AREVAEPRDCPEm Resource

From:	WELLS Russell D (AREVA NP INC) [Russell.Wells@areva.com]
Sent:	Monday, April 19, 2010 6:17 PM
To:	Tesfaye, Getachew
Cc:	BRYAN Martin (EXT); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC)
Subject:	Response to U.S. EPR Design Certification Application RAI No. 368, FSAR Ch 6
Attachments:	RAI 368 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 368 Response US EPR DC.pdf," provides technically correct and complete responses to 3 of the 23 questions.

The following table indicates the respective pages in the response document, "RAI 368 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

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A complete answer is not provided for 20 of the 23 questions. The schedule for a technically correct and complete response to these questions is provided below. Some of the response dates are subject to change based on anticipated feedback from the NRC staff regarding prioritization of responses. AREVA NP plans to discuss the response schedule with the NRC staff during an April 30, 2010, meeting.

Question #	Response Date
RAI 368 — 06.02.01-58	June 9, 2010
RAI 368 — 06.02.01-59	June 9, 2010

RAI 368 — 06.02.01-60	June 9, 2010
RAI 368 — 06.02.01-61	July 8, 2010
RAI 368 — 06.02.01-62	August 5, 2010
RAI 368 — 06.02.01-63	July 8, 2010
RAI 368 — 06.02.01-64	July 8, 2010
RAI 368 — 06.02.01-65	June 9, 2010
RAI 368 — 06.02.01-66	August 5, 2010
RAI 368 — 06.02.01-67	August 5, 2010
RAI 368 — 06.02.01-68	August 5, 2010
RAI 368 — 06.02.01-69	August 5, 2010
RAI 368 — 06.02.01-70	July 8, 2010
RAI 368 — 06.02.01-71	July 8, 2010
RAI 368 — 06.02.01-73	July 8, 2010
RAI 368 — 06.02.01-76	July 8, 2010
RAI 368 — 06.02.01-77	June 9, 2010
RAI 368 — 06.02.01-78	July 8, 2010
RAI 368 — 06.02.01-80	July 8, 2010
RAI 368 — 06.02.01-81	July 8, 2010

Sincerely,

(Russ Wells on behalf of)
Martin (Marty) C. Bryan
Licensing Advisory Engineer
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From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Friday, March 19, 2010 4:08 PM
To: ZZ-DL-A-USEPR-DL
Cc: Jensen, Walton; Jackson, Christopher; Snodderly, Michael; Carneal, Jason; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 368 (4344), FSARCh. 6

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on February 9, 2010, and discussed with your staff on March 4, 2010. Drat RAI Question 06.02.01-79 was deleted, and Draft RAI Questions 06.02.01-61, 06.02.01-72, 06.02.01-73, and 06.02.01-78 were modified 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: 1323

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Response to

Request for Additional Information No. 368(4344), Revision 1

3/19/2010

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 06.02.01 - Containment Functional Design
Application Section: 06.02.01

QUESTIONS for Containment and Ventilation Branch 1 (AP1000/EPR Projects) (SPCV)

Question 06.02.01-58:

From ANP-10299P Rev. 2 Table 12-21, the staff notes that several of the significant pie groups were not scaled well between the US-EPR containment and HDR containment test ISP-23 HDR/T31.5. For those pie groups which were found to have a high or medium significance and a high or medium distortion between US-EPR and HDR, provide justification that the US-EPR GOTHIC containment model is adequately representing the phenomena represented by these pie groups.

Response to Question 06.02.01-58:

A response to this question will be provided by June 9, 2010.

Question 06.02.01-59:

The response to RAI 221 06.02.01-46 states that for hot leg breaks the ECCS configuration in Technical Report ANP-10299P, Section 8.1.4, will be modified to incorporate the impact of the transition to hot leg injection, which will result in a reduction of pumped ECCS to the cold legs. The ECCS configuration in the hot leg break scenario will consider that ECCS will be aligned to the hot legs at 3600 seconds and spill out the break; only the medium head safety injection (MHSI) and a portion of the low head safety injection (LHSI) will be delivered to the cold legs for core cooling. When will these modifications to ANP-10299P be done and presented to the staff? What are assumptions for the hot leg injection water after it spills from the break? Does it mix in the containment atmosphere or is it spilled on the containment floor? Is this done in RELAP5-BW or in GOTHIC portion of the mass and energy release analysis?

Response to Question 06.02.01-59:

A response to this question will be provided by June 9, 2010.

Question 06.02.01-60:

The response to RAI 221 06.02.01-46 states that for hot leg breaks the transition time between RELAP5/MOD2-BW and GOTHIC will be made when the reactor coolant system (RCS) reaches a quasi-steady state condition which can be modeled in GOTHIC as a boiling pot but that the time will be before HLI at 3600 seconds. What criteria must be met to determine that a quasi-steady state condition occurs? What if these conditions are not met before 3600 seconds?

Response to Question 06.02.01-60:

A response to this question will be provided by June 9, 2010.

Question 06.02.01-61:

The response to RAI 221, Question 06.02.01-46 states that the configuration for a cold leg pump discharge break limits the delivery of coolant to the loops seal piping because of a virtual weir in the U.S. EPR reactor coolant pump design that rises above the top of the cold leg piping. As a result of the weirs, the loop seals will not form as early in the CLPD scenario as for a CLPS break. For this reason the transition from RELAP5/MOD2-BW to GOTHIC for the discharge breaks can be as late as 3600 seconds coincident with the initiation of hot leg injection. Provide the supporting data and evaluation to justify the later formation of loop seals for postulated CLPD breaks given the chugging nature of the coolant flow in cold legs predicted by RELAP5-BW.

Response to Question 06.02.01-61:

A response to this question will be provided by July 8, 2010.

Question 06.02.01-62:

The response to RAI 221 06.02.01-46 states that as the break size decreases, the dynamics of the RCS changes and input considerations such as the partial cooldown of the steam generators, loop seal formation, and hot leg injection have a significant impact on the containment response. The response states that methods and inputs will be evaluated individually for each break to verify a conservative pressure and temperature response. Describe how these methods and inputs are evaluated as a function of break size and justify that the process yields conservative results. Describe how partial cooldown of the steam generators, loop seal formation and hot leg injection are evaluated for small breaks. Provide and justify the nodding used in the RELAP5-BW model for small break LOCA if different from that presented in ANP-10299P. Provide and justify the GOTHIC model used to calculate long term mass and energy release and describe and justify the criteria that are used in switching between the reactor system models.

Response to Question 06.02.01-62:

A response to this question will be provided by August 5, 2010.

Question 06.02.01-63:

Section 9 of ANP-10299P Rev 2 describes the application of the LOCA mass and energy release methodology described in Section 8 to a double-ended guillotine break in the cold leg pump suction piping. Descriptions of the RELAP5-BW nodding and the 1200 second time for switching between the RELAP5-BW model and the GOTHIC mass and energy model are described in Section 9. FSAR Table 6.2.1.1 lists LOCA break sizes and locations that were analyzed for US-EPR. Identify which of these analyses were done using assumptions consistent with those of ANP-10299P Sections 8 and 9. For those which were not, describe what assumptions that were used. Justify that sufficient break sizes have been analyzed using the ANP-10299P methodology including the multi-nodded GOTHIC containment model, that the limiting break size at each location has been identified.

Response to Question 06.02.01-63:

A response to this question will be provided by July 8, 2010.

Question 06.02.01-64:

For the LOCA Mass and Energy release cases for which off site power was assumed to be present, describe the assumptions that were used for tripping the reactor coolant pumps during the course of the accident analysis.

Response to Question 06.02.01-64:

A response to this question will be provided by July 8, 2010.

Question 06.02.01-65:

FSAR Section 6.2.1.3 states that the containment pressure for the containment M&E release matched the predicted GOTHIC containment pressure profile. Discuss how this was done for the portions the calculations for which containment pressure is input into RELAP5-BW.

Response to Question 06.02.01-65:

A response to this question will be provided by June 9, 2010.

Question 06.02.01-66:

FSAR Section 6.2.1.3 describes the various break locations that were analyzed to include a double ended break of the pressurizer surge line inside the pressurizer compartment. This evaluation was stated to be used in the design of 6 safety related pressurizer doors. The methodology for evaluating the mass and energy release from this break was not included in the discussions. Describe this methodology and justify that conservative assumptions were used.

Response to Question 06.02.01-66:

A response to this question will be provided by August 5, 2010.

Question 06.02.01-67:

Describe the location of the 6 safety doors in the containment. Provide the elevation of the doors; identify neighboring compartments, including the size of compartments the doors connect to. Describe how the doors are represented in the GOTHIC calculations. Discuss appropriateness of the code representation.

Response to Question 06.02.01-67:

A response to this question will be provided by August 5, 2010.

Question 06.02.01-68:

Provide a diagram of the GOTHIC model that was used to size the six pressurize doors. Provide the results of the containment analysis that was used to size the doors.

Response to Question 06.02.01-68:

A response to this question will be provided by August 5, 2010.

Question 06.02.01-69:

Was the rupture of other high energy lines in the pressurizer compartment beside the surge line evaluated? What would be the effect of a break of a spray line at the top of the pressurizer compartment? Provide the methodology used in these analyses justification that these analyses are conservative.

Response to Question 06.02.01-69:

A response to this question will be provided by August 5, 2010.

Question 06.02.01-70:

Provide the safety related requirements that the 6 safety related pressurizer compartment doors will be designed to meet. Provide the results from the testing programs that show that the pressurizer doors are adequately qualified. If this testing has not been completed, provide the schedule when the results of the testing program will be presented to the NRC staff.

Response to Question 06.02.01-70:

A response to this question will be provided by July 8, 2010.

Question 06.02.01-71:

Provide ITAAC and technical specification requirements for the safety related pressurizer compartment doors.

Response to Question 06.02.01-71:

A response to this question will be provided by July 8, 2010.

Question 06.02.01-72:

Acceptable mitigation of the containment consequences of LB-LOCA depends on manual action by plant operators. The operators need to initiate hot leg injection within a time window. Provide the actions which the operators must take to perform this function. When are they to begin these actions and on what control room signal? How much time is available for completion of hot leg injection before the calculated containment pressure exceeds the design pressure of the containment? Will the operators be reminded that this function must be completed within a time period?

Response to Question 06.02.01-72:

To initiate hot leg injection, the operator must perform the following actions:

- Closing the low head safety injection (LHSI) main containment isolation valves (CIVs) outside the Reactor Building (RB) to reduce the LHSI cold leg injection flow.
- Opening the isolation valves of the connection line between the LHSI discharge line and the reactor coolant system (RCS) hot leg suction line outside the containment.
- Opening the first and second reactor coolant pressure boundary (RCPB) isolation valves of the RCS hot leg suction line inside the containment.

When the operator receives a loss of subcooling margin alarm, this provides the first indication that hot leg injection may be necessary. A second indication that hot leg injection may be necessary occurs when the RCS pressure is less than 289.7 psia and the permissive P16 is present in the control room. Guidance will be provided by the emergency operating procedures (EOPs) to instruct the operator to initiate hot leg injection when conditions mandating hot leg injection are present. These conditions include criteria such as:

- Continued loss of subcooling margin.
- Reactor coolant pumps (RCPs) not running.
- Time-specific criteria to limit.
  - Containment pressure.
  - Boron precipitation.

The time available to reach containment design pressure due to a loss of coolant accident (LOCA) depends on the size of the break. The bounding calculations with respect to the containment pressure response show that for a double-ended guillotine break in the cold leg pump suction, the switchover to hot leg injection must be performed within one hour to preclude exceeding the containment design pressure.

The indications in the control room for this bounding case when hot leg injection may be necessary (e.g., loss of core exit subcooling margin and permissive P16 present) are present within the first few minutes of the design basis accident. For the bounding containment pressure case, the operator will have one hour to complete the switchover to hot leg injection.

Plant operators will be trained and qualified in the emergency procedures to initiate hot leg injection within the timeframe required to satisfy safety analysis assumptions.

FSAR Impact:

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

Question 06.02.01-73:

As part of RAI 209 the staff requested that AREVA demonstrate that the nodding detail of the multi-node GOTHIC simulation of the US-EPR containment is adequate to:

A. model the effects of containment stratification. (The concern is for both temperature and non-condensibles. Containment stratification is an issue for postulated MSLBs high in containment.)

B. not produce artificial circulation patterns as discussed Section 22.10 of the GOTHIC Users Manual, NAI 8907-02 Rev. 17, January 2006.

The staff could not find this information in AREVA's response and requests that it be provided.

Response to Question 06.02.01-73:

A response to this question will be provided by July 8, 2010.

Question 06.02.01-74:

The staff could not find the response to RAI#221 06.02.01-38b concerning ITAAC and flow split for LHSI during hot leg injection. When will this response be provided?

Response to Question 06.02.01-74:

The Response to RAI 212, Question 06.03-11, Part d provided ITAAC that includes a minimum hot leg injection acceptance criterion in U.S. EPR FSAR Tier 1, Section 2.2.3 and Table 2.2.3-3.

FSAR Impact:

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

Question 06.02.01-75:

Provide the schedule for when safety related qualification results for the containment foils and dampers will be presented for NRC staff review.

Response to Question 06.02.01-75:

Qualification testing and the documentation of test results for the containment foils and dampers are part of the equipment selection and procurement process. These activities continue beyond design certification.

FSAR Impact:

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

Question 06.02.01-76:

FSAR, Revision 2 – Interim indicates that a conservative insertion of negative reactivity was used. Section 3.3.1 of ANP-10299P Rev. 2 states that for DEG LBLOCA control rods are not credited for reactor shutdown. If control rod insertion is credited for other break sizes; provide, the control rod shutdown curve used for LOCA analysis. Compare this curve with the equivalent curve used in Chapter 15 of the FSAR for plant safety analysis. Explain differences, if any.

Response to Question 06.02.01-76:

A response to this question will be provided by July 8, 2010.

Question 06.02.01-77:

Provide detailed results of one of the DEG MSLB calculations in the accessible area. The results should include: pressure and temperature history, flow rates in various flow path, heat transfer to major heat sinks, concentration of non-condensable gases at selected locations. Discuss observed flow patterns, non-condensable distributions, temperature stratification, local heat transfer and energy deposition to major heat sinks.

Response to Question 06.02.01-77:

A response to this question will be provided by June 9, 2010.

Question 06.02.01-78:

FSAR, Revision 2-Interim states that MSLBs were analyzed using RELAP5-BW and using GOTHIC Version 7.2b. The FSAR provides insufficient information on how this was done. Analytical models for containment analysis of LOCAs are discussed in Technical Report ANP-10299. Provide the equivalent information for modeling MSLB accidents. Table 6.2.1-2 of the FSAR presents 43 MSLB cases which were analyzed. Did all cases use the same computer model? If there were differences, please explain.

Response to Question 06.02.01-78:

A response to this question will be provided by July 8, 2010.

Question 06.02.01-80:

Provide the temperature envelope to be used for Equipment Qualification. Cover all postulated MSLBs including those that exhibit a return to power.

Response to Question 06.02.01-80:

A response to this question will be provided by July 8, 2010.

Question 06.02.01-81:

FSAR, Revision 2-Interim indicates that due to negative moderator and Doppler temperature coefficients the cooldown of the RCS might be sufficient to insert positive reactivity in excess of inserted control rod shutdown worth. Provide the control rod shutdown worth curve used for MSLB events in containment analysis. Compare this curve with the equivalent curve used for MSLB analysis in Chapter 15 of the FSAR. Explain differences, if any.

Response to Question 06.02.01-81:

A response to this question will be provided by July 8, 2010.