ArevaEPRDCPEm Resource

From: Tesfaye, Getachew
Sent: Tuesday, September 22, 2009 1:16 PM
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Cc: Jensen, Walton; Ashley, Clinton; Jackson, Christopher; Hammer, Charles; Terao, David; Carneal, Jason; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: Draft - U.S. EPR Design Certification Application RAI No. 297 (3759,3719,3775), FSAR Ch. 6
Attachments: Draft RAI_297_CPCV_3759_3719_CIB1_3775.doc

Attached please find draft RAI No. 297 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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Hearing Identifier: AREVA_EPR_DC_RAIs
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Request for Additional Information No. 297 (3759, 3719, 3775), Revision 0

9/22/2009

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 06.02.01 - Containment Functional Design
SRP Section: 06.02.02 - Containment Heat Removal Systems
Application Section: FSAR Chapter 6

QUESTIONS for Containment and Ventilation Branch 1 (AP1000/EPR Projects) (SPCV)
QUESTIONS for Component Integrity, Performance, and Testing Branch 1 (AP1000/EPR Projects) (CIB1)

06.02.01-49

The NRC staff realizes that the design of some of the safety related systems used to mitigate containment overpressure is not complete. When the design of these systems is completed, provide an evaluation of potential common mode failure such that a single failure might compromise the safety functions of the several systems used to mitigate accidents. Consider the ECCS, CONVECT system, partial cooldown function, main feedwater and main steam line isolation, the RPS and any other safety related systems used to mitigate the event.

06.02.01-50

In RAI 203 question 06.02.01-13 the NRC staff requested in tabular form for the US-EPR containment analysis in ANP-10299P: 1) the steam flow rate and enthalpy leaving each side of the break and liquid flow rate and enthalpy leaving each side of the break; and 2) the containment atmospheric pressure and temperature and IRWST temperature as a function of time. This information was provided by AREVA but the calculation has been revised as described in ANP-10299P Revision 1. Provide this information for the revised calculation.

06.02.01-51

The U.S. EPR FSAR presents two sets of MSLB analyses, one in Chapter 6 and one in Chapter 15. The Chapter 6 calculations are part of containment analysis, while the Chapter 15 calculations are mainly to evaluate core performance and radioactive material release. Chapter 6 addresses a break inside containment, Chapter 15 a break outside containment. The assumed single failures are also different. The Chapter 15 analysis shows that the reactor returns to power due to more severe cooldown, since 2 steam generators are blowing down. No return to power was indicated in the Chapter 6 analysis.

With postulating failure of a Main Steam Relief Control Valve (MSRCV) as the single failure in case of a MSLB inside containment, the core would return to power increasing heat input to the containment. On the other hand, the MSRCV is outside containment, energy removed through the blowdown of the second steam generator would be transferred to the atmosphere, not the containment. This is a compensating effect. The combined effect on containment pressure is not known.

Perform a containment analysis for MSLB inside containment with an assumed MSRCV failure as the single failure. Run the case that resulted in the highest return to power in Chapter 15 but assuming that the break flow enters the containment. The calculations should be run until steam flow to the containment ceases. Show that the results meet all applicable containment related requirements.

06.02.01-52

In an SER concerning reload of AREVA fuel into the North Anna Power Station (ML040370390), the staff concluded that AREVA methodology for calculating minimum containment back pressure using the ICECON code could be accepted if it is shown to be conservative for each case. For US-EPR provide a benchmark showing that, for the limiting large break LOCA analyzed of FSAR Chapter 15, the ICECON methodology is conservative compared with a best estimate analysis using the AREVA multi-node GOTHIC model. The same mass and energy releases should be input into both ICECON and GOTHIC.

06.02.02-37

AREVA's proposed Debris Generation Analysis provides the basis for selecting the volume of Microtherm insulation debris, generated by the postulated break, as 'discussions with vendors'. RG 1.82 indicates that the volume of debris contained within the ZOI should be used to estimate the amount of debris generated by a postulated break. Provide justification that the alternate method proposed to select the volume of Microtherm is conservative in comparison to the ZOI methodology. Also, AREVA indicates that Microtherm is a fibrous source term. NUREG/CR 6808 section 2.2 indicates Microtherm is a particulate insulation. What are the characteristics of Microtherm (type, size, shape, density etc.) that AREVA assumes in the analysis?

06.02.02-38

AREVA's proposed Debris Generation Analysis calculates the amount of fiber debris due to small diameter piping (1/2” diameter piping). The calculation assumes a certain number of small diameter pipes are present in the ZOI. Provide the basis for the assumed number of small diameter pipes in the ZOI. In addition, the number of pipes assumed is described as 10 pipes or 30 lengths. The calculation uses 10. How are these numbers related or which number is correct?

06.02.02-39

ANP-10293 report section 3.1.1.5 lists the strainer submergence at approximately 5 feet of water post-LBLOCA. AREVA RAI response to Question 06.02.02-8 H12 indicates the strainer submergence is approximately 2.1 feet under loss of coolant accident conditions. What is the

correct minimum submergence of the strainer under loss of coolant accident conditions? In addition, given that submergence levels may be less than the strainers design basis head loss, provide a summary of the methodology, assumptions, and results used to determine if flashing would occur across the strainer surface.

06.02.02-40

AREVAs' response to Question 06.02.02-8 H12 suggests that strainer submergence may be less than design basis head loss (2.2 psi @ 104F per ANP-10293). If strainer submergence is less than the design basis head loss some deaeration of the fluid as it passes through the debris bed may occur. Air ingestion due to deaeration is a plant specific or load specific issue. Therefore, AREVA is requested to assess the potential for US EPR sump fluid to undergo deaeration. If deaeration is predicted to occur, assess the impact on required NPSH and explain how the testing considers this phenomenon.

06.02.02-41

Provide the methodology and acceptance criteria for evaluating the ex-vessel downstream components for conservatively-determined debris load in the recirculation fluid. Since the specific ex-vessel downstream components (e.g., pumps, valves, seals, heat exchangers) have not yet been selected or designed for specific EPR plants, the staff will base its findings regarding their ability to adequately perform their safety functions for the required mission time on a review of the applicable evaluation methods and acceptance criteria. For operating U.S. PWRs, the evaluations of specific downstream components for wear and plugging for conservatively-determined debris-laden recirculation water are based on approved methods and acceptance criteria that are then applied to plant-specific components. In response to RAI No. 111 6.02.02-10 and RAI No. 111 6.02.02-11, AREVA stated that the assessments of specific downstream components for wear and plugging would be addressed by the equipment vendors. An audit of available safety injection system design calculations on April 23, 2009, did not reveal any methods or criteria for evaluating specific components. Also, in a discussion with AREVA at a public meeting on July 8, 2009, AREVA indicated that downstream sampling of test recirculation fluid would be input to vendor specifications and that the vendors would then qualify the equipment for the fluid debris and mission time. However, tests that maximize the head loss across the strainer may not maximize the debris that passes downstream, and there was no specific methodology and acceptance criteria provided at the meeting for the various possible component materials and configurations. In addition, because the specific components will be evaluated at a time after design certification, please provide an ITAAC for verifying that this activity has been adequately performed.

06.02.02-42

Address the effects of debris-laden post-LOCA recirculation fluid conditions on the heat exchanger fouling factors. In RAI No. 82 6.02.02-1a, the staff requested that AREVA justify the fouling factors used in the LHSI heat exchangers. In response, AREVA characterized the fouling factors as “typical” and stated that the fouling factors can be monitored with available systems information. In RAI No. 266 6.02.02-33, the staff further requested that AREVA demonstrate that the fouling factors used in the containment analysis conservatively represent those that will be present over the life of the plant. In response to this RAI, please address the

following additional consideration. The fouling factors that can be monitored with available systems information reflect only the normal degradation of heat transfer by the heat exchangers for normally occurring decay heat removal fluid conditions and would not reflect the greater degradation that might occur during debris-laden post-LOCA fluid conditions. For example, the thermal properties of the debris-laden recirculation water may be different, and the water will contain various suspended solid debris and dissolved chemicals that may deposit on heat transfer surfaces.