ArevaEPRDCPEm Resource

From: WELLS Russell (AREVA) [Russell.Wells@areva.com]
Sent: Thursday, March 31, 2011 5:20 PM
To: Tesfaye, Getachew
Cc: GUCWA Len (EXTERNAL AREVA); BENNETT Kathy (AREVA); DELANO Karen (AREVA); ROMINE Judy (AREVA); RYAN Tom (AREVA)
Subject: Response to U.S. EPR Design Certification Application RAI No. 363, FSARCh. 6, Supplement 4
Attachments: RAI 363 Supplement 4 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for responding to the 2 questions in RAI 363 on March 16, 2010, and revised the schedule on April 22 and May 20, 2010. AREVA NP submitted Supplement 3 to the response on June 2, 2010 to provide a response to the 2 questions.

The attached file, "RAI 363 Supplement 4 Response US EPR DC.pdf" provides a technically correct and complete revised response to items 4, 5, 12, 14, and 21c of Question 06.02.02-43.

The following table indicates the respective pages in the response document, "RAI 363 Supplement 4 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 363 — 06.02.02-43 (items 4, 5, 12, 14, and 21c)	2	6

This concludes the formal AREVA NP response to RAI 363, and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

Russ Wells
U.S. EPR Design Certification Licensing Manager
AREVA NP, Inc.
3315 Old Forest Road, P.O. Box 10935
Mail Stop OF-57
Lynchburg, VA 24506-0935
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Russell.Wells@Areva.com

From: BRYAN Martin (EXT)
Sent: Wednesday, June 02, 2010 2:32 PM
To: Tesfaye, Getachew
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); GUCWA Len T (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 363, FSARCh. 6, Supplement 3

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for responding to the 2 questions in RAI 363 on March 16, 2010, and revised the schedule on April 22 and May 20, 2010. The attached file, "RAI 363 Supplement 3 Response US EPR DC.pdf," provides a technically correct and complete response to the 2 remaining questions.

The following table indicates the pages in the response document, "RAI 363 Supplement 3 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 363 — 06.02.02-43	2	15
RAI 363 — 06.02.02-44	16	17

This concludes the formal AREVA NP response to RAI 363, and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
Tel: (434) 832-3016
702 561-3528 cell
Martin.Bryan.ext@areva.com

From: BRYAN Martin (EXT)
Sent: Thursday, May 20, 2010 4:17 PM
To: 'Tesfaye, Getachew'
Cc: KOWALSKI David J (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); ROMINE Judy (AREVA NP INC); GUCWA Len T (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 363, FSARCh. 6, Supplement 2

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for responding to the 2 questions in RAI 363 on March 16, 2010, and revised the schedule on April 22, 2010.

The responses to RAI 363 are dependent upon other ongoing GSI-191 evaluations for demonstrating sump strainer performance. Because of these ongoing activities, AREVA NP is postponing the response to RAI 363 by two weeks. This delay has been discussed with and accepted by the NRC staff. The revised schedule for a technically correct and complete response to RAI 363 is provided below.

Question #	Response Date
RAI 363 — 06.02.02-43	June 2, 2010
RAI 363 — 06.02.02-44	June 2, 2010

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
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702 561-3528 cell

Martin.Bryan.ext@areva.com

From: BRYAN Martin (EXT)
Sent: Thursday, April 22, 2010 6:20 PM
To: 'Getachew.Tesfaye@nrc.gov'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); GUCWA Len T (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 363, FSARCh. 6, Supplement 1

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for responding to the 2 questions in RAI 363 on March 16, 2010. The responses to RAI 363 are dependent upon the results of ongoing GSI-191 evaluations for demonstrating sump strainer performance. Because of these ongoing activities, AREVA NP is not providing a response at this time. The revised schedule for a technically correct and complete response to RAI 363 is provided below.

Question #	Response Date
RAI 363 — 06.02.02-43	May 20, 2010
RAI 363 — 06.02.02-44	May 20, 2010

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
Tel: (434) 832-3016
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Martin.Bryan.ext@areva.com

From: BRYAN Martin (EXT)
Sent: Tuesday, March 16, 2010 2:32 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); GUCWA Len T (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 363, FSARCh. 6

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 363 Response US EPR DC.pdf" provides a schedule since a technically correct and complete response to the 2 questions is not provided.

The following table indicates the respective pages in the response document, "RAI 363 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 363 — 06.02.02-43	2	3
RAI 363 — 06.02.02-44	4	4

A complete answer is not provided for the 2 questions. The schedule for a technically correct and complete response to this question is provided below.

Question #	Response Date
RAI 363 — 06.02.02-43	April 22, 2010
RAI 363 — 06.02.02-44	April 22, 2010

Sincerely,

Martin (Marty) C. Bryan
Licensing Advisory Engineer
AREVA NP Inc.
Tel: (434) 832-3016
Martin.Bryan@areva.com

From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Tuesday, February 16, 2010 4:43 PM
To: ZZ-DL-A-USEPR-DL
Cc: Ashley, Clinton; Jackson, Christopher; Snodderly, Michael; Carneal, Jason; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 363 (4136), FSARCh. 6

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on January 26, 2010, 2009, and on February 15, 2010, 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: 2798

Mail Envelope Properties (1F1CC1BBDC66B842A46CAC03D6B1CD41042B9C77)

Subject: Response to U.S. EPR Design Certification Application RAI No. 363, FSARCh. 6, Supplement 4
Sent Date: 3/31/2011 5:19:49 PM
Received Date: 3/31/2011 5:19:52 PM
From: WELLS Russell (AREVA)

Created By: Russell.Wells@areva.com

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Files	Size	Date & Time
MESSAGE	7570	3/31/2011 5:19:52 PM
RAI 363 Supplement 4 Response US EPR DC.pdf		29310

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

Response to

Request for Additional Information No. 363, Supplement 4

2/16/2010

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 06.02.02 - Containment Heat Removal Systems
Application Section: 6.2 and 6.3

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

Question 06.02.02-43:

This request for additional information is based primarily on an audit conducted on AREVA document 51-9125267-000, Revision 0, "US EPR STRAINER TEST PROTOCOL", dated October 26, 2009.

Describe how testing of the US EPR containment sump debris interceptors (weirs, trash racks, retaining basket (RB), and strainer) is prototypical or conservative (bounding) in comparison to the plant. The following list provides examples where additional information is requested:

1. Describe the scaling methodology and explain how it ensures prototypical or bounding test data.
   A. What similarities between test and plant conditions are preserved?
   B. Identify any assumptions in the scaling analysis and evaluate the impact on debris interceptor performance, particularly suction strainer head loss.
2. Identify important control parameters which must be considered in the design and operation of the test facility and explain the effects of the test facility design and operation on these important parameters.
3. Discuss how AREVA's approach to the number of tests conducted will provide results that are bounding.
4. Provide the basis for the water fall height in the test and how this height is prototypical or conservative in comparison to the plant.
5. Describe the potential for the cross brace support located at the entrance to the plants RB and extending above the basket wall to cause debris laden water to splash outside the basket (bypassing basket filtering) and how this bypass potential is accounted for in the test protocol.
6. Describe how delivering water flow to the RB during the test (pipe nozzles) is prototypical or conservative with respect to the plant arrangement (trapezoidal opening). Explain how the manner in which flow is delivered to the RB impacts the ability of the debris bed to form prototypically or conservatively inside the RB.
7. What is the basis for placing the RB bottom at the same elevation as the strainer bottom and how is this prototypical or conservative?
8. Describe the RB scaling approach. Explain how the tested RB surface area and tested RB volume are prototypical or conservative when compared to the plant.
   A. What is the basis for selecting the RB screened area on one side only (facing strainer) and having the other normally screened surfaces tested as solid surfaces? How is this arrangement prototypical or conservative?
9. How do the hydraulic conditions internal to the tested RB compare with the plant design RB hydraulic conditions?
10. What measurements are planned specific to the RB?
11. How is the RB small compartment (only receives flow from the annular floor wall opening) and its postulated debris source term bounded by the testing for the large compartment?
12. Describe how the flow rate to the retaining basket is determined.

13. How are drains that introduce debris between RB and strainer (example: refueling pool) accounted for in the test protocol?
14. The strainer flow rate listed in the test protocol and selected for scaling analysis is a certain value per strainer. ANP-10293 lists strainer flow at a different value. What is the correct flow rate through the plant strainer and what is the basis for this flow rate? In addition describe how all scaled flow values selected for testing are prototypical or conservative.
15. Describe how the flow conditions (velocities and turbulence levels) in the test flume region between the RB and strainer are prototypical or conservative in comparison to the plant.
16. What is the basis for the visual observation criteria that may be used to decide if a thin bed test will be conducted?
17. Justify chemical introduction location and why it is representative or conservative.
18. How is the tested strainers slope/angle for the nearly vertical face representative or conservative with respect to the plant design?
19. Describe how the selected test termination criteria are realistic or conservative.
20. Provide a simplified drawing (single line) depicting the debris interceptors test set-up.
21. Provide the following test and plant parameters, and scaling justification for each, as applicable.
    a) Screen mesh size for RB and strainer
    b) Distance between strainer and RB
    c) Debris source term amounts for testing
    d) Test termination – number of flume turnovers

Response to Question 06.02.02-43:

4. The following response supersedes the previous Response to Question 06.02.02-43, Item 4.

   The majority of the flow downstream of the strainer (except for the mini-line flow) was reintroduced to the test flume with nozzles above the retaining basket (RB). This represents safety injection system (SIS) flow from the break location onto the heavy floor, then into one of the four RBs through a heavy floor opening. The plant conditions provide approximately 15.3 feet of water freefall prior to the water reaching the surface of the in-containment refueling water storage tank (IRWST). The test flume represents an adjusted one-to-one vertical scale of the U.S. EPR IRWST. To conserve the vertical scale in the test facility, the momentum produced by the water freefall must be conserved or simulated. The test facility ceiling limits the freefall of water to approximately eight feet. The velocity of the water exiting the nozzles above the flume RB is increased to represent the plant's actual water freefall conditions using Equation 1:

$$mgH = mgh + \frac{1}{2}mv^2$$

$$\therefore (32.174)*(15.3) = (32.174)(8) + \frac{1}{2}v^2$$

Equation 1: Conservation of Energy

$$v = 21.7\ ft/\sec$$

Where,

m = Mass of water (lb_m).

g = Gravity (32.174 ft/sec^2).

H = Height from heavy floor to IRWST water surface (ft).

h = Flume height from heavy floor to IRWST water surface (ft).

v = Water velocity (ft/sec).

The test facility used two nozzles to simulate flow from the heavy floor onto the flume IRWST water surface. The diameter of each exit nozzle was 1.59 inches (0.133 feet). The exit velocity of the water is calculated using Equation 2. The area of one nozzle exit is calculated as the following:

$$One\,Exit\,Area = \pi * r^2 = \pi * 0.0665^2 = 0.0139\,ft^2$$

Because there are two exit nozzles, the total exit area is two times the calculated area, or 0.0278 ft^2. The flow through the nozzles in ft^3/sec is shown as the following:

$$Main\,Flow = \frac{296\,gallons}{1\min} * \frac{1\min}{60\sec} * \frac{1\,ft^3}{7.4805\,gallons} = 0.660\,ft^3/\sec$$

The velocity of the test flume water exiting the nozzles is calculated by the flow in Equation 2:

$$Velocity = \frac{Flow}{Area} = \frac{0.660\,ft^3/\sec}{0.0278\,ft^2} = 23.7\,ft/\sec \qquad \text{(Equation 2: Flow)}$$

The water velocity exiting the nozzles is greater than the 21.7 ft/sec velocity where water impacts the surface in the plant's IRWST design. The water freefall in the test apparatus is bounding to plant conditions.

5. The following response supersedes the previous Response to Question 06.02.02-43, Item 5.

The cross brace support forms an "X" shape on top of the double compartment RB. The width of one of the braces is approximately 3.6 inches. The perimeter of a trash rack that receives flow from a loss of coolant accident (LOCA) break on the heavy floor is approximately 291 inches. Assuming an equal distribution of flow around the trash rack (sides and front) into the IRWST, there are four areas where the flow may impact the cross brace. Dividing the width of the four brace impact areas by the trash rack perimeter equates to approximately five percent of the flow that may impact the brace. Of this flow, a high percentage would still be contained in the basket.

According to the test plan, approximately 10 percent (0.21 lbm) of the fibrous debris source term was added between the RB and the strainer. This conservatively bounds any fibrous debris that may hit the RB support beams and splash outside the basket.

12. The following response supersedes the previous Response to Question 06.02.02-43, Item 12.

    The total test apparatus flow rate is calculated by applying the same scaling factor (9.37 percent) to the flow designed for SIS operation (approximately 3447 gpm). The mini-flow, prototypical to plant conditions, routes a portion of strainer suction flow back into the IRWST, bypassing the RB. The plant mini-flow, approximately 290 gpm, was scaled by 9.37 percent and applied to the test apparatus. Assuming that 100 percent of the heavy floor flow enters one RB, the flow allocated to the test apparatus RB was calculated by scaling the difference of the total flow minus the mini-flow.

14. The following response supersedes the previous Response to Question 06.02.02-43, Item 14.

    The actual strainer flow rate is approximately 3447 gpm. The strainer flow rate for head loss testing is scaled to 9.37 percent of the actual strainer flow rate (approximately 323 gpm). Table 06.02.02-43-2 provides the basis for the strainer flow rate.

    The scaled flow values selected for testing are prototypical because they are uniformly scaled down to 9.37 percent of the actual plant values as detailed in the U.S. EPR FSAR.

21c. The following response supersedes the previous Response to Question 06.02.02-43, Item 21c.

    Debris source term amounts for testing:

    Table 06.02.02-43-3 presents the debris source term amounts used for the U.S. EPR strainer testing accomplished from November 2010 to February 2011. With the exception of coating chips, these amounts are based on a U.S. EPR debris generation calculation and sump chemistry model calculation and then scaled by 9.37 percent to match apparatus scaling. Qualified epoxy coatings account for approximately 33 percent of the total amount of epoxy coatings generated in a postulated LOCA for the U.S. EPR design. The amount of qualified epoxy coatings were tested as particulate and chips for conservatism.

FSAR Impact:

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

Table 06.02.02-43-2—Basis for the Strainer Flow Rate

U.S. EPR ECCS Flow (~gpm)		9.37 percent Scaled Flow for Strainer Head Loss Testing (~gpm)
Flow to RCS Cold Leg	3157	296
ECCS Pump Miniflow Bypass to IRWST	290	27
Total ECCS Flow to Strainer	3447	323

Table 06.02.02-43-3—Debris totals for the Design Basis Strainer Head Loss Test

Scaled 9.37 percent	Scaled Amount (lb_m)	Description / Surrogate
RMI	15.99	Based on 0.0813 lb_m/ft^2 for RMI
Microtherm®	1.41	N/A
NUKON® Fiber	2.2	All Shredded NUKON® Fines
Epoxy Coatings	35.27	Acrylic Powder
Epoxy Chips	11.86	~5/8 inch chips (~4-12 mils thick)
IOZ Coatings	89.86	Tin Powder
Latent Dirt and Dust	12.2	Dirt and Dust Mix
Sodium Aluminum Silicate	15.91	Aluminum Oxyhydroxide
Calcium Phosphate	16.74	N/A