ArevaEPRDCPEm Resource

From: Tesfaye, Getachew
Sent: Friday, November 05, 2010 8:40 AM
To: 'usepr@areva.com'
Cc: Wu, Cheng-Ih; Wong, Yuken; Dixon-Herrity, Jennifer; Miernicki, Michael; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 458 (5149,5152), FSAR Ch. 3
Attachments: RAI_458_EMB1_5149_EMB2_5152.doc

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on October 29, 2010, and on November 3, 2010, you informed us that the RAI is clear and no further clarification is needed. As a result, no change is made to the draft RAI. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

Thanks,
Getachew Tesfaye
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Hearing Identifier: AREVA_EPR_DC_RAIs
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Request for Additional Information No. 458(5149, 5152), Revision 0

11/05/2010

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 03.09.01 - Special Topics for Mechanical Components
SRP Section: 03.09.02 - Dynamic Testing and Analysis of Systems Structures and Components
Application Section: 3.9

QUESTIONS for Engineering Mechanics Branch 1 (AP1000/EPR Projects) (EMB1)
QUESTIONS for Engineering Mechanics Branch 2 (ESBWR/ABWR Projects) (EMB2)

03.09.01-13

FSAR Section 3.12.5.19 states that “the effects of reactor coolant environment, using the methodology described in RG 1.207, are considered when performing fatigue analyses for Class 1 piping and components.” RG 1.207 recommends using Fen method presented in NUREG/CR-6909. The staff reviewed the design basis documentation (Document #: 32-9119032-002, “Fatigue Modules for US EPR Piping System”, 07/16/2010). The staff has identified the discrepancies between the design basis document and NUREG/CR-6909 as follows:

NUREG/CR-6909		AREVA Document #: 32-9119032-002
Eq. 23	$T^* = T – 150$ ($150 < T \leq 350°C$)	$T^* = T – 302$ ($302 < T \leq 662°F$)
Eq. 25	$\varepsilon^* = \ln(0.001)$ ($\varepsilon^* < 0.001\%/s$)	$\varepsilon^* = \ln(1.0E-5)$ ($\varepsilon^* < 0.001\%/s$)

The staff requests AREVA to clarify and correct the differences.

The staff noted that the AREVA document indicated that the threshold strain amplitude of 0.1% is considered for all type material. However, the threshold strain amplitude of 0.07% for carbon steel and low alloy steel is defined in Section 4.2.13 of NUREG/CR-6909. Please clarify.

The staff also noted that AREVA’s weighted average Fen method is not consistent with existing method identified in NUREG/CR-6909. AREVA states that the weighted average Fen method is conservative. The staff’s concern is that final Fen may be reduced if partial Fen=1.0 for some stress components due to threshold consideration. The staff requests AREVA to demonstrate the conservatism of the proposed weighted average Fen method.

03.09.01-14

The staff reviewed the design basis documentation (Document, “Program Verification of PC Version of P91232”, 02/16/2001). P91232 stratification option is used to calculate equivalent linear profile with top and bottom temperature and ΔT4 which has been used to calculate local thermal stress.

The staff noted that the AREVA methodology developed to calculate the temperature profile on pipe cross-section (@ mid-thickness) should be verified and benchmarked by a computer program which is recognized in the public domain and has had sufficient history of use to justify its applicability and validity (e.g. ANSYS). The staff requests AREVA to provide the benchmark comparison.

Rev. 1 of the FatTool (Document #: 32-9119032-001) defined that local thermal stratification stress equals to $E\alpha\Delta T4/(1-n)$. Rev. 2 the FatTool (Document #: 32-9119032-002) defined that local thermal stratification stress equals to $E\alpha\Delta T4$. The staff requests the benchmark justification for the local thermal stratification stress

03.09.01-15

FSAR 3.9.1.2 identified that computer program RESPECT is to be used for EPR design. The staff reviewed the supporting documents for the program RESPECT and noted that the validation is not found for RESPECT computer program that generates response spectrum from an acceleration time history for un-broaden and broaden spectra that will be used in the downstream response spectrum piping analysis. The staff requests AREVA to provide validation for this computer program.

03.09.02-146

Provide the total damping for the flow distribution device (FDD), and clarify if the value associated with structural damping (composed of damping from bolted connections and material damping such as hysteresis) is greater than 1 percent. If greater than 1 percent, AREVA is further requested to strongly support these higher values of structural damping with measurements per the recommendations of RG 1.20. Revise Technical Report ANP-10306P (CVAP), Section 4.3.2.1 to include the requested information.

03.09.02-147

In CVAP Section 4.6.3.1, AREVA discussed the damping applied to the control rod guide assembly (CRGA) internals. The discussion is not clear as to the total damping employed in the analysis. Further, AREVA is requested to discuss the damping mechanisms included in the total damping and the contribution of each mechanism to the total. If the structural component is greater than 1 percent, AREVA is further requested to strongly support the higher values of structural damping with measurements per the recommendations of RG 1.20. Revise CVAP Section 4.6.3.1 to include the requested information.

03.09.02-148

Provide a discussion of the measurement methodology and the measurements which support the high damping values tabulated in CVAP Table 4-27 for the HR tie rod. Include the requested discussion in CVAP Section 4.7.2.

03.09.02-149

The applicant is requested to:

a. Verify that the effect of the uncertainties and bias errors on the calculations do not result in a possible range of lock-in occurring for the RPV internals.

b. Provide tables of resonant frequencies, flow rate, shedding frequency (for the upper internals) together with any possible range of lock-in and the effect of uncertainty on the lock-in parameters per the recommendation of RG 1.20.

c. Revise the CVAP to include the requested information.

03.09.02-150

Discuss in detail the procedure for handling the bias and uncertainties in the Strouhal number and how it is incorporated into the screening methodology for shear-wave resonance in piping systems discussed in CVAP Appendix A.

03.09.02-151

Provide justification for neglecting the tones associated with the RCP in the analysis of the RPV upper internals (extends RAI 03.09.021-101). Revise the CVAP to include the requested information.

03.09.02-152

Provide the acoustic frequencies for the various volumes in the RPV, the RSG and the attached piping for inclusion in the respective sections of the CVAP and compare these resonant frequencies to the vortex shedding frequencies for appropriate flow rates within the standard operating range of the reactor through full power to verify that the pressure disturbances generated by vortex shedding will not excite an acoustic resonance. Revise the CVAP to include the requested information.

03.09.02-153

RG 1.20 recommends the sufficient number and placement of transducers to monitor significant lateral, vertical and torsional structural motions resulting from shell, beam and rigid body vibrations of major RPV internal components, as well as being useful for confirming input forcing functions.

a. How will the proposed sensor suite capture the more complex behaviors of the RPV internals mentioned above? For example, the core barrel is instrumented with only four accelerometers (see Table 5-2), which would appear to be too few to positively identify the shell and other more complex modes in that structure.

b. Discuss the plans for replacing transducers after the start of the test or if there are any plans to install redundant sensors beyond the set listed in CVAP or other strategies for recovering following the failure of sensors during the testing program to mitigate the risk of the loss of transducers in the minimal set described in CVAP Section 5 precluding achieving the measurement requirements of the preoperational and HFT testing programs

03.09.02-154

The tests presented in Table 5-4 of the CVAP are specified in terms of number of operating pumps, temperature and pressure. The staff was unable to locate the recommended description of specific hold points together with the specific durations and activities consistent with the guidance of RG 1.20. Together with RAI 03.09.02-141, this RAI requests the applicant to provide 1) the specific hold points with a predetermined duration, 2) specified activities during hold points, 3) plant parameters to be monitors in comparison with applicable limit curves, 4) walk downs and inspections of the steam, condensate, and feedwater systems, 5) defined methods to trend plant parameters, 6) defined acceptance criteria for walkdowns, 7) actions to be taken if the acceptance criteria are not met, 8) communication of these items with NRC personnel prior to and during the power ascension program, especially of the any failure to meet the criteria, and resolution of any safety concern encountered. Items 6 and 7 are partially covered by 03.09.02-141. Revise the CVAP to include the requested information.