ArevaEPRDCPEm Resource

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Sent: Tuesday, February 09, 2010 3:26 PM
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Subject: Draft - U.S. EPR Design Certification Application RAI No. 368 (4344), FSAR Ch. 6
Attachments: Draft RAI_368_SPCV_4344.doc

Attached please find draft RAI No. 368 regarding your application for standard design certification of the U.S. EPR. If you have any question or need clarifications regarding this RAI, please let me know as soon as possible, I will have our technical Staff available to discuss them with you.

Please also review the RAI to ensure that we have not inadvertently included proprietary information. If there are any proprietary information, please let me know within the next ten days. If I do not hear from you within the next ten days, I will assume there are none and will make the draft RAI publicly available.

Thanks,
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Email Number: 1133

Mail Envelope Properties (0A64B42AAA8FD4418CE1EB5240A6FED10E0E7B4299)

Subject: Draft - U.S. EPR Design Certification Application RAI No. 368 (4344), FSAR Ch. 6
Sent Date: 2/9/2010 3:26:23 PM
Received Date: 2/9/2010 3:30:55 PM
From: Tesfaye, Getachew

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Post Office: HQCLSTR02.nrc.gov

Files	**Size**	**Date & Time**
MESSAGE	737	2/9/2010 3:30:55 PM
Draft RAI_368_SPCV_4344.doc	49658	

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

Draft

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

2/9/2010

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)

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.

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?

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?

06.02.01-61

The response to RAI 221 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 analyses 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. Provide analyses of the consequences if loop seals formed at the time assumed for CLPS breaks.

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 noding 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.

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 noding 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-noded GOTHIC containment model, that the limiting break size at each location has been identified.

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.

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.

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 surgeline 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.

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.

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.

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.

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.

06.02.01-71

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

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. Discuss the Emergency Procedures which instruct the operators to perform this function. When are they supposed to perform this function? How much time is available for completion of hot leg injection before the calculated containment pressure exceeds the design pressure of the containment? Are the operators reminded that this function must be completed within a time period?

06.02.01-73

As part of RAI 209 the staff requested that AREVA demonstrate that the noding detail of the multi-node GOTHIC simulation of the US-EPR containment is adequate to model the effects of containment stratification and to demonstrate that the noding arrangement does 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.

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?

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.

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.

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.

06.02.01-78

FSAR, Revision 2-Interim states that MSLBs were analyzed with GOTHIC Version 7.2b. The FSAR provides no information on how this was done for the U.S. EPR containment modeled by the GOTHIC code. Modeling of the containment for LOCAs is discussed in Technical Report ANP-10299. Provide the equivalent information for modeling the U.S. EPR containment for MSLB accidents. Justify that the model has the capability to predict expected temperature and non-condensable stratifications within the containment. 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.

06.02.01-79

FSAR, Revision 2-Interim states that the most severe active failure in case of MSLBs is failure of an MSIV on the main steamline of the effected steam generator. Explain how this conclusion was reached relative to the failure of a MSRCV on one of the unaffected steamlines. Please provided MSLB analyses with an assumed MSRCV failure as the single failure. In the FSAR please include a description of how the limiting single faiure was determined.

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.

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.