September 29, 2011

Mr. David Czufin, Chairman
Exelon Generation
Chairman, BWR Vessel and Internals Project
Electric Power Research Institute
3420 Hillview Avenue
Palo Alto, CA 94304-1395

SUBJECT: ACCEPTANCE FOR REVIEW AND REQUEST FOR ADDITIONAL INFORMATION, FOR BWRVIP-234: "BWR VESSEL AND INTERNALS PROJECT: THERMAL AGING AND NEUTRON EMBRITTLEMENT EVALUATION OF CAST AUSTENITIC STAINLESS STEEL FOR BWR INTERNALS" (TAC NO. ME5060)

Dear Mr. Czufin:

By letter dated September 10, 2010 (Agencywide Documents Access and Management System Accession No. ML102570749), the Boiling Water Reactor (BWR) Vessel and Internals Project (BWRVIP) submitted to the U.S. Nuclear Regulatory Commission (NRC) staff for review Technical Report (TR) "BWRVIP-234: BWR Vessel and Internals Project: Thermal Aging and Neutron Embrittlement Evaluation of Cast Austenitic Stainless Steels for BWR Internals." Per your request, the Office of Chief Financial Officer granted the fee exemption (ADAMS Accession No. ML102990404) on October 26, 2011.

Upon detailed review of the provided information, the NRC staff determined that additional information is needed to complete the review. During the conference call on August 3, 2011, Mr. Bob Carter and Mr. Larry Steinert agreed with the NRC staff to provide your response to the Request for Additional Information (RAI) questions within 6 months.

If you have questions regarding this matter, please contact Andrew Hon at (301) 415-8480.

Sincerely,

/RA/

John R. Jolicoeur, Chief
Licensing Process Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Project No. 704

Enclosure: RAI Questions

Mr. David Czufin, Chairman
Exelon Generation
Chairman, BWR Vessel and Internals Project
Electric Power Research Institute
3420 Hillview Avenue
Palo Alto, CA 94304-1395

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REQUEST FOR ADDITIONAL INFORMATION ON BWRVIP-234,

THERMAL AGING AND NEUTRON EMBRITTLEMENT EVALUATION OF CAST AUSTENITIC

STAINLESS STEEL FOR BOILING WATER REACTOR INTERNALS (TAC NO. ME5060)

RAI 1
For Figure 2-1, the absorbed energy saturation values for the CF-8M castings are between 10 and 20 ft-lbs. The saturation is reached in about 10^5 hours at the temperature of 300^o C. These values are independent of the delta ferrite content. Is this result consistent with other alloys like CF-8 and CF-3?

RAI 2
Please clarify your conclusion in Section 2.1.1 on the differences between the thermal embrittlement (TE) of cast austenitic stainless steel (CASS) components in a pressurized water reactor versus a boiling water reactor (BWR).

RAI 3
Figures 2-4 and 2-5 document the toughness as a function of delta ferrite content. The aging conditions for these test results should be included for our review. If these results represent the saturation of the TE effects, please discuss why these results are different from Figure 2-1 where the TE effects are not a function of delta ferrite content.

For the purposes of this report, are the saturation values for TE of CASS components within the scope of the assessments in this report?

RAI 4
Discuss why room temperature Charpy absorbed energy is an appropriate way to quantify the extent of TE. The upper shelf energy (USE) that you show in Figure 2-5 could be a more valuable parameter because USE could be related directly to the service temperature, similar to what is done for ferritic reactor vessel properties.

RAI 5
Please provide clear and consistent definitions for “screening” and “threshold” that can be incorporated in the approved version of BWRVIP-234.

RAI 6
Welding or weld repairs and how they might affect the properties of a CASS component in the BWR environment were discussed. Welding of CASS components can increase the delta ferrite content in the heat affected zone of the weld (Mimura et al. Welding Journal, 1998, pp 350s-360s). Please discuss the impact that welding and/or weld repairs would have on the component screening.

ENCLOSURE

RAI 7
Typically, the measured delta ferrite values are not reported on the certified material test record. In Section 3.4, “Ferrite Content,” the Ni and Cr equivalent equations from Hull are used to calculate the delta ferrite content.

Please discuss how calculated values compare with measured values for CASS components to demonstrate the level of confidence one can place on the calculations. Provide additional discussion in Section 4.1 as to how the uncertainty in the calculations affects the screening process.

RAI 8
In Section 4.1, “Screening Based on Ferrite Content,” for the discussion about fatigue for CASS jet pump components, BWRVIP-234 assumes that BWRVIP-41 inspections are sufficient to eliminate concern for any augmented inspections for fatigue of CASS jet pump components. BWRVIP-41, Revision 2, recommends eliminating CASS components from the scope of inspections because castings are considered immune to intergranular stress corrosion cracking. Please summarize the recommendations in BWRVIP-41, Revision 2 and revise this section as-needed to demonstrate how the BWRVIP-41 inspections will impact the screening of CASS components for fatigue in BWRVIP-234.

RAI 9
In Section 4.3, “Screening Based on Toughness,” the alternative method to estimate the J-R curve parameters from Reference 8 was developed for core shroud welds. The delta ferrite content of core shroud welds is typically lower than the delta ferrite content of the CASS components in the BWR fleet. Given the uncertainty in the calculation of delta ferrite (RAI 7) and the potential for an increase in the % delta ferrite due to welding/weld repairs (RAI 6), discuss the effect that a higher delta ferrite content would have on the methodology to estimate toughness.

cc:

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