ArevaEPRDCPEm Resource

From: Tesfaye, Getachew
Sent: Tuesday, June 01, 2010 9:49 AM
To: 'usepr@areva.com'
Cc: Wu, Cheng-Ih; Le, Tuan; Dixon-Herrity, Jennifer; Patel, Jay; Miernicki, Michael; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 404(4692, 4684), FSAR Ch. 3 OPEN ITEM
Attachments: RAI_404_EMB1_4692_4684.doc

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on May 11, 2010, and discussed with your staff on June 1, 2010. No changes were made to the draft RAI as a result of that discussion. The questions in this RAI are OPEN ITEMs in the safety evaluation report for Chapter 3, Group 2 sections in Phases 2 and 3 reviews. 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. 404(4692, 4684), Revision 1

6/01/2010

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: 03.09.03 - ASME Code Class 1, 2, and 3 Components
Application Section: 3.9

QUESTIONS for Engineering Mechanics Branch 1 (AP1000/EPR Projects) (EMB1)

03.09.01-5

OPEN ITEM

Follow-up to RAI 179, Question 03.09.01-1.2:

In RAI 179, Question 03.09.01-1.2, the staff requested the applicant to provide the basis to justify not including earthquakes dynamic events at the rated operating power conditions in Table 3.9.1-1.

In a February 26, 2009, response to RAI No. 179, Question 03.09.01-1.2 (Accession Number ML090570933), the applicant stated that FSAR Tier 2, Table 3.9.1-1 provides a summary of thermal design transients. The seismic design basis is addressed in FSAR Tier 2, Section 3.7.1, "Seismic Design Parameters," Section 3.7.2, "Seismic System Analysis," and Section 3.7.3, "Seismic Subsystem Analysis." The Final Safety Evaluation Report for Topical Report ANP-10264NP-A, "Piping Analysis and Pipe Support Design Topical Report," states: "AREVA meets 10 CFR Part 50, Appendix S, requirements by designing the safety related piping systems, with a reasonable assurance to withstand the dynamic effects of earthquakes with an appropriate combination of other loads of normal operation and postulated events with an adequate margin for ensuring their safety functions." Additionally, per FSAR Tier 2, Table 3.9.3-1, the seismic inertial loads are included in the fatigue analysis of ASME Class 1 Components. The earthquake dynamic loads are included in the fatigue analysis of structures, systems, and components.

The staff notes that FSAR Tier 2, Table 3.9.3-1 provides the loading combinations and corresponding stress design criteria per ASME Service Level for ASME Class 1 components. Section 3.4 of Topical Report ANP-10264NP-A requires that the fatigue analysis be performed for all ASME Code Class 1 piping to meet 10 CFR Part 50, Appendix S requirements. However, neither Table 3.9.3-1 nor Topical Report ANP-10264NP-A provides specific requirements for fatigue evaluation regarding the number of cycles, estimated magnitude, and frequency of the reversing dynamic seismic events that may occur during the 60 years plant operation, thus the applicant is requested to provide the above information.

03.09.01-6

OPEN ITEM

Follow-up to RAI 179, Question 03.09.01-1.3:

In RAI 179, Question 03.09.01-1.3, the staff requested the applicant to provide the basis for not including the turbine stop valve closure induced loads in FSAR Tier 2, Section 3.9.1.

In a February 26, 2009, response to RAI 179, Question 03.09.01-1.3, the applicant stated that the applicant has not been able to identify a precedent in which the NRC has requested a design certification applicant to provide such information.

The staff notes that the TSV closure event has been considered to be a Service Level B fluid transient load (i.e., steam hammer loads). The applicant is requested to address why this transient due to TSV closure is not applicable to U,S,EPR design.

03.09.01-7

OPEN ITEM

Follow-up to RAI 179, Question 03.09.01-1.4:

In RAI 179, Question 03.09.01-1.4, the staff requested the applicant to provide the basis for not considering the thermal stratification in FSAR Tier 2, Section 3.9.1.1, as it relates to the design transient in the piping design on fatigue.

In a February 26, 2009, response to RAI 179, Question 03.09.01-1.4, the applicant stated that FSAR Tier 2, Section 3.12.5.10, “Thermal Stratification,” addresses thermal stratification for the pressurizer (PZR) surge line , PZR lower head, normal spray line, auxiliary spray line, main feedwater (MFW) line, and emergency feedwater (EFW) line. The contribution of normal and upset condition stratification cycles is considered in the fatigue analysis of these piping systems. In addition, the applicant referred the staff to its August 21, 2008, response to RAI 48, Question 03.06.03-3 and Question 03.06.03-4 for more information on thermal stratification of the PZR SL.

The staff noted that the stratification has been extensively considered in the design of piping in FSAR Tier 2, Section 3.12.5.10 for fatigue analysis. However, the applicant has not defined or described the thermal stratification transient including information regarding the number of cycles for the transients and the magnitude and frequency of the transients that may occur during plant operation. Accordingly, the staff requests the applicant to provide the above information for the fatigue evaluation.

03.09.01-8

OPEN ITEM

Follow-up to RAI 179, Question 03.09.01-1.5:

Regarding the vibration effects on the components and piping due to acoustic resonance stated in NRC RG 1.20, Revision 3, staff requested the applicant in RAI 179, Question 03.09.01-1.5 to provide the basis for not including this acoustic cyclic loading in FSAR Tier 2, Section 3.9.1.1, as it relates to cyclic loadings applying to Class 1 piping and components.

In a February 26, 2009, response to RAI 179, Question 03.09.01-1.5, the applicant referred to its February 23, 2009 response to RAI 160, Question 03.09.02-17. The response noted that acoustic resonances, such as those caused by flow past a dead leg of closed relief valves, have the characteristic that the pressure flow oscillations travel through the entire affected piping system with little attenuation.

It is noted that the vibration effects can significantly affect the fatigue cumulative factor in the case where the acoustic resonance occurs coupled with the structural frequencies. Therefore, the staff requests the applicant to confirm that the U.S. EPR is designed to ensure no acoustic resonance will occur when flow passing through the dead leg of closed relief valve or no acoustic resonance was found in the database for PWR systems.

03.09.01-9

OPEN ITEM

Follow-up to RAI 179, Question 03.09.01-2.3:

In RAI 179, Question 03.09.01-2.3, the staff requested the applicant to provide a summary of the verification and validation (V/V) for this program including benchmark problems. The V/V information is required by Appendix B to 10 CFR 50 and should be available as requested.

Instead of providing the V/V information, the applicant stated in a February 26, 2009, response to RAI 179, Question 03.09.01-2.3, that Section 3.3.1 of the NRC FSER for Topical Report ANP-10264NP-A approved the use of the BWSPAN computer code for the U.S. EPR and specifically accepted the referenced Oconee RCL analysis methodology for steam generator replacement as part of the basis for their approval.

The staff determines that methodology for steam generator replacement using BWSPAN program does not relate to the review of the V/V information of BWSPAN, thus requests the applicant to provide the V/V information as mentioned in RAI 179, Question 03.09.01-2.3.

03.09.01-10

OPEN ITEM

Follow-up to RAI 179, Question 03.09.01-2.6:

ASME Code Section III requires that the cumulative damage from fatigue be evaluated for all ASME Code Class 1 piping, components, and supports. In RAI 179, Question 03.09.01-2.6, the staff requested the applicant to identify the computer

programs which were used to perform the fatigue analysis and confirm these analyses for ASME Section III Class 1 components and piping for the fatigue evaluation including environmental effects in accordance with Regulatory Guide 1.207.

In a February 26, 2009, response to RAI 179, Question 03.09.01-2.6, the applicant identified computer codes ANSYS, BWSPAN, and SUPERPIPE which are used to perform the fatigue analysis for ASME Code Class 1 piping and components. The applicant also stated that as noted in FSAR Tier 2, Section 3.12.5.19, "Effects of Environment on Fatigue Design," 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.

The applicant did not address the staff's question whether the computer codes ANSYS, BWSPAN, and SUPERPIPE which perform the fatigue analysis incorporate the environmental effects on fatigue, thus the staff requests the applicant to address the information above.

03.09.01-11

OPEN ITEM

Follow-up to RAI 179, Question 03.09.01-2.7:

Experience suggests that most structural and piping damages during seismic events were caused by the foundation and anchor movements. To prevent such damages, the staff suggested that appropriate methodologies discussed in NUREG-1061 should be used for calculating the stresses and fatigue on piping and components subjected to multiple individual support motions.

In RAI 179, Question 03.09.01-2.7, the staff requested the applicant to verify that all computer programs used for EPR design of piping that use the Independent Support Motion Response Spectrum analysis method comply with the staff position for combining mode, group (absolute sum) and direction responses, as stated in NUREG-1061, Volume 4.

In a February 26, 2009, response to RAI 179, Question 03.09.01-2.7, the applicant stated that conformance with NUREG-1061, Volume 4 was evaluated by the NRC in Section 3.2.3 of the NRC FSER for Topical Report ANP-10264NP-A.

The applicant did not address how the methodology in NUREG-1061, Volume 4 with absolute summation is appropriately incorporated in the U.S. EPR analyses when using computer codes ANSYS, BWSPAN, and SUPERPIPE in the piping analyses, thus the staff requests the applicant to address the above request.

03.09.01-12

OPEN ITEM

Follow-up to RAI 179, Question 03.09.01-3:

In RAI 179, Question 03.09.01-3, the staff requested the applicant to discuss the stress analysis methods used to verify the design adequacy for the design of U.S. EPR components such as snubbers, pipe whip restraints, and the prototype fine motion control rod drive.

In its response to the RAI, the applicant indicated that the pipe whip restraints are designed using elastic and elastic-plastic methodologies in accordance with the guidance in SRP Section 3.6.2 and that experimental stress analysis is not used to evaluate stresses for the restraints. Regarding the stress evaluation for the snubbers, the applicant referred to its response to RAI 107, Questions 03.09.03-13 and 03.09.03-14 and the response to RAI 178, Questions 03.09.03-19 and 03.09.03-20 where it addresses the snubbers as the linear supports which may be designed by experimental analysis or load rating methods in accordance with NF-3370 and NF-3380. The applicant noted that it does not design and manufacture snubber components; they are purchased from a qualified vendor to meet ASME Code requirements. Snubber vendors provide a certified load data sheet that states the design of its snubber meets the requirements of ASME Section III, Subsections NCA and NF. ASME Section III, Subsection NF, Paragraph NF-1214, "Standard Supports" provides guidance on the design of snubbers.

The design specifications require the snubber vendor to meet the design stress criteria of the applicable ASME Code standards. The staff notes that it is the applicant's responsibility to ensure that the vendor design of its snubbers meets the requirements of ASME Section III, Subsections NCA and NF. The applicant is request to confirm that if snubbers are designed by experimental stress analysis, they meet the provisions of Appendix II to ASME Code, Section III, Division 1, in accordance with SRP 3.9.1.II acceptance criterion.

03.09.03-24

OPEN ITEM

Follow-up to the RAI 178, Question 03.09.03-18:

In RAI 107, Question 3.9.3-4, the staff requested that AREVA commit to provide the ASME Design Specifications of risk-significant mechanical components, as a minimum, for NRC audit prior to certification. This is to ensure that the components are ready for procurement, and that the FSAR design methodologies and criteria are adequately reflected in the associated component ASME Design Specifications. For the ASME Design Reports, the staff requests that AREVA discuss in the FSAR its plan and schedule for making the design reports of EPR mechanical components available for NRC audit, e.g., through an ITAAC, to ensure that AREVA has established a procedure to verify the completion of the EPR component design.

By email letter dated December 1, 2008, AREVA states that a representative sample of the design specifications will be available for NRC inspection beginning April 1, 2009. In order for the staff to reach a reasonable assurance finding based on the requirements of 10 CFR 52.47, the staff requests the applicant make available for audit the ASME Design Specifications for all risk-significant mechanical components, not just a representative sample, prior to the certification of the U.S. EPR design.

03.09.03-25

OPEN ITEM

Follow-up to RAI 107, Question 03.09.03-10:

AREVA, in response to RAI 107, Question 03.09.03-10 stated that in accordance with SRP 3.9.3, functional and operational capability requirements apply only to active components (and their supports) such as pumps, valves, snubbers and Class 1, 2 and 3 piping components. Although design of equipment using lower ASME service limits is one acceptable method of demonstrating functional capability of the equipment, it is also acceptable to design to the service limits of ASME corresponding to the specified service condition provided operability and functionality of the component is demonstrated through additional analysis or testing or a combination of these methods. The staff agrees with the applicant response about the different methods to demonstrate the functionality of the components; however, Section 1 of the SRP Appendix A also states that the treatment of the functionality, including collapse and deflection limits, is not adequately treated by the ASME code for all situations. Such factors should therefore be evaluated and appropriate information should be developed for inclusion in the Design Specification or other referenced documents. The staff requests that the applicant include the treatment of the functionality, including collapse and deflection limits in the ASME Design Specifications that will be made available for staff audit.