ArevaEPRDCPEm Resource

From: Pederson Ronda M (AREVA NP INC) [Ronda.Pederson@areva.com]
Sent: Thursday, April 23, 2009 10:52 AM
To: Pederson Ronda M (AREVA NP INC); Getachew Tesfaye
Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); GUCWA Len T (EXT); OWEN Dennis E (EXT); LANIER Dave (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 206, FSARCh. 15
Attachments: RAI 206 Response US EPR DC.pdf

Getachew,

Attached please find AREVA NP Inc.'s (AREVA NP) response to the subject request for additional information (RAI). The attached file, "RAI 206 Response US EPR DC pdf," provides technically correct and complete responses to Question 15.00.03-36.

The following table indicates the respective pages in the response document, "RAI 206 Response US EPR DC pdf," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 206 —15.00.03-36	2	4

This concludes the formal response to RAI 206, and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

Ronda Pederson
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Sent: Friday, March 27, 2009 6:00 PM
To: ZZ-DL-A-USEPR-DL
Cc: Jeffrey Poehler; David Terao; Jason Carneal; Joseph Colaccino; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 206 (2455), FSARCh. 15

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on March 23, 2009, and on March 27, 2009, you informed us that the RAI is clear and no further clarification is needed. As a result, no change is made to the draft RAI. 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: 422

Mail Envelope Properties (5CEC4184E98FFE49A383961FAD402D31D9AA3E)

Subject: Response to U.S. EPR Design Certification Application RAI No. 206, FSARCh. 15
Sent Date: 4/23/2009 10:51:41 AM
Received Date: 4/23/2009 10:51:44 AM
From: Pederson Ronda M (AREVA NP INC)

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Files	**Size**	**Date & Time**
MESSAGE	2080	4/23/2009 10:51:44 AM
RAI 206 Response US EPR DC.pdf	67290	

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

Response to

Request for Additional Information No. 206

3/27/2009

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 15.00.03 - Design Basis Accidents Radiological Consequence Analyses for Advanced Light Water Reactors
Application Section: 15.0.3

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

Question 15.00.03-36:

Background

(Reference RAI 137, Question 15.00.03-33) The concentrations of strong acids (HCl and HNO_3) in the containment sump that affect pH are listed in Table 15.0-55 of the FSAR. The response to the above referenced RAI question provided additional information regarding the pH of the sump over the course of thirty days with some details regarding decomposition of PVC insulation on cables that result from air dose to the cables. However, the assumed dose to the cables was not noted.

The amount of nitric acid identified in the tables appears to be calculated based only on the noble gas activity in the containment air (plus a small contribution from non-noble gas radionuclides). It does not appear that formation of nitric acid from radiolysis by radionuclides within the liquid phase of the containment spray is included in this calculation (in the licensee response Table 15.00.03-34-1 Sheet 2 of 3, Row 2).

NUREG/CR-5950 states that in the tests conducted for nitric acid formation following a LOCA, irradiated water-saturated air did not form measurable nitric acid, but irradiated, air-saturated water did form nitric acid. The formation of nitric acid is related to the overall sump pool dose rate, the time of exposure and the nitric acid formation constant (G-value of 0.007 molecules per 100 eV of deposited energy).

Following a LOCA the activity concentration in the RCS liquid phase will increase 1-2 orders of magnitude from its operating value. This needs to be accounted for in the total dose to the sump pool and the formation of nitric acid in this phase.

Requested Information

1. Based on the information provided in NUREG/CR-5950 and the increased activity of the RCS following a LOCA (from crud entrained in the liquid due to hydraulic and pH effects):

    a. What activity assumptions were made to calculate the dose to form nitric acid?
    b. What G-value was used for nitric acid formation?
    c. What was the dose rate as a function of time?
    d. What was the average nitrogen concentration in the sump pool?

    If a bounding assumption was made for the overall sump pool dose rate or total integrated dose, provide the basis and reference for the bounding assumption.

2. With regards to the cable jacketing decomposition to form HCl, what was the average noble gas and iodine air dose used as a function of time to determine the cable jacketing decomposition to form HCl?

Response to Question 15.00.03-36:

For the U.S. EPR, it is more conservative (in terms of strong acid production) to assume that available activity is airborne rather than transferred to the in-containment refueling water storage tank (IRWST). This is because the G value for HCl production from irradiated cable is much greater than the G value for HNO_3 production from radiolysis of water. Even though only a few

percent of the gamma and beta energy assumed to be airborne is absorbed by the chloride-bearing cable jacket (resulting in HCl generation), the strong acid production per MeV available from this mechanism is much greater than it is for radiolysis of water.

The activity assumed to be in the IRWST for calculating the production of nitric acid is the fraction of the total release not assumed to be airborne. All noble gas activity is assumed to be airborne, and 67% of the remaining non-noble gas activity is assumed to be airborne during the first 24 hours. Beyond 24 hours, 34% of the remaining activity is assumed to be airborne. This means that nitric acid production is based on 33% of the non-noble gas activity during the first 24 hours and 66% of the non-noble gas activity during the remaining 30 days.

The G value for nitric acid formation is 0.007 molecules/100 eV = 1.16E-22 mol/MeV.

Table 15.00.03-36-1 shows the IRWST dose rate as a function of time for nitric acid formation.

Table 15.00.03-36-1—IRWST Dose Rate for Nitric Acid Formation vs. Time

Time (hours)	MeV/cc/sec	Rad/hr
0 – 1	8.38E+09	4.83E+05
1 – 2	3.16E+09	1.82E+05
2 – 5	2.18E+09	1.26E+05
5 – 12	1.54E+09	8.85E+04
12 – 24	1.19E+09	6.85E+04
24 – 72	1.67E+09	9.63E+04
72 – 240	8.81E+08	5.08E+04
240 – 480	3.90E+08	2.24E+04
480 – 720	2.51E+08	1.44E+04

The nitrogen concentration in the water is assumed to be that of water in contact with air (the experimental condition corresponding to the 0.007 molecules/100 eV).

Table 15.00.03-36-2 shows the assumed average air dose rates as a function of time used to determine HCl formation due to cable jacket decomposition.

The dose rate at a representative location for the cable insulation is assumed to be 44% of the peak dose rate at the center of the containment volume.

Table 15.00.03-36-2—Air Dose Rate for Cable Jacket Decomposition vs. Time

Time (hours)	Gamma R/hr*	Beta Rad/hr
0 – 1	1.60E+06	7.20E+06
1 – 2	1.12E+06	5.05E+06
2 – 5	8.35E+05	3.75E+06
5 – 12	5.81E+05	2.61E+06
12 – 24	4.21E+05	1.89E+06
24 – 72	1.87E+05	8.40E+05
72 – 240	9.49E+04	4.26E+05
240 – 480	3.36E+04	1.51E+05
480 – 720	1.72E+04	7.73E+04

*At the center of the containment volume

FSAR Impact:

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