ArevaEPRDCPEm Resource

From: Tesfaye, Getachew
Sent: Friday, April 23, 2010 9:41 AM
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Cc: Jensen, Walton; Peng, Shie-Jeng; Hayes(NRO), Michelle; Ashley, Clinton; Jackson, Christopher; McKirgan, John; Carneal, Jason; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 378 (4409,4513,4490), FSAR Ch. 6
Attachments: RAI_378_SPCV_4409_4513_4490.doc

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on March 17, 2010, and discussed with your staff on April 13 and 16, 2010. Drat RAI Questions 06.02.01-87 and 06.02.01-89 were modified as a result of those discussions. 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,
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Hearing Identifier: AREVA_EPR_DC_RAIs
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Request for Additional Information No. 378(4409, 4513, 4490), Revision 2

4/23/2010

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
SRP Section: 06.02.03 - Secondary Containment Functional Design

Application Section: 06.02.

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

06.02.01-82

FSAR Rev. 2 interim Section 6.2.1.4.1 lists SG fluid inventory among the significant parameters which must be considered in determining the M&E release following a MSLB. Provide the steam generator inventory which was used in the analyses as function of power level, describe how these inventories were determined, address how these values were made to conservative for containment analysis and describe how these values will be verified for the as built plant. This question is a follow-up to the February 9 and 10, 2010 audit on containment analyses.

06.02.01-83

Provide the list of references for FSAR Chapter 6.2 Interim Rev. 2. This question is a follow-up to the February 9 and 10, 2010 audit on containment analyses.

06.02.01-84

For secondary system breaks outside of the Equipment Space, the rupture and convection foils will experience opening forces and temperatures different than for breaks inside the Equipment Space. For each break analyzed outside the Equipment Space, provide the time assumed for opening of the foils and provide the supporting analyses and justifications that conservative results are obtained. This question is a follow-up to the February 9 and 10, 2010 audit on containment analyses.

06.02.01-85

Section 8.3.2.1 of ANP-10299P contains the equations by which steam flow from the break and ECCS water spillage are calculated within the GOTHIC code for the period before HL injection. Section 8.3.2.2 contains the equations by which steam and water flow from the break and ECCS water spillage are calculated for the period after hot leg injection. These equations are implemented by input into GOTHIC by selection of appropriate boundary conditions and control variables. Using the nomenclature of ANP-10299P, provide logic diagrams showing how this is accomplished. Specify the GOTHIC outputs that were used in producing the mass and energy release Table 6.2.1-20 of the FSAR interim Rev. 2 and explain how this was accomplished. This question is a follow-up to the February 9 and 10, 2010 audit on containment analyses.

06.02.01-86

Provide the elevations of the main steam lines as they traverse the Equipment Space of the US-EPR containment and provide the elevations of the main steam lines as they exit the steam generator compartments and traverse the Accessible Space. Provide the node numbers in the 30 node GOTHIC containment model through which the main steam lines travel. This question is a follow-up to the February 9 and 10, 2010 audit on containment analyses.

06.02.01-87

This question is a follow-up to the February 9 and 10, 2010 audit on containment analyses. For the postulated 0.2 ft^2 main steam line split break at zero reactor power analyzed by AREVA as described in FSAR 6.2 Rev. 2 interim, provide the following information. All plots should be extended to 2500 seconds with no more than 5 traces per figure:

a. Tables of the mass and energy release as a function of time.

b. The location of the break (elevation, and local subdivided cell number or lumped parameter node number)

c. The location of the maximum atmospheric temperature (elevation, and local subdivided cell number or lumped parameter node number)

d. Time history plots for maximum atmospheric temperature location and pressure. The atmospheric temperature plot should include both gas (vapor) and saturation temperatures.

e. Time history atmospheric temperature plots for lumped parameter nodes below the dome (nodes 1-30, excluding node 25). The atmospheric temperature plots should include both gas (vapor) and saturation temperatures.

f. Time history atmospheric temperature plots for subdivided nodes in the dome region nearest the containment centerline (19 vertical locations). The atmospheric temperature plots should include both gas (vapor) and saturation temperatures.

g. A time history temperature plot for the inner containment shell (note sub-divided or lumped parameter node in figure) in proximity to the location of maximum atmospheric (gas) temperature

06.02.01-88

This question is a follow-up to the February 9 and 10, 2010 audit on containment analyses. For the postulated cold leg pump suction (CLPS) LOCA as reported in the FSAR 6.2 Rev. 2 interim (Figures 6.2.1-16 and -17), provide the following information. No more that 5 traces should be given per figure:

a. Location of the maximum temperature reported in the FSAR (elevation and sub- divided node or lumped parameter node).

b. Time history plots for atmospheric temperatures in the sub-divided dome (at elevations along the containment centerline, (19 elevations). Use the same time scale as the FSAR.
c. Time history plots for atmospheric temperature below the dome (lump parameter nodes 1-30, excluding sub-divided dome region). Use the same time scale as the FSAR.
d. Time history plots for gas velocity in pathways (FP #31 and 53 – rupture foils; FP# 11 and 12 – IRWST dampers; FP# 74 and 82 – middle annulus to dome; FP# 115 and 123 – upper annulus to dome). Use the same time scale as the FSAR.

06.02.01-89

This question is a follow-up to the February 9 and 10, 2010 audit on containment analyses. For the postulated DEG main steam line break at 20% reactor power analyzed by AREVA as described in FSAR 6.2 Rev. 2 interim, provide the following information. All plots should be extended to 1800 seconds with no more than 5 traces per figure:

a. The location of the break (elevation, and local subdivided cell number or lumped parameter node number)
b. The location of the maximum atmospheric temperature (elevation, and local subdivided cell number or lumped parameter node number)
c. Time history plots for maximum atmospheric temperature location and pressure. The atmospheric temperature plot should include both gas (vapor) and saturation temperatures.
d. Time history atmospheric temperature plots for lumped parameter nodes below the dome (nodes 1-30, excluding node 25). The atmospheric temperature plots should include both gas (vapor) and saturation temperatures.
e. Time history atmospheric temperature plots for subdivided nodes in the dome region nearest the containment centerline (19 vertical locations). The atmospheric temperature plots should include both gas (vapor) and saturation temperatures.
f. A time history temperature plot for the inner containment shell (note sub-divided or lumped parameter node in figure) in proximity to the location of maximum atmospheric (gas) temperature.

06.02.01-90

This question is a follow-up to the February 9 and 10, 2010 audit on containment analyses. Revision 2 – Interim of the U.S. EPR FSAR lists five small break LOCA calculations performed for the U.S. EPR in Table 6.2.1-1. Provide the following information concerning these analyses.

a. Figures showing for a typical small break, the containment pressure and temperature for the duration of the analysis. Temperature curves should be included for the maximum temperature node, for the top of the dome and for the two lower annulus nodes.

b. Figures comparing the peak pressure curves and peak temperature curves of

the five cases analyzed.

c. Provide the result from a postulated small break in the Accessible Space. Select one of the highest pipe elevations. Provide the same curves as requested for the typical small break case above under sub-item a.

d. Provide a discussion on the performance of the CONVECT system during small break accidents. Show that sufficient vent area exists between the two rooms of the containment. Justify opening of the foils for breaks within the Equipment Room and the Accessible Space.

06.02.01-91

Chapter 8 of ANP-10299P includes a table showing how the AREVA methodology meets SRP acceptance criteria for large break LOCAs. Provide the equivalent table for MSLB accidents. This question is a follow-up to the February 9 and 10, 2010 audit on containment analyses.

06.02.01-92

Chapter 8 of ANP-10299P includes a Table showing how the AREVA methodology meets SRP acceptance criteria for large break LOCAs. Discuss the applicability of the large break LOCA Table for small break LOCAs. This question is a follow-up to the February 9 and 10, 2010 audit on containment analyses.

06.02.01-93

The results of single-node GOTHIC calculations may not be reliable for predicting long term pressure peaks. Provide the results from multi-node scoping calculations for large cold leg LOCAs. The purpose of these scoping calculations is to identify the limiting scenarios for containment pressure and temperature, and also to help develop the temperature envelope for equipment qualification. The results should cover different break sizes, break locations, break types and single failures. Consider the break sizes, locations, break types and single failures of Revision 2 to FSAR Interim Tables 6.2.1-7 and 6.2.1-8 for CLPS and CLPD breaks. Double ended guillotine breaks and at least one smaller split break should be examined to determine the limiting condition. This question is a follow-up to the February 9 and 10, 2010 audit on containment analyses.

06.02.02-45

During Feb 22-27, AREVA conducted US EPR retaining basket and strainer qualification testing at Alden Research Labs in Holden MA. The NRC staff audited the testing and developed this request for additional information related to thin bed testing.

Guidance indicates that it is acceptable in a thin-bed test to sequence the debris by adding 100 percent of the plant particulate load to the test flume and subsequently adding fibrous debris in incremental batches of an appropriate size to form a thin bed. Even if the plant has enough fiber to form a thick fibrous bed, the accumulation process should pass from zero accumulation to bed thicknesses greater than the typical thin-bed thickness incrementally to ensure that the peak head loss (…or level rise in a basket…) is determined.

A thin bed can be more challenging than thicker beds because a relatively small amount of fibrous debris captures a relatively large amount of particulate debris. For US EPR, the first screen encountered by the debris is the retaining basket. Therefore, the thin bed test should attempt to form a thin bed in the basket, by incremental addition of fibrous debris, to determine the peak level rise and possible basket overflow (bypass).

The completed thin-bed test used about 33% less fiber (first batch) than the full load test and resulted in a 70% increase in basket level. The baskets response during the thin bed test demonstrated that incremental fiber additions can have a significant impact on US EPR basket levels. However, the incremental fiber amounts used during the thin-bed tests appear non-conservative given that they were based on the total screen area in the test flume and not the screen area first encountered by the debris. Using the screen area first encountered by the debris indicates the first fiber batch addition amount may have been three times greater than what was needed to form a thin bed.

Justify the basis for selecting the total screen area as the basis for calculating the thin bed fiber batch amounts and justify that the completed thin bed test develops the worst case or limiting condition for strainer head loss.

06.02.02-46

During Feb 22-27, AREVA conducted US EPR retaining basket and strainer qualification testing at Alden Research Labs in Holden MA. The NRC staff audited the testing and developed this request for additional information related to debris settlement.

After drain-down of the test flume following the thin-bed test, the staff visually observed debris settled on the test tank floor between the strainer and the basket. The staff also noted debris collected in overhead seams (where walls met ceiling area) in the retaining basket. Justify the debris that settled/collected during the test was prototypical or representative of plant conditions. Include in the response a description of the settled/collected debris and its impact on test results.

06.02.03-6

As a follow-up to question 6.2.3-3 the staff was unable to reproduce the conclusions in the RAI response. The applicant stated that it would take 23 hours for post-accident heat to diffuse through the metal penetrations. However, the staff believes that it is possible for the large metal penetrations like the equipment hatch or personnel hatch to conduct heat into the secondary containment in less than 23 hours. Provide a more detailed explanation as to why it will take 23 hours to conduct heat through the steel components. Include analysis assumptions in the explanation so that the staff can perform confirmatory calculations. Alternatively, the applicant could conservatively calculate the heat transfer and include it in the design basis of the ventilation system.