ArevaEPRDCPEm Resource

From: BRYAN Martin (EXTERNAL AREVA) [Martin.Bryan.ext@areva.com]
Sent: Wednesday, June 30, 2010 7:02 PM
To: Tesfaye, Getachew
Cc: DELANO Karen (AREVA); ROMINE Judy (AREVA); BENNETT Kathy (AREVA); CORNELL Veronica (EXTERNAL AREVA); VAN NOY Mark (EXTERNAL AREVA)
Subject: Response to U.S. EPR Design Certification Application RAI No. 190, FSAR Ch 3, Supplement 6
Attachments: RAI 190 Supplement 6 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for responses to the 3 questions of RAI No. 190 on March 20, 2009. AREVA NP submitted Supplement 1 to the response on June 12, 2009, to address 2 of the remaining 3 questions. AREVA NP submitted Supplement 2 to the response on October 29, 2009, to provide a revised schedule for response to the remaining 1 question of RAI 190. AREVA NP submitted Supplement 3 to the response on February 22, 2010, to provide a revised schedule for response to the remaining 1 question of RAI 190. AREVA NP submitted Supplement 4 to the response on March 25, 2010, to provide a revised schedule for response to the remaining 1 question of RAI 190.

On May 27, 2010, AREVA NP provided a revised date for RAI 190 Supplement 5 to accommodate NRC review of the DRAFT response. AREVA NP has clarified the response to address the NRC's comments. The attached file, "RAI 190 Response U.S. EPR DC.pdf" provides a technically correct and complete response Question 03.08.01-29.

The following table indicates the respective pages in the response document, "RAI 190 Response U.S. EPR DC," that contain the AREVA NP response to the subject questions.

Question #	Start Page	End Page
RAI 190 — 03.08.01-29	2	3

This completes the formal AREVA NP response to RAI 190. There are no additional questions associated with this RAI.

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 27, 2010 11:43 AM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); VAN NOY Mark (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 190, FSAR Ch 3, Supplement 5

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for responses to the 3 questions of RAI No. 190 on March 20, 2009. AREVA NP submitted Supplement 1 to the response on June 12, 2009, to address 2 of the remaining 3 questions. AREVA NP submitted Supplement 2 to the response on October 29, 2009, to provide a revised schedule for response to the remaining 1 question of RAI 190. AREVA NP submitted Supplement 3 to the response on February 22, 2010, to provide a revised schedule for response to the remaining 1 question of RAI 190. AREVA NP submitted Supplement 4 to the response on March 25, 2010, to provide a revised schedule for response to the remaining 1 question of RAI 190.

As agreed with the NRC, AREVA NP is providing a revised date for RAI 190 Supplement 5 to allow time to interact with the NRC on the draft response.

The revised schedule for technically correct and complete responses to the remaining question is provided below:

Question #	Response Date
RAI 190 — 03.08.01-29	June 30, 2010

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, March 25, 2010 12:10 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); VAN NOY Mark (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 190, FSAR Ch 3, Supplement 4

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for responses to the 3 questions of RAI No. 190 on March 20, 2009. AREVA NP submitted Supplement 1 to the response on June 12, 2009, to address 2 of the remaining 3 questions. AREVA NP submitted Supplement 2 to the response on October 29, 2009, to provide a revised schedule for response to the remaining 1 question of RAI 190. AREVA NP submitted Supplement 3 to the response on February 22, 2010, to provide a revised schedule for response to the remaining 1 question of RAI 190.

AREVA NP Inc. (AREVA NP) is unable to provide a response for RAI 190 Supplement 3 at this time. The response to Question 03.08.01-29 is dependent upon results of the new embedded Finite Element Model (FEM) based seismic analysis, which affects seismic response of the Reactor Building Internal Structure (RBIS). Results of the new embedded FEM will be provided in the AREVA NP response to RAI 283 Question 03.08.01-37.

The revised schedule for technically correct and complete responses to the remaining question is provided below:

Question #	Response Date
RAI 190 — 03.08.01-29	May 27, 2010

Sincerely,

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

From: DUNCAN Leslie E (AREVA NP INC)
Sent: Monday, February 22, 2010 1:44 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); ROMINE Judy (AREVA NP INC); VAN NOY Mark (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 190, FSAR Ch 3, Supplement 3

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for responses to the 3 questions of RAI No. 190 on March 20, 2009. AREVA NP submitted Supplement 1 to the response on June 12, 2009, to address 2 of the remaining 3 questions. AREVA NP submitted Supplement 2 to the response on October 29, 2009, to provide a revised schedule for response to the remaining 1 question of RAI 190.

AREVA NP Inc. (AREVA NP) is unable to provide a response for RAI 190 question 03.08.01-29 at this time. The new seismic analyses using an embedded Finite Element – SASSI model are being finalized, which yield a new in-structure-seismic-response-spectra. This response is being deferred due to its effect on the Reactor Building Internal Structure and interdependency with the response to RAI 283 Question 03.08.01-37.

The revised schedule for a technically correct and complete response to the remaining question is provided below:

Question #	Response Date
RAI 190 — 03.08.01-29	March 25, 2010

Sincerely,

Les Duncan
Licensing Engineer
AREVA NP Inc.
An AREVA and Siemens Company
Tel: (434) 832-2849
Leslie.Duncan@areva.com

From: WELLS Russell D (AREVA NP INC)
Sent: Thursday, October 29, 2009 6:11 PM

To: 'Getachew Tesfaye'
Cc: Pederson Ronda M (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 190, FSAR Ch 3, Supplement 2

Getachew,

AREVA NP Inc. (AREVA NP) is unable to provide a response for RAI 190 Supplement 2 at this time. As discussed with the NRC staff, new seismic analyses using an embedded Finite Element – SASSI model are being finalized, which yield a new in-structure-seismic-response-spectra. This response is being deferred to reflect the new spectra and its effect on the Reactor Building Internal Structure.

The revised schedule for technically correct and complete responses to the remaining question is provided below:

Question #	Response Date
RAI 190 — 03.08.01-29	February 25, 2010

Sincerely,

(Russ Wells on behalf of)

Ronda Pederson
ronda.pederson@areva.com
Licensing Manager, U.S. EPR Design Certification
New Plants Deployment
AREVA NP, Inc.
An AREVA and Siemens company
3315 Old Forest Road
Lynchburg, VA 24506-0935
Phone: 434-832-3694
Cell: 434-841-8788

From: WELLS Russell D (AREVA NP INC)
Sent: Friday, June 12, 2009 6:07 PM
To: 'Getachew Tesfaye'
Cc: Pederson Ronda M (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 190, FSAR Ch 3, Supplement 1

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for the responses to the 3 questions of RAI No. 190 on March 20, 2009. The attached file, "RAI 190 Supplement 1 Response U.S. EPR DC" provides technically correct and complete responses to 2 of the 3 questions.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 190 Question 03.08.01-28.

The following table indicates the respective pages in the response document, "RAI 190 Supplement 1 Response U.S. EPR DC," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 03.08.01-28	2	3
RAI 03.08.01-30	4	4

A revised schedule for a technically correct and complete response to the remaining question is provided below.

Question #	Response Date
RAI 03.08.01-29	October 29, 2009

Sincerely,

(Russ Wells on behalf of)

Ronda Pederson
ronda.pederson@areva.com
Licensing Manager, U.S. EPR Design Certification
New Plants Deployment
AREVA NP, Inc.
An AREVA and Siemens company
3315 Old Forest Road
Lynchburg, VA 24506-0935
Phone: 434-832-3694
Cell: 434-841-8788

From: Pederson Ronda M (AREVA NP INC)
Sent: Friday, March 20, 2009 3:33 PM
To: 'Getachew Tesfaye'
Cc: PORTER Thomas (EXT); DELANO Karen V (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 190, FSARCh. 3

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 190 Response US EPR DC.pdf" provides a schedule since a technically correct and complete response to the 3 questions is not provided.

The following table indicates the respective page in the response document, "RAI 190 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 190 — 03.08.01-28	2	2
RAI 190 — 03.08.01-29	3	3
RAI 190 — 03.08.01-30	4	4

The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 190 —03.08.01-28	June 12, 2009
RAI 190 —03.08.01-29	June 12, 2009
RAI 190 —03.08.01-30	June 12, 2009

Sincerely,

Ronda Pederson
ronda.pederson@areva.com
Licensing Manager, U.S. EPR Design Certification
AREVA NP Inc.
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3315 Old Forest Road
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From: Getachew Tesfaye [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Friday, February 20, 2009 11:11 AM
To: ZZ-DL-A-USEPR-DL
Cc: Jim Xu; Sujit Samaddar; Michael Miernicki; Joseph Colaccino; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 190 (2205), FSARCh. 3

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on February 18, 2009, and on February 20, 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 except to correct a typographical error in the RAI numbering. The RAI no is changed from 190(2083) to 190(2205) in the email subject line and from 2205 to 190 (2205) in the attachment. 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: 1646

Mail Envelope Properties (BC417D9255991046A37DD56CF597DB7106B9776B)

Subject: Response to U.S. EPR Design Certification Application RAI No. 190, FSAR Ch 3, Supplement 6
Sent Date: 6/30/2010 7:01:53 PM
Received Date: 6/30/2010 7:02:35 PM
From: BRYAN Martin (EXTERNAL AREVA)

Created By: Martin.Bryan.ext@areva.com

Recipients:
"DELANO Karen (AREVA)" <Karen.Delano@areva.com>
Tracking Status: None
"ROMINE Judy (AREVA)" <Judy.Romine@areva.com>
Tracking Status: None
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Tracking Status: None
"CORNELL Veronica (EXTERNAL AREVA)" <Veronica.Cornell.ext@areva.com>
Tracking Status: None
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Tracking Status: None
"Tesfaye, Getachew" <Getachew.Tesfaye@nrc.gov>
Tracking Status: None

Post Office: AUSLYNCMX02.adom.ad.corp

Files	**Size**	**Date & Time**
MESSAGE	12264	6/30/2010 7:02:35 PM
RAI 190 Supplement 6 Response US EPR DC.pdf	65084	

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

Response to

Request for Additional Information No. 190, Supplement 6

2/18/2009

U.S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 03.08.01 - Concrete Containment
Application Section: FSAR Ch 3

QUESTIONS for Structural Engineering Branch 2 (ESBWR/ABWR Projects) (SEB2)

Question 03.08.01-29:

As a result of the structural audit conducted by the NRC staff at AREVA offices, during the week of January 26, 2009, a question arose regarding the separate stability analysis performed for the Reactor Building Internal Structures (RBIS). Since there is no physical connection between the RBIS and the containment liner, and no connection between the containment liner and the NI basemat, there is a need to evaluate whether uplift of the RBIS could occur under seismic loadings. The finite element model (FEM) of the RBIS used in the RBIS stability analysis restrains the base of the RBIS in the vertical direction. Since this modeling approach prevents uplift, provide technical information that demonstrates whether uplift of the RBIS could actually occur. If some uplift could occur, describe the extent of the uplift from a realistic analysis and explain how this uplift affects the design of the NI structures, including the containment liner. The evaluation for the uplift effects on the liner should demonstrate that no damage occurs to the liner resulting from potential liftoff of the liner due to bond between the RBIS base concrete and the liner, tearing of the liner at the periphery, and damage of the liner underneath the RBIS due to repetitive impact forces. Note that it would not be sufficient to simply review the vertical reaction forces at the base of the RBIS in the existing linear analysis because if tension occurs at some of the nodes, then those restraints would need to be released which makes this evaluation a nonlinear problem.

Response to Question 03.08.01-29:

To quantify the magnitude of reactor building internal structure (RBIS) uplift under seismic loading and to confirm Nuclear Island (NI) design margin for this motion, a realistic, nonlinear transient dynamic analysis of the RBIS assembly was conducted. This analysis employs frictional contact elements at the RBIS to NI interface that provide relative motion and load transfer time histories between the RBIS and NI foundation. The applied loads are dead loads, 25 percent live loads, 75 percent precipitation loads, and seismic loads.

The nonlinear dynamic model was analyzed for two frictional cases at the RBIS to basemat interface. The “low friction” case considered a static coefficient of friction of 0.4 and a dynamic coefficient of friction of 0.2, which are considered as worst case minimum values. The “high friction” case considered a static coefficient of friction of 0.75 and a dynamic coefficient of friction of 0.45, which are based on empirical data obtained from friction tests conducted as part of the EPR OL3 project.

Enveloping both frictional cases, the maximum uplift is 0.05 inches, the maximum sliding value is 0.24 inches, and the maximum bearing pressure is 427 psi in the vertical direction and 462 psi in the horizontal direction. The haunch wall is designed for a horizontal bearing pressure of 755 psi. A worst-case permanent rotation of 0.01^{o} about the z-axis of the RBIS relative to the basemat is seen at the final time step. The minimum total contact area (region of RBIS to NI load transfer) at the bottom elevation (-25.6 ft / -7.8 m) of the RBIS is calculated to be approximately 79 percent of the total area at this elevation. The maximum liner strain is calculated to be 0.0000183 inches/inch in tension and 0.0000256 inches/inch in compression. Compared to the ASME liner plate membrane allowable strain of 0.005 for compression and 0.003 for tension, these liner plate strains due to basemat uplift are negligible.

Rigid body rocking of the RBIS relative to the basemat does not occur (i.e., the RBIS does not “stand on its toe”). Minor uplift occurs, but only in the form of local bending at the RBIS to basemat interface. Thus, there is no need to consider impact damage to the liner. Along the

vertical wall adjacent to the area of uplift, a gap exists between the RBIS and basemat. Consequently, there will be no peripheral tearing of the liner due to uplift. At the location of maximum uplift, uplift is seen to occur 7 times at elevation -25.6 ft and 13 times at elevation -14.1 ft. There is, therefore, no damage to the liner due to repetitive impact forces.

Analyses were performed for soil case 2sn4um, which was expected to control based on ZPA values from the surface founded dynamic stick model. Subsequent to the selection of soil case 2sn4u, results from the more detailed embedded dynamic FEM model were released. Considering ZPA values at twelve key nodes in the basemat and RBIS of the embedded dynamic FEM model, five soil cases, including soil case 2sn4um, are seen to control for at least one location in one direction. Soil case 4um controls more often than 2sn4um. Based on these same twelve key locations, soil case 2sn4um produces ZPAs in the RBIS and NI basemat that are, on average, 12 percent lower than those for soil case 4um. Because the results of these analyses show a significant margin of safety regarding liner plate strain, concrete compressive stress, and the haunch wall bearing pressure (see Table 03.08.01-29-1), these differences are acceptable without further analysis.

Table 03.08.01-29-1—Factors of Safety

	Maximum Calculated Value	Allowable Value	Factor of Safety
Liner Strain (Tension)	0.0000183 in./in.	0.003 (ASME)	164
Liner Strain (Compression)	0.0000256 in./in.	0.005 (ASME)	195
Concrete Crushing (Horizontal)	462 psi	2,400 psi (0.6[1]f_c')	5.2
Concrete Crushing (Vertical)	427 psi	2,400 psi (0.6[1]f_c')	5.6
Haunch Wall	462 psi	755 psi (Design Value[1])	>1.6[1]

Note:

1. The design value of 755 psi is the allowable bearing pressure on the entire wall surface, while the maximum calculated bearing pressure of 462 psi occurs only in a localized area. The overall factor of safety is greater than 1.6.

FSAR Impact:

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