of the information provided, we request that the licensee provide responses to the enclosed request for additional information (RAI). Based on discussions with your staff, we understand that you plan to respond to the enclosed RAI by January 18, 2010.

If you have any questions about this material, please contact me at (301) 415-2788.

Sincerely,

A handwritten signature in black ink, appearing to read "Tracy J. Orf".

Tracy J. Orf, Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-261

Enclosure: Request for Additional Information

cc: Distribution via Listserv

REQUEST FOR ADDITIONAL INFORMATION
INSPECTIONS OF THE REACTOR VESSEL NOZZLE
DISSIMILAR METAL BUTT WELDS DURING REFUELING OUTAGE 25
H.B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
PROGRESS ENERGY
DOCKET NO. 50-261

By letter dated December 8, 2008, Carolina Power & Light Company (the licensee), also known as Progress Energy Carolinas, Inc., submitted to the NRC the results of inspections conducted on dissimilar metal butt welds in the reactor vessel nozzles.

By letter dated January 12, 2009, the licensee submitted, based on the NRC's request, the Westinghouse proprietary report WCAP-15620-P, Revision 1, "Background and Technical basis: Handbook on Flaw Evaluation for the H.B. Robinson Unit 2 Reactor Vessel."

To continue its review of the submittal, the staff requests the following additional information:

- A. The licensee accepted one flaw in the cold leg and 9 flaws in the hot leg by analysis. Discuss whether these 10 flaws will be subject to successive examinations. If so, discuss the schedules for the successive examinations of these 10 flaws.
- B. Comments on Background and Technical Basis: Handbook on Flaw Evaluation for the H.B. Robinson Unit 2 Reactor Vessel (WCAP-15620-P)
 1. Page 2-1. Combining Moments. The licensee used the square root of the sum of the square of the moment components to estimate the equivalent moment for bending stress. NUREG/CR-6299 recommends the following for good comparisons to finite element results:

$$M_{eff} = \sqrt{M_x^2 + M_y^2 + \left(\frac{\sqrt{3}}{2} T\right)^2}$$

In light of moment combination in NUREG/CR-6299, discuss the validity of the square root of the sum of square of the moment components.

2. Page 2-3. A third order approximation is used for the through wall thickness stress profile. In many cases, this representation may not be adequate, especially for welding residual stress. This approximation can underpredict the stresses on the crack face and provide non-conservative approximations of time to leakage. Discuss the validity of using the third order approximation for the through wall thickness stress.

Enclosure

3. Page 2-3. The licensee stated that the same influence functions for stress intensity are used for longitudinal and circumferential flaws because there is no difference until the crack is deep. Both American Petroleum Institute (API) and American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, have published influence functions that are different for circumferential and longitudinal cracks and illustrate they are a function of R/t , location (internal/external), etc. Please provide references or examples to show why the same influence functions for stress intensity can be used for longitudinal and circumferential flaws.
4. Page 2-7. The licensee stated that Z factors for Alloy 182 are used, and referenced the ASME Code, Section XI. However, to date the 1995 edition of the ASME Code, Section XI, does not have Z factors for Alloy 182. Provide the Z factors that were used in the analysis and discussion from which edition or addenda of the ASME code were the Z factors taken.
5. Page 2-8. In dealing with net section collapse of dissimilar metal welds, the lower strength base metal controls the failure. It is unclear what value of S_m was used in the analyses for the dissimilar metal welds. Using the higher strength Alloy 182 in the predictions will over estimate the maximum load carrying capacity. Clarify the value of S_m for the dissimilar metal welds.
6. Page 3-1. The licensee stated that the flaw was assumed to maintain a constant shape as it grew. Does constant shape mean constant aspect ratio? And if so, what aspect ratio was assumed?
7. Page 3-7. The licensee estimated welding residual stresses based on a 1986 paper on similar metal welds. A third order approximation for a yield stress of 30 ksi is assumed. Recent work on dissimilar metal welds (Alloy 81/182 metal) has shown that this approximation can significantly underestimate the welding residual stress. In fact, a 2008 ASME PVP paper written by Westinghouse staff (Bamford, et al, "Technical Basis For Revisions To Section XI Appendix C For Alloy 600/82/182/132 Flaw Evaluation In Both PWR And BWR Environments," PVP2008-61840, Proceedings of PVP2008, 2008 ASME Pressure Vessel and Piping Division Conference, July 28 – 31, 2008, Chicago, IL USA) suggests the inside diameter welding residual stress for Section XI analyses should be about 54 ksi. Using the data from the 1986 paper can underpredict the calculated times to failure. Justify the use of welding residual stresses from the 1986 paper.

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/RA/
Tracy J. Orf, Project Manager
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*Via E-mail

OFFICE	LPL2-2/PM	LPL2-2/LA	CPNB/BC	LPL2-2/BC
NAME	TOrf	RSola	TChan*	TBoyce (SLingam for)
DATE	12/24/09	12/23/09	08/13/09	12/24/09

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