ArevaEPRDCPEm Resource

From: WELLS Russell D (AREVA NP INC) [Russell.Wells@areva.com]
Sent: Thursday, February 26, 2009 1:49 PM
To: Getachew Tesfaye
Cc: Pederson Ronda M (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); SLIVA Dana (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 179, FSAR Ch 3
Attachments: RAI 179 Response US EPR DC.pdf

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 179 Response US EPR DC.pdf" provides technically correct and complete responses to 1 of the 4 questions.

The following table indicates the respective pages in the response document, "RAI 179 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 179 — 03.09.01-1	2	3
RAI 179 — 03.09.01-2	4	6
RAI 179 — 03.09.01-3	7	8
RAI 179 — 03.09.01-4	9	9

A complete answer is not provided for 3 of the 4 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 179 — 03.09.01-1.1	April 15, 2009
RAI 179 — 03.09.01-2.1a	May 15, 2009
RAI 179 — 03.09.01-4	May 15, 2009

Sincerely,

(Russ Wells on behalf of)
Ronda Pederson
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New Plants Deployment
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From: Getachew Tesfaye [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Wednesday, January 28, 2009 8:17 PM
To: ZZ-DL-A-USEPR-DL
Cc: Cheng-Ih Wu; Anthony Hsia; Jennifer Dixon-Herrity; Michael Miernicki; Joseph Colaccino; Meena Khanna;

ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 179 (1938), FSARCh. 3

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on January 19, 2009, and discussed with your staff on January 27, 2009. No changes were made to the Draft RAI Questions as a result of that discussion. 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
Sr. Project Manager
NRO/DNRL/NARP
(301) 415-3361

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 257

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Subject: Response to U.S. EPR Design Certification Application RAI No. 179, FSAR Ch 3
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MESSAGE	2460	2/26/2009 1:49:12 PM
RAI 179 Response US EPR DC.pdf	84622	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

Response to

Request for Additional Information No. 179 (1938), Revision 0

01/28/2009

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 03.09.01 - Special Topics for Mechanical Components
Application Section: 3.9.1

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

Question 03.09.01-1:

1. FSAR Tier 2, Section 3.9.1.1, "Design Transients," provides a list of the design transients and the number of cycles for the transients in FSAR Tier 2, Table 3.9.1-1. The applicant stated that the number of cycles is a conservative estimate of the magnitude and frequency of the temperature and pressure transients that may occur during plant operation. The number of design transients is based on a plant life of 60 years. The transients are defined for equipment design purposes and are not intended to represent actual operating experience. However, the applicant did not provide description of the transients. SRP 3.9.1 states that the method for determining the number of occurrences for each event is compared to the same information on similar and previously licensed applications. Any deviations from previous accepted practice are noted and the applicant should justify them. Previous accepted application defines the magnitude of these transients including temperature and pressure variations and duration. Areva is requested to:
   A. Provide a description for each the listed transient regarding the event background, involved systems, operating conditions (pressure, temperature and flow), including heat-up and cool-down rate limits,
   B. Discuss the basis for the Plant Operating Events and corresponding "number of events" listed in Table 3.9.1-1,
   C. Provide confirmation that the transients in Table 3.9.1-1 are for 60 years.
   D. Provide a summary for events relating to the unscheduled power variation, the unscheduled fluctuations at hot shutdown and the external induced transient,
   E. Discuss the basis for selecting 1 cycle for External Induced Transient, Control Rod Ejection, MFW Line Break and Main Steam Line Break,
   F. Provide the number of occurrences for each of the emergency transients.
2. Appendix S to 10CFR50 specifies that applicants include seismic events in the design basis. The applicant is requested to provide the basis to justify that the earthquakes dynamic events at the rated operating power conditions are not included in Table 3.9.1-1.
3. The dynamic fluid loads due to the turbine stop valve closure are more severe than the main steam isolation valve closure induced loads that are listed in Table 3.9.1-1. Discuss the basis for not including the turbine stop valve closure induced loads in FSAR Section 3.9.1.
4. NRC Bulletin 79-13 addressed the fatigue loading due to thermal stratification and high cycle thermal striping during low flow emergency feedwater injection. Bulletin 88-08 and its supplements indicates that during low feed water flow stratification flow conditions can result in significant differences in thermal fatigue cycles that have resulted in failures of the feedwater piping pressure boundary in PWR. Bulletin 88-11 requires consideration of the effects of thermal stratification on the pressurizer surge line dynamic loads. Discuss the basis for not considering the thermal stratification in Section 3.9.1.1, which is an important design transient in design of piping.
5. Discuss the vibration effects on the components and piping due to Acoustic Resonance in accordance with the NRC Regulatory Guide 1.20, Revision 3. Provide the basis for not including this acoustic cyclic loading in the design transients for EPR FSAR.

Response to Question 03.09.01-1:

1. A response to this question will be provided by April 15, 2009.
2. U.S. EPR FSAR Tier 2, Table 3.9.1-1 provides a summary of thermal design transients. The seismic design basis is addressed in U.S. EPR FSAR Tier 2, Section 3.7.1, Section 3.7.2, and Section 3.7.3. The Final Safety Evaluation Report (FSER) for Topical Report ANP-10264NP-A, 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 U.S. EPR 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 (SSC).
3. AREVA NP does not understand the basis to support the NRC statement that "The dynamic fluid loads due to the turbine stop valve closure are more severe than the main steam isolation valve closure induced loads." U.S. EPR FSAR Tier 2, Section 10.2.1 states that turbine stop valves are designed to turbine generator supplier standards. Further, AREVA has not been able to identify a precedent in which the NRC has requested a design certification applicant to provide such information.
4. U.S. EPR FSAR Tier 2, Section 3.12.5.10 addresses thermal stratification for the pressurizer (PZR) surge line (SL), 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. Also see the Response to RAI No. 48, Question 03.06.03-3 and Question 03.06.03-4 for more information on thermal stratification of the PZR SL.
5. The requested information is provided in U.S. EPR FSAR Tier 2, Section 3.9.2, which also addresses conformance with RG 1.20. Additional information is provided in the Response to RAI 160, Question 03.09.02-17.

FSAR Impact:

1. A response to this question will be provided by April 15, 2009.
2. The U.S. EPR FSAR will not be changed as a result of this question.
3. The U.S. EPR FSAR will not be changed as a result of this question.
4. The U.S. EPR FSAR will not be changed as a result of this question.
5. The U.S. EPR FSAR will not be changed as a result of this question.

Question 03.09.01-2:

1) In accordance with SRP 3.9.1, provide a list of all computer programs used for generating hydraulic forcing functions and performing structural analyses including preprocessors and postprocessors which are listed in FSAR Section 3.9.1, Appendix 3C, and in the Topical Report ANP-10264NP Section 5.1.

    a. The information should contain: 1) The author, source, dated version and facility, 2) The extent and limitation of its application, and 3) The method used to demonstrate its applicability and validity.

    b. Confirm that the analyses of pipe supports were performed using the computer code GT STRUDL, which is not found in the EPR FSAR.

2) 10 CFR Part 50, Appendix B requires provisions to assure that appropriate standards are specified and included in design documents including design methods and computer programs for the design and analysis of Seismic Category I, ASME Code Class 1, 2, 3, and core support structures and non-Code structures. Areva is requested to confirm that the computer programs used for EPR design and listed in FSAR Section 3.9.1.1, Appendix 3C and Topical Report ANP-10264NP Section 5.1, Computer Codes, are in compliance with requirements of Appendix B to 10CFR50 and ASME NQA-1. Confirm that the documentation of these computer programs is available for staff review. The information should include the author, source code, dated version, and facility; the program users manual and theoretical description, the extent and limitation of the program application; and the benchmarking problems, the QA control and maintenance of the program.

3) For applicability of the computer code BWSPAN, the applicant stated that the use of BWSPAN for Class 1 RCL analysis has previously been approved by the NRC, see letter David E. LaBarge (NRC) to W.R. McCollum, Jr. (Duke Energy Corporation), Oconee Nuclear Station, Units 1, 2 and 3 Re: Reactor Coolant Loop Analysis Methodology for Steam Generator Replacement, dated September 6, 2001. This reference letter contains an SE in which the staff evaluated the Steam Generator replacement analysis for Oconee, but did not review the BWSPAN computer code. The applicant is requested to provide a summary of the verification and validation for this program including benchmark problems.

4) Regarding the qualification of the SUPERPIPE computer program, the applicant indicated that the previous versions were approved by the NRC as shown in previous license applications including the Catawba Nuclear Station (CNS UFSAR, Rev. 12, Table 3-68) and the System 80+ Design Certification (NUREG-1462, Section 3.12.3). The applicant is requested to provide the dates and version number of the current version which was used for the design of EPR components and piping.

5) In EPR DC Appendix 3C, there are computer codes requiring the verification against the results from the analysis of a sample problem to the classical solution of the sample problem, each time they are executed. Explain the reason why it is required to run a sample problem each time the computer code is used. Confirm whether the results of the sample problem runs are documented in the calculation. Also, discuss how the quality assurance requirements will be satisfied for not using an executable file.

6) Identify the computer programs which were used to perform the fatigue analysis. Confirm that the analyses for ASME Section III Class 1 components and piping for the fatigue evaluation include environmental effects in accordance with Regulatory Guide 1.207. .

7) 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.

Response to Question 03.09.01-2:

1. a. A response to this question will be provided by May 15, 2009.

   b. Information on the computer code GT STRUDL, including marked-up pages to the U.S. EPR FSAR, was provided in the Response to RAI 107, Question 03.06.02-5.

2. The AREVA NP Quality Assurance Plan (QAP) for Design Certification of the U.S. EPR Topical Report ANP-10266A, (which has been approved by the NRC), Section 2.1.1, "Scope," states: "The QAP assures that activities affecting quality are accomplished under suitably controlled conditions. It also provides for the development, control, and use of computer programs." Additionally, Topical Report ANP-10266A, Section 3.6.2, Design Control states: "Computer programs used for design analyses are certified or verified and validated as appropriate." Accordingly, the computer codes listed in the U.S. EPR FSAR sections in this question are subject to the requirements of ANP-10266A, which complies with the requirements of 10 CFR 50 Appendix B and the guidance of ASME NQA-1. As noted in Section 3.3.1 of the NRC Final Safety Evaluation Report (FSER) for ANP-10264NP-A and U.S. EPR FSAR Tier 2, Section 3.9.1, the following information on computer codes is available for NRC inspection: author, source, version date, program description, extent, and limitation of the program application, and code solutions to the test problems.

3. In Section 3.3.1 of the NRC Final Safety Evaluation Report (FSER) for Topical Report ANP-10264NP-A, the NRC approved the use of the BWSPAN computer code for the U.S. EPR and specifically accepted the referenced Oconee reactor coolant loop (RCL) analysis methodology for steam generator (SG) replacement as part of the basis for their approval.

4. In Section 3.3.1 of the NRC FSER for Topical Report ANP-10264NP-A, the NRC approved the use of the SUPERPIPE computer code for the U.S. EPR design certification. As noted in Section 3.3.1 of the FSER for ANP-10264NP-A, the requested information is available for NRC inspection.

5. The computer programs described in U.S. EPR FSAR Tier 2, Appendix 3C are verified per the AREVA NP QAP in accordance with the requirements of 10 CFR 50 Appendix B (see the Response to Item 2 above). The internally developed software programs have verification documents which consist of test cases the users are required to perform each time the program is used. For some programs, these test cases are classical textbook solutions. The purpose of running these test cases is to perform an additional check for computer-based codes and to demonstrate that computers with different hardware configurations do not adversely affect the performance of the program.

6. Computer codes ANSYS, BWSPAN, and SUPERPIPE are used to perform the fatigue analysis for ASME Code Class 1 piping and components. As noted in U.S. EPR FSAR Tier 2, Section 3.12.5.19, 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.

7. 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.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 03.09.01-3:

EPR FSAR Tier 2, Section 3.9.1.3, "Experimental Stress Analysis," indicates that experimental stress analysis is not used to evaluate stresses for Seismic Category I components and supports. The applicant is requested to discuss the stress analysis methods used to verify the design adequacy for the design of EPR components consisting of piping seismic snubbers, pipe whip restraints, and the prototype fine motion control rod drive.

Response to Question 03.09.01-3:

U.S. EPR FSAR Tier 2, Section 3.9.3 describes the analytical methods used to evaluate stresses for Seismic Category I systems and components subjected to faulted condition loading. Information related to the design of snubbers is provided in the Response to RAI 107, Question 03.09.03-13 and Question 03.09.03-14 and in the Response to RAI 178, Question 03.09.03-19 and Question 03.09.03-20. (Note that the U.S. EPR design does not have a prototype fine motion control rod drive as stated in the question.)

Pipe whip restraint structures are designed using elastic and elastic-plastic methodologies in accordance with the guidance in SRP 3.6.2. The methodologies and approaches in ASCE Manual No. 58 (Reference 1) are used to determine the pipe whip motions using the time history method, the energy balance method, or the elastic load factor method. Reference 1 is also used when evaluating the whip restraint structure for the impact and impulse loads applied by the pipe. In cases where elastic-plastic analysis of the restraint structure is performed, the maximum ductility ratio is limited to 50 percent of the total energy absorption capability of the structure.

During a January 27, 2009 discussion with the NRC staff regarding this question, the NRC staff stated that if experimental stress analysis methods are not used, then AREVA NP needs to provide justification for not using these methods. This position appears to AREVA to be contrary to the guidance cited below, which indicates that justification is needed if experimental analysis methods <u>are</u> used:

Specifically, RG 1.206 3.9.1.3 states:

> "If the applicant uses experimental stress analysis methods in lieu of analytical methods for seismic Category I ASME Code and non-ASME Code items, it should provide sufficient information to show the validity of the design."

SRP 3.9.1 states:

> "To meet the requirements of GDCs 1, 14, and 15, if experimental stress analysis methods are used in lieu of analytical methods for any seismic Category I Code or non-Code items, the section of the SAR addressing the experimental stress analysis methods is acceptable if the information meets the provisions of Appendix II to ASME Code, Section III, Division 1 and, as in the case of analytical methods, if the information is sufficiently detailed to show the design meeting the provisions of the Code-required 'Design Specifications'."

Further, the NRC Final Safety Evaluation Report (FSER) for Topical Report ANP-10264NP-A notes that experimental stress analysis methods are not planned to be used to design piping for the U.S. EPR.

References for Question 03.09.01-3:

1. ASCE Manual No. 58, Structural Analysis and Design of Nuclear Plant Facilities, Committee on Nuclear Structures and Materials, ASCE, 1980.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 03.09.01-4:

1) For each of the components, supports, core support structures, and RPV vessel listed in Section 3.9.3, describe the computer program that was used to evaluate the stresses for determining that the ASME Section III, Appendix F, limits were met.
2) Identify the components evaluated in Section 3.9.3 where the inelastic Service Level D limits were met under the faulted condition loads and load combinations in Table 3.9.3-1.

Response to Question 03.09.01-4:

A response to this question will be provided by May 15, 2009.