ArevaEPRDCPEm Resource

From: WELLS Russell (AREVA) [Russell.Wells@areva.com]
Sent: Friday, May 20, 2011 7:46 AM
To: Tesfaye, Getachew
Cc: WILLIAMSON Rick (AREVA); CORNELL Veronica (EXTERNAL AREVA); BREDEL Daniel (AREVA); WILLIFORD Dennis (AREVA); BENNETT Kathy (AREVA); DELANO Karen (AREVA); HALLINGER Pat (EXTERNAL AREVA); ROMINE Judy (AREVA); RYAN Tom (AREVA)
Subject: Draft Response to U.S. EPR Design Certification Application RAI No. 371, FSAR Ch. 3, Question 03.07.02-66
Attachments: RAI 371 Question 03.07.02-66 US EPR DC - DRAFT.pdf

Getachew,

Attached is a draft response for RAI No. 371, FSAR Ch 3, Question 03.07.02-66 in advance of the July 8, 2011 final response date.

Let me know if the staff has questions or if the draft response can be sent as a final response.

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
Phone: 434-832-3884 (work)
434-942-6375 (cell)
Fax: 434-382-3884
Russell.Wells@Areva.com

From: WELLS Russell (RS/NB)
Sent: Friday, May 20, 2011 7:43 AM
To: 'Tesfaye, Getachew'
Cc: CORNELL Veronica (External RS/NB); WILLIFORD Dennis (RS/NB); BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 371, FSAR Ch. 3, Supplement 18

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to RAI No. 371 on April 26, 2010. AREVA NP submitted Supplement 1 to the response on June 7, 2010, to provide a revised schedule for question 03.07.01-29. On June 24, 2010, AREVA provided a revised response schedule in Supplement 2 for the other 8 questions based on the information presented at the June 9, 2010 public meeting on civil/structural replanning activities. AREVA NP provided Supplement 3 to the response on July 8, 2010, to provide a revised date for submittal of a FINAL response to question 03.07.01-29 to allow time to address NRC comments. AREVA NP submitted Supplement 4 to the response on July 29, 2010, to provide INTERIM responses to questions 03.07.02-66 through question 03.07.02-68. AREVA NP submitted Supplement 5 to the response on August 31, 2010, to provide technically correct and complete FINAL responses to questions 03.07.02-70 through 03.07.02-72. On September 9, 2010, AREVA NP submitted

Supplement 6 to provide a revised schedule for a FINAL response to question 03.07.01-29. On October 4, 2010, AREVA NP submitted Supplement 7 to provide a FINAL response to question 03.07.01-29. On October 18, 2010, AREVA NP submitted Supplement 8 to provide an INTERIM response to question 03.07.02-69. On November 11, 2010, AREVA NP submitted Supplement 9 to provide a revised schedule for a response to question 03.07.01-28. On January 20, 2011, AREVA NP submitted Supplement 10 to provide a revised schedule for a response to questions 03.07.02-67, 03.07.02-68, and 03.07.02-69. AREVA NP submitted Supplement 11 to the response on February 11, 2011 to provide a revised schedule for a response to question 03.07.02-66. On February 28, 2011, AREVA NP submitted Supplement 12 to provide a revised schedule for Question 03.07.01-28 and Question 03.07.02-69. AREVA NP submitted Supplement 13 on March 8, 2011, to provide an INTERIM response to Question 03.07.02-69. On March 24, 2011, AREVA NP submitted Supplement 14 to provide a revised schedule for Question 03.07.02-66. AREVA NP submitted Supplement 15 on April 1, 2011, to provide a revised schedule for Question 03.07.02-68. On April 27, 2011, AREVA NP submitted Supplement 16 to provide a revised schedule for Questions 03.07.02-67 and 03.07.02-69. AREVA NP submitted Supplement 17 on May 2, 2011, to provide a revised schedule for Question 03.07.02-68.

The schedule for Question 03.07.02-66 is being revised. The schedule for the remaining questions is unchanged.

The schedule for the technically correct and complete responses to the remaining questions is provided below.

Question #	Interim Response Date	Response Date
RAI 371-03.07.01-28	N/A	June 21, 2011
RAI 371-03.07.02-66	July 29, 2010 (Actual)	**July 8, 2011**
RAI 371-03.07.02-67	July 29, 2010 (Actual)	July 8, 2011
RAI 371-03.07.02-68	July 29, 2010 (Actual)	July 8, 2011
RAI 371-03.07.02-69	October 18, 2010 (Actual) March 21, 2011 March 8, 2011 (Actual)	July 8, 2011

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
Phone: 434-832-3884 (work)
434-942-6375 (cell)
Fax: 434-382-3884
Russell.Wells@Areva.com

From: WELLS Russell (RS/NB)
Sent: Monday, May 02, 2011 10:30 AM
To: Tesfaye, Getachew
Cc: CORNELL Veronica (External RS/NB); BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 371, FSAR Ch. 3, Supplement 17

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to RAI No. 371 on April 26, 2010. AREVA NP submitted Supplement 1 to the response on June 7, 2010, to provide a revised schedule for question 03.07.01-29. On June 24, 2010, AREVA provided a revised response schedule in Supplement 2 for the other 8 questions based on the information presented at the June 9, 2010 public meeting on civil/structural replanning activities. AREVA NP provided Supplement 3 to the response on July 8, 2010, to provide a revised date for submittal of a FINAL response to question 03.07.01-29 to allow time to address NRC comments. AREVA NP submitted Supplement 4 to the response on July 29, 2010, to provide INTERIM responses to questions 03.07.02-66 through question 03.07.02-68. AREVA NP submitted Supplement 5 to the response on August 31, 2010, to provide technically correct and complete FINAL responses to questions 03.07.02-70 through 03.07.02-72. On September 9, 2010, AREVA NP submitted Supplement 6 to provide a revised schedule for a FINAL response to question 03.07.01-29. On October 4, 2010, AREVA NP submitted Supplement 7 to provide a FINAL response to question 03.07.01-29. On October 18, 2010, AREVA NP submitted Supplement 8 to provide an INTERIM response to question 03.07.02-69. On November 11, 2010, AREVA NP submitted Supplement 9 to provide a revised schedule for a response to question 03.07.01-28. On January 20, 2011, AREVA NP submitted Supplement 10 to provide a revised schedule for a response to questions 03.07.02-67, 03.07.02-68, and 03.07.02-69. AREVA NP submitted Supplement 11 to the response on February 11, 2011 to provide a revised schedule for a response to question 03.07.02-66. On February 28, 2011, AREVA NP submitted Supplement 12 to provide a revised schedule for Question 03.07.01-28 and Question 03.07.02-69. AREVA NP submitted Supplement 13 on March 8, 2011, to provide an INTERIM response to Question 03.07.02-69. On March 24, 2011, AREVA NP submitted Supplement 14 to provide a revised schedule for Question 03.07.02-66. AREVA NP submitted Supplement 15 on April 1, 2011, to provide a revised schedule for Question 03.07.02-68. On April 27, 2011, AREVA NP submitted Supplement 16 to provide a revised schedule for Questions 03.07.02-67 and 03.07.02-69.

Due to changes in the schedule for FSAR Sections 3.7 and 3.8 as discussed with NRC, the schedule for Question 03.07.02-68 is being revised. The schedule for the remaining questions is unchanged.

The schedule for the technically correct and complete responses to the remaining questions is provided below.

Question #	Interim Response Date	Response Date
RAI 371-03.07.01-28	N/A	June 21, 2011
RAI 371-03.07.02-66	July 29, 2010 (Actual)	May 26, 2011
RAI 371-03.07.02-67	July 29, 2010 (Actual)	July 8, 2011
RAI 371-03.07.02-68	July 29, 2010 (Actual)	**July 8, 2011**
RAI 371-03.07.02-69	October 18, 2010 (Actual) March 21, 2011 March 8, 2011 (Actual)	July 8, 2011

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
Phone: 434-832-3884 (work)
434-942-6375 (cell)
Fax: 434-382-3884
Russell.Wells@Areva.com

From: WELLS Russell (RS/NB)
Sent: Wednesday, April 27, 2011 8:25 AM
To: 'Tesfaye, Getachew'
Cc: CORNELL Veronica (External RS/NB); BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 371, FSAR Ch. 3, Supplement 16

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to RAI No. 371 on April 26, 2010. AREVA NP submitted Supplement 1 to the response on June 7, 2010, to provide a revised schedule for question 03.07.01-29. On June 24, 2010, AREVA provided a revised response schedule in Supplement 2 for the other 8 questions based on the information presented at the June 9, 2010 public meeting on civil/structural replanning activities. AREVA NP provided Supplement 3 to the response on July 8, 2010, to provide a revised date for submittal of a FINAL response to question 03.07.01-29 to allow time to address NRC comments. AREVA NP submitted Supplement 4 to the response on July 29, 2010, to provide INTERIM responses to questions 03.07.02-66 through question 03.07.02-68. AREVA NP submitted Supplement 5 to the response on August 31, 2010, to provide technically correct and complete FINAL responses to questions 03.07.02-70 through 03.07.02-72. On September 9, 2010, AREVA NP submitted Supplement 6 to provide a revised schedule for a FINAL response to question 03.07.01-29. On October 4, 2010, AREVA NP submitted Supplement 7 to provide a FINAL response to question 03.07.01-29. On October 18, 2010, AREVA NP submitted Supplement 8 to provide an INTERIM response to question 03.07.02-69. On November 11, 2010, AREVA NP submitted Supplement 9 to provide a revised schedule for a response to question 03.07.01-28. On January 20, 2011, AREVA NP submitted Supplement 10 to provide a revised schedule for a response to questions 03.07.02-67, 03.07.02-68, and 03.07.02-69. AREVA NP submitted Supplement 11 to the response on February 11, 2011 to provide a revised schedule for a response to question 03.07.02-66. On February 28, 2011, AREVA NP submitted Supplement 12 to provide a revised schedule for Question 03.07.01-28 and Question 03.07.02-69. AREVA NP submitted Supplement 13 on March 8, 2011, to provide an INTERIM response to Question 03.07.02-69. On March 24, 2011, AREVA NP submitted Supplement 14 to provide a revised schedule for Question 03.07.02-66. AREVA NP submitted Supplement 15 on April 1, 2011, to provide a revised schedule for Question 03.07.02-68.

The schedule for Questions 03.07.02-67 and 03.07.02-69 is being revised. The schedule for the remaining questions is unchanged.

The schedule for the technically correct and complete responses to the remaining questions is provided below.

Question #	Interim Response Date	Response Date
RAI 371-03.07.01-28	N/A	June 21, 2011
RAI 371-03.07.02-66	July 29, 2010 (Actual)	May 26, 2011
RAI 371-03.07.02-67	July 29, 2010 (Actual)	**July 8, 2011**
RAI 371-03.07.02-68	July 29, 2010 (Actual)	May 26, 2011
RAI 371-03.07.02-69	October 18, 2010 (Actual) March 21, 2011 March 8, 2011 (Actual)	**July 8, 2011**

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

Phone: 434-832-3884 (work)
434-942-6375 (cell)
Fax: 434-382-3884
Russell.Wells@Areva.com

From: WELLS Russell (RS/NB)
Sent: Friday, April 01, 2011 2:23 PM
To: 'Tesfaye, Getachew'
Cc: CORNELL Veronica (External RS/NB); BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 371, FSAR Ch. 3, Supplement 15

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to RAI No. 371 on April 26, 2010. AREVA NP submitted Supplement 1 to the response on June 7, 2010, to provide a revised schedule for question 03.07.01-29. On June 24, 2010, AREVA provided a revised response schedule in Supplement 2 for the other 8 questions based on the information presented at the June 9, 2010 public meeting on civil/structural replanning activities. AREVA NP provided Supplement 3 to the response on July 8, 2010, to provide a revised date for submittal of a FINAL response to question 03.07.01-29 to allow time to address NRC comments. AREVA NP submitted Supplement 4 to the response on July 29, 2010, to provide INTERIM responses to questions 03.07.02-66 through question 03.07.02-68. AREVA NP submitted Supplement 5 to the response on August 31, 2010, to provide technically correct and complete FINAL responses to questions 03.07.02-70 through 03.07.02-72. On September 9, 2010, AREVA NP submitted Supplement 6 to provide a revised schedule for a FINAL response to question 03.07.01-29. On October 4, 2010, AREVA NP submitted Supplement 7 to provide a FINAL response to question 03.07.01-29. On October 18, 2010, AREVA NP submitted Supplement 8 to provide an INTERIM response to question 03.07.02-69. On November 11, 2010, AREVA NP submitted Supplement 9 to provide a revised schedule for a response to question 03.07.01-28. On January 20, 2011, AREVA NP submitted Supplement 10 to provide a revised schedule for a response to questions 03.07.02-67, 03.07.02-68, and 03.07.02-69. AREVA NP submitted Supplement 11 to the response on February 11, 2011 to provide a revised schedule for a response to question 03.07.02-66. On February 28, 2011, AREVA NP submitted Supplement 12 to provide a revised schedule for Question 03.07.01-28 and Question 03.07.02-69. AREVA NP submitted Supplement 13 on March 8, 2011, to provide an INTERIM response to Question 03.07.02-69. On March 24, 2011, AREVA NP submitted Supplement 14 to provide a revised schedule for Question 03.07.02-66.

The schedule for Question 03.07.02-68 is being revised to allow AREVA NP additional time to address NRC comments. The schedule for the remaining questions is unchanged.

The schedule for the technically correct and complete responses to the remaining questions is provided below.

Question #	Interim Response Date	Response Date
RAI 371-03.07.01-28	N/A	June 21, 2011
RAI 371-03.07.02-66	July 29, 2010 (Actual)	May 26, 2011
RAI 371-03.07.02-67	July 29, 2010 (Actual)	April 28, 2011
RAI 371-03.07.02-68	July 29, 2010 (Actual)	**May 26, 2011**
RAI 371-03.07.02-69	October 18, 2010 (Actual) March 21, 2011 March 8, 2011 (Actual)	April 28, 2011

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
Phone: 434-832-3884 (work)
434-942-6375 (cell)
Fax: 434-382-3884
Russell.Wells@Areva.com

From: WELLS Russell (RS/NB)
Sent: Thursday, March 24, 2011 1:11 PM
To: 'Tesfaye, Getachew'
Cc: CORNELL Veronica (External RS/NB); BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 371, FSAR Ch. 3, Supplement 14

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to RAI No. 371 on April 26, 2010. AREVA NP submitted Supplement 1 to the response on June 7, 2010, to provide a revised schedule for question 03.07.01-29. On June 24, 2010, AREVA provided a revised response schedule in Supplement 2 for the other 8 questions based on the information presented at the June 9, 2010 public meeting on civil/structural replanning activities. AREVA NP provided Supplement 3 to the response on July 8, 2010, to provide a revised date for submittal of a FINAL response to question 03.07.01-29 to allow time to address NRC comments. AREVA NP submitted Supplement 4 to the response on July 29, 2010, to provide INTERIM responses to questions 03.07.02-66 through question 03.07.02-68. AREVA NP submitted Supplement 5 to the response on August 31, 2010, to provide technically correct and complete FINAL responses to questions 03.07.02-70 through 03.07.02-72. On September 9, 2010, AREVA NP submitted Supplement 6 to provide a revised schedule for a FINAL response to question 03.07.01-29. On October 4, 2010, AREVA NP submitted Supplement 7 to provide a FINAL response to question 03.07.01-29. On October 18, 2010, AREVA NP submitted Supplement 8 to provide an INTERIM response to question 03.07.02-69. On November 11, 2010, AREVA NP submitted Supplement 9 to provide a revised schedule for a response to question 03.07.01-28. On January 20, 2011, AREVA NP submitted Supplement 10 to provide a revised schedule for a response to questions 03.07.02-67, 03.07.02-68, and 03.07.02-69. AREVA NP submitted Supplement 11 to the response on February 11, 2011 to provide a revised schedule for a response to question 03.07.02-66. On February 28, 2011, AREVA NP submitted Supplement 12 to provide a revised schedule for Question 03.07.01-28 and Question 03.07.02-69. AREVA NP submitted Supplement 13 on March 8, 2011, to provide an INTERIM response to Question 03.07.02-69.

The schedule for Question 03.07.02-66 is being revised. In addition, the schedule for Question 03.07.01-28 is being revised to allow additional time for AREVA NP to address NRC comments. The schedule for the remaining questions is unchanged.

The schedule for the technically correct and complete responses to the remaining questions is provided below.

Question #	Interim Response Date	Response Date
RAI 371-03.07.01-28	N/A	**June 21, 2011**
RAI 371-03.07.02-66	July 29, 2010 (Actual)	**May 26, 2011**
RAI 371-03.07.02-67	July 29, 2010 (Actual)	April 28, 2011
RAI 371-03.07.02-68	July 29, 2010 (Actual)	April 5, 2011
RAI 371-03.07.02-69	October 18, 2010 (Actual) March 21, 2011	April 28, 2011

	March 8, 2011 (Actual)	

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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434-942-6375 (cell)
Fax: 434-382-3884
Russell.Wells@Areva.com

From: WELLS Russell (RS/NB)
Sent: Tuesday, March 08, 2011 3:45 PM
To: 'Tesfaye, Getachew'
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); CORNELL Veronica (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 371, FSAR Ch. 3, Supplement 13

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to RAI No. 371 on April 26, 2010. AREVA NP submitted Supplement 1 to the response on June 7, 2010, to provide a revised schedule for question 03.07.01-29. On June 24, 2010, AREVA provided a revised response schedule in Supplement 2 for the other 8 questions based on the information presented at the June 9, 2010 public meeting on civil/structural replanning activities. AREVA NP provided Supplement 3 to the response on July 8, 2010, to provide a revised date for submittal of a FINAL response to question 03.07.01-29 to allow time to address NRC comments. AREVA NP submitted Supplement 4 to the response on July 29, 2010, to provide INTERIM responses to questions 03.07.02-66 through question 03.07.02-68. AREVA NP submitted Supplement 5 to the response on August 31, 2010, to provide technically correct and complete FINAL responses to questions 03.07.02-70 through 03.07.02-72. On September 9, 2010, AREVA NP submitted Supplement 6 to provide a revised schedule for a FINAL response to question 03.07.01-29. On October 4, 2010, AREVA NP submitted Supplement 7 to provide a FINAL response to question 03.07.01-29. On October 18, 2010, AREVA NP submitted Supplement 8 to provide an INTERIM response to question 03.07.02-69. On November 11, 2010, AREVA NP submitted Supplement 9 to provide a revised schedule for a response to question 03.07.01-28. On January 20, 2011, AREVA NP submitted Supplement 10 to provide a revised schedule for a response to questions 03.07.02-67, 03.07.02-68, and 03.07.02-69. AREVA NP submitted Supplement 11 to the response on February 11, 2011 to provide a revised schedule for a response to question 03.07.02-66. On February 28, 2011, AREVA NP submitted Supplement 12 to provide a revised schedule for Question 03.07.01-28 and Question 03.07.02-69.

The attached file, “RAI 371 Supplement 13 Response US EPR DC-INTERIM.pdf” provides a technically correct INTERIM response to the Question 03.07.02-69, as committed.

The following table indicates the page in the response document, “RAI 371 Supplement 13 Response US EPR DC-INTERIM.pdf” that contains AREVA NP’s response to the subject question.

Question #	Start Page	End Page
RAI 371 – 03.07.02-69	2	32

The schedule for the technically correct and complete responses to the remaining questions is provided below.

Question #	Interim Response Date	Response Date
RAI 371-03.07.01-28	N/A	March 24, 2011
RAI 371-03.07.02-66	July 29, 2010 (Actual)	April 8, 2011
RAI 371-03.07.02-67	July 29, 2010 (Actual)	April 28, 2011
RAI 371-03.07.02-68	July 29, 2010 (Actual)	April 5, 2011
RAI 371-03.07.02-69	October 18, 2010 (Actual) March 21, 2011 **March 8, 2011 (Actual)**	April 28, 2011

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
Phone: 434-832-3884 (work)
434-942-6375 (cell)
Fax: 434-382-3884
Russell.Wells@Areva.com

From: WELLS Russell (RS/NB)
Sent: Monday, February 28, 2011 5:09 PM
To: 'Tesfaye, Getachew'
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); CORNELL Veronica (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 371, FSAR Ch. 3, Supplement 12

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to RAI No. 371 on April 26, 2010. AREVA NP submitted Supplement 1 to the response on June 7, 2010, to provide a revised schedule for question 03.07.01-29. On June 24, 2010, AREVA provided a revised response schedule in Supplement 2 for the other 8 questions based on the information presented at the June 9, 2010 public meeting on civil/structural replanning activities. AREVA NP provided Supplement 3 to the response on July 8, 2010, to provide a revised date for submittal of a FINAL response to question 03.07.01-29 to allow time to address NRC comments. AREVA NP submitted Supplement 4 to the response on July 29, 2010, to provide INTERIM responses to questions 03.07.02-66 through question 03.07.02-68. AREVA NP submitted Supplement 5 to the response on August 31, 2010, to provide technically correct and complete FINAL responses to questions 03.07.02-70 through 03.07.02-72. On September 9, 2010, AREVA NP submitted Supplement 6 to provide a revised schedule for a FINAL response to question 03.07.01-29. On October 4, 2010, AREVA NP submitted Supplement 7 to provide a FINAL response to question 03.07.01-29. On October 18, 2010, AREVA NP submitted Supplement 8 to provide an INTERIM response to question 03.07.02-69. On November 11, 2010, AREVA NP submitted Supplement 9 to provide a revised schedule for a response to question 03.07.01-28. On January 20, 2011, AREVA NP submitted Supplement 10 to provide a revised schedule for a response to questions 03.07.02-67, 03.07.02-68, and 03.07.02-69. AREVA NP submitted Supplement 11 to the response on February 11, 2011 to provide a revised schedule for a response to question 03.07.02-66.

The schedule for the FINAL response to Question 03.07.01-28 is being revised to allow additional time for AREVA NP to interact with the NRC. In addition, the schedule for the INTERIM response to Question 03.07.02-69 is being revised to allow additional time for AREVA NP to address NRC comments. The schedule for the remaining questions is unchanged.

The schedule for the technically correct and complete responses to the remaining questions is provided below.

Question #	Interim Response Date	Response Date
RAI 371-03.07.01-28	N/A	**March 24, 2011**
RAI 371-03.07.02-66	July 29, 2010 (Actual)	April 8, 2011
RAI 371-03.07.02-67	July 29, 2010 (Actual)	April 28, 2011
RAI 371-03.07.02-68	July 29, 2010 (Actual)	April 5, 2011
RAI 371-03.07.02-69	October 18, 2010 (Actual) **March 21 2011**	April 28, 2011

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
Phone: 434-832-3884 (work)
434-942-6375 (cell)
Fax: 434-382-3884
Russell.Wells@Areva.com

From: BRYAN Martin (External RS/NB)
Sent: Friday, February 11, 2011 1:55 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); CORNELL Veronica (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 371, FSAR Ch. 3, Supplement 11

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to RAI No. 371 on April 26, 2010. AREVA NP submitted Supplement 1 to the response on June 7, 2010, to provide a revised schedule for question 03.07.01-29. On June 24, 2010, AREVA provided a revised response schedule in Supplement 2 for the other 8 questions based on the information presented at the June 9, 2010 public meeting on civil/structural replanning activities. AREVA NP provided Supplement 3 to the response on July 8, 2010, to provide a revised date for submittal of a FINAL response to question 03.07.01-29 to allow time to address NRC comments. AREVA NP submitted Supplement 4 to the response on July 29, 2010, to provide INTERIM responses to questions 03.07.02-66 through question 03.07.02-68. AREVA NP submitted Supplement 5 to the response on August 31, 2010, to provide technically correct and complete FINAL responses to questions 03.07.02-70 through 03.07.02-72. On September 9, 2010, AREVA NP submitted Supplement 6 to provide a revised schedule for a FINAL response to question 03.07.01-29. On October 4, 2010, AREVA NP submitted Supplement 7 to provide a FINAL response to question 03.07.01-29. On October 18, 2010, AREVA NP submitted Supplement 8 to provide an INTERIM response to question 03.07.02-69. On November 11, 2010, AREVA NP submitted Supplement 9 to provide a revised schedule for a response to

question 03.07.01-28. On January 20, 2011, AREVA NP submitted Supplement 10 to provide a revised schedule for a response to questions 03.07.02-67, 03.07.02-68, and 03.07.02-69.

The schedule for Question 03.07.02-66 has changed. The schedule for the remaining questions is unchanged

The schedule for the technically correct and complete responses to the remaining questions is provided below.

Question #	Interim Response Date	Response Date
RAI 371-03.07.01-28	N/A	February 28, 2011
RAI 371-03.07.02-66	July 29, 2010 (Actual)	April 8, 2011
RAI 371-03.07.02-67	July 29, 2010 (Actual)	April 28, 2011
RAI 371-03.07.02-68	July 29, 2010 (Actual)	April 5, 2011
RAI 371-03.07.02-69	October 18, 2010 (Actual) February 28, 2011	April 28, 2011

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 (External RS/NB)
Sent: Thursday, January 20, 2011 6:53 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); CORNELL Veronica (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 371, FSAR Ch. 3, Supplement 10

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to RAI No. 371 on April 26, 2010. AREVA NP submitted Supplement 1 to the response on June 7, 2010, to provide a revised schedule for question 03.07.01-29. On June 24, 2010, AREVA provided a revised response schedule in Supplement 2 for the other 8 questions based on the information presented at the June 9, 2010 public meeting on civil/structural replanning activities. AREVA NP provided Supplement 3 to the response on July 8, 2010, to provide a revised date for submittal of a FINAL response to question 03.07.01-29 to allow time to address NRC comments. AREVA NP submitted Supplement 4 to the response on July 29, 2010, to provide INTERIM responses to questions 03.07.02-66 through question 03.07.02-68. AREVA NP submitted Supplement 5 to the response on August 31, 2010, to provide technically correct and complete FINAL responses to questions 03.07.02-70 through 03.07.02-72. On September 9, 2010, AREVA NP submitted Supplement 6 to provide a revised schedule for a FINAL response to question 03.07.01-29. On October 4, 2010, AREVA NP submitted Supplement 7 to provide a FINAL response to question 03.07.01-29. On October 18, 2010, AREVA NP submitted Supplement 8 to provide an INTERIM response to question 03.07.02-69. On November 11, 2010, AREVA NP submitted Supplement 9 to provide a revised schedule for a response to question 03.07.01-28.

The schedule for the responses to Question 03.07.02-67 and Question 03.07.02-68 is being revised to allow additional time for AREVA NP to address NRC comments. The schedule for the response to

Question 03.07.02-69 is also being revised to allow additional time for AREVA NP to prepare and submit a revised INTERIM response. The schedule for the remaining questions is unchanged

The schedule for the technically correct and complete responses to the remaining questions is provided below.

Question #	Interim Response Date	Response Date
RAI 371-03.07.01-28	N/A	February 28, 2011
RAI 371-03.07.02-66	July 29, 2010 (Actual)	February 17, 2011
RAI 371-03.07.02-67	July 29, 2010 (Actual)	April 28, 2011
RAI 371-03.07.02-68	July 29, 2010 (Actual)	April 5, 2011
RAI 371-03.07.02-69	October 18, 2010 (Actual) February 28, 2011	April 28, 2011

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 (External RS/NB)
Sent: Thursday, November 11, 2010 11:24 AM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); CORNELL Veronica (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 371, FSAR Ch. 3, Supplement 9

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to RAI No. 371 on April 26, 2010. AREVA NP submitted Supplement 1 to the response on June 7, 2010, to provide a revised schedule for question 03.07.01-29. On June 24, 2010, AREVA provided a revised response schedule in Supplement 2 for the other 8 questions based on the information presented at the June 9, 2010 public meeting on civil/structural replanning activities. AREVA NP provided Supplement 3 to the response on July 8, 2010, to provide a revised date for submittal of a FINAL response to question 03.07.01-29 to allow time to address NRC comments. AREVA NP submitted Supplement 4 to the response on July 29, 2010, to provide INTERIM responses to questions 03.07.02-66 through question 03.07.02-68. AREVA NP submitted Supplement 5 to the response on August 31, 2010, to provide technically correct and complete FINAL responses to questions 03.07.02-70 through 03.07.02-72. On September 9, 2010, AREVA NP submitted Supplement 6 to provide a revised schedule for a FINAL response to question 03.07.01-29. On October 4, 2010, AREVA NP submitted Supplement 7 to provide a FINAL response to question 03.07.01-29. On October 18, 2010, AREVA NP submitted Supplement 8 to provide an INTERIM response to question 03.07.02-69.

The schedule for the response to Question 03.07.01-28 is being revised to allow additional time for AREVA NP to address NRC comments. The schedule for the remaining questions is unchanged

The schedule for the technically correct and complete responses to the remaining questions is provided below.

Question #	Interim Response Date	Response Date
RAI 371-03.07.01-28	N/A	February 28, 2011

RAI 371-03.07.02-66	July 29, 2010 (Actual)	February 17, 2011
RAI 371-03.07.02-67	July 29, 2010 (Actual)	January 20, 2011
RAI 371-03.07.02-68	July 29, 2010 (Actual)	January 20, 2011
RAI 371-03.07.02-69	October 18, 2010 (Actual)	January 20, 2011

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 (External RS/NB)
Sent: Monday, October 18, 2010 4:30 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); CORNELL Veronica (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 371, FSAR Ch. 3, Supplement 8

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to RAI No. 371 on April 26, 2010. AREVA NP submitted Supplement 1 to the response on June 7, 2010, to provide a revised schedule for question 03.07.01-29. On June 24, 2010, AREVA provided a revised response schedule in Supplement 2 for the other 8 questions based on the information presented at the June 9, 2010 public meeting on civil/structural replanning activities. AREVA NP provided Supplement 3 to the response on July 8, 2010, to provide a revised date for submittal of a FINAL response to question 03.07.01-29 to allow time to address NRC comments. AREVA NP submitted Supplement 4 to the response on July 29, 2010, to provide INTERIM responses to questions 03.07.02-66 through question 03.07.02-68. AREVA NP submitted Supplement 5 to the response on August 31, 2010, to provide technically correct and complete FINAL responses to questions 03.07.02-70 through 03.07.02-72. On September 9, 2010, AREVA NP submitted Supplement 6 to provide a revised schedule for a FINAL response to question 03.07.01-29. On October 4, 2010, AREVA NP submitted Supplement 7 to provide a FINAL response to question 03.07.01-29.

The attached file, “RAI 371 Supplement 8 Response US EPR DC-INTERIM.pdf” provides a technically correct and complete INTERIM response to question 03.07.02-69, as committed.

The following table indicates the respective pages in the response document, “RAI 371 Supplement 8 Response US EPR DC-INTERIM.pdf,” that contain AREVA NP’s response to the subject question.

Question #	Start Page	End Page
RAI 371 — 03.07.02-69	2	4

The schedule for the technically correct and complete responses to the remaining questions is unchanged and is provided below.

Question #	Interim Response Date	Response Date
RAI 371-03.07.01-28	N/A	November 12, 2010
RAI 371-03.07.02-66	July 29, 2010 (Actual)	February 17, 2011

RAI 371-03.07.02-67	July 29, 2010 (Actual)	January 20, 2011
RAI 371-03.07.02-68	July 29, 2010 (Actual)	January 20, 2011
RAI 371-03.07.02-69	October 18, 2010 (Actual)	January 20, 2011

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 (External RS/NB)
Sent: Monday, October 04, 2010 4:57 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); CORNELL Veronica (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 371, FSAR Ch. 3, Supplement 7

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to RAI No. 371 on April 26, 2010. AREVA NP submitted Supplement 1 to the response on June 7, 2010, to provide a revised schedule for question 03.07.01-29. On June 24, 2010, AREVA provided a revised response schedule in Supplement 2 for the other 8 questions based on the information presented at the June 9, 2010 public meeting on civil/structural replanning activities. AREVA NP provided Supplement 3 to the response on July 8, 2010, to provide a revised date for submittal of a FINAL response to question 03.07.01-29 to allow time to address NRC comments. AREVA NP submitted Supplement 4 to the response on July 29, 2010, to provide INTERIM responses to questions 03.07.02-66 through question 03.07.02-68. AREVA NP submitted Supplement 5 to the response on August 31, 2010, to provide technically correct and complete FINAL responses to questions 03.07.02-70 through 03.07.02-72. On September 9, 2010, AREVA NP submitted Supplement 6 to provide a revised schedule for a FINAL response to question 03.07.01-29.

The attached file, “RAI 371 Supplement 7 Response US EPR DC.pdf” provides technically correct and complete FINAL response to question 03.07.01-29, as committed.

The following table indicates the respective pages in the response document, “RAI 371 Supplement 7 Response US EPR DC.pdf,” that contain AREVA NP’s response to the subject questions.

Question #	Start Page	End Page
RAI 371 — 03.07.01-29	2	5

The schedule for an interim response and the technically correct and complete responses to the remaining questions is unchanged and is provided below.

Question #	Interim Response Date	Response Date
RAI 371-03.07.01-28	N/A	November 12, 2010
RAI 371-03.07.02-66	July 29, 2010 (Actual)	February 17, 2011
RAI 371-03.07.02-67	July 29, 2010 (Actual)	January 20, 2011
RAI 371-03.07.02-68	July 29, 2010 (Actual)	January 20, 2011

RAI 371-03.07.02-69	October 18, 2010	January 20, 2011

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 (External RS/NB)
Sent: Thursday, September 09, 2010 12:44 PM
To: Tesfaye, Getachew
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); CORNELL Veronica (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 371, FSAR Ch. 3, Supplement 6

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to RAI No. 371 on April 26, 2010. AREVA NP submitted Supplement 1 to the response on June 7, 2010, to provide a revised schedule for question 03.07.01-29. On June 24, 2010, AREVA provided a revised response schedule in Supplement 2 for the other 8 questions based on the information presented at the June 9, 2010 public meeting on civil/structural replanning activities. AREVA NP provided Supplement 3 to the response on July 8, 2010, to provide a revised date for submittal of a FINAL response to question 03.07.01-29 to allow time to address NRC comments. AREVA NP submitted Supplement 4 to the response on July 29, 2010, to provide INTERIM responses to question 03.07.02-66 through question 03.07.02-68. AREVA NP submitted Supplement 5 to the response on August 31, 2010, to provide technically correct and complete FINAL responses to questions 03.07.02-70 through 03.07.02-72.

The schedule for the FINAL response to Question 03.07.01-29 is being revised to allow time for AREVA NP to address NRC comments. The schedule for the remaining questions is unchanged.

The schedule for a technically correct and complete interim response and responses to the following questions is provided below.

Question #	Interim Response Date	Response Date
RAI 371-03.07.01-28	N/A	November 12, 2010
RAI 371-03.07.01-29	N/A	**October 5, 2010**
RAI 371-03.07.02-66	July 29, 2010 (Actual)	February 17, 2011
RAI 371-03.07.02-67	July 29, 2010 (Actual)	January 20, 2011
RAI 371-03.07.02-68	July 29, 2010 (Actual)	January 20, 2011
RAI 371-03.07.02-69	October 18, 2010	January 20, 2011

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 (External RS/NB)
Sent: Tuesday, August 31, 2010 4:55 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); CORNELL Veronica (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 371, FSAR Ch. 3, Supplement 5

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to RAI No. 371 on April 26, 2010. AREVA NP submitted Supplement 1 to the response on June 7, 2010, to provide a revised schedule for question 03.07.01-29. On June 24, 2010, AREVA provided a revised response schedule in Supplement 2 for the other 8 questions based on the information presented at the June 9, 2010 public meeting on civil/structural replanning activities. AREVA NP provided Supplement 3 to the response on July 8, 2010, to provide a revised date for submittal of a FINAL response to question 03.07.01-29 to allow time to address NRC comments. AREVA NP submitted Supplement 4 to the response on July 29, 2010, to provide INTERIM responses to question 03.07.02-66 through question 03.07.02-68.

The attached file, "RAI 371 Supplement 5 Response US EPR DC.pdf" provides technically correct and complete FINAL responses to 3 of the remaining 9 questions, as committed.

The following table indicates the respective pages in the response document, "RAI 371 Supplement 5 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 371 — 03.07.02-70	2	3
RAI 371 — 03.07.02-71	4	10
RAI 371 — 03.07.02-72	11	11

The schedule for a technically correct and complete response to the remaining questions is unchanged and is provided below.

Question #	Interim Response Date	Response Date
RAI 371-03.07.01-28	N/A	November 12, 2010
RAI 371-03.07.01-29	N/A	September 17, 2010
RAI 371-03.07.02-66	July 29, 2010 (Actual)	February 17, 2011
RAI 371-03.07.02-67	July 29, 2010 (Actual)	January 20, 2011
RAI 371-03.07.02-68	July 29, 2010 (Actual)	January 20, 2011
RAI 371-03.07.02-69	October 18, 2010	January 20, 2011

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, July 29, 2010 8:08 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); CORNELL Veronica (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 371, FSAR Ch. 3, Supplement 4 - Interim

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to RAI No. 371 on April 26, 2010. AREVA NP submitted Supplement 1 to the response on June 7, 2010, to provide a revised schedule for question 03.07.01-29. On June 24, 2010, AREVA provided a revised response schedule in Supplement 2 for the other 8 questions based on the information presented at the June 9, 2010 public meeting on civil/structural replanning activities. AREVA NP provided Supplement 3 to the response on July 8, 2010, to provide a revised date for submittal of a FINAL response to question 03.07.01-29 to allow time to address NRC comments.

The attached file, "RAI 371 Supplement 4 Response US EPR DC.pdf" provides technically correct and complete INTERIM responses to 3 of the remaining 10 questions, as committed.

The following table indicates the respective pages in the response document, "RAI 371 Supplement 4 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 371 — 03.07.02-66	2	2
RAI 371 — 03.07.02-67	3	3
RAI 371 — 03.07.02-68	4	8

The schedule for an interim response and the technically correct and complete response to these questions is unchanged and is provided below.

Question #	Interim Response Date	Response Date
RAI 371-03.07.01-28	N/A	November 12, 2010
RAI 371-03.07.01-29	N/A	September 17, 2010
RAI 371-03.07.02-66	July 29, 2010 (Actual)	February 17, 2011
RAI 371-03.07.02-67	July 29, 2010 (Actual)	January 20, 2011
RAI 371-03.07.02-68	July 29, 2010 (Actual)	January 20, 2011
RAI 371-03.07.02-69	October 18, 2010	January 20, 2011
RAI 371-03.07.02-70	N/A	September 3, 2010
RAI 371-03.07.02-71	N/A	September 3, 2010
RAI 371-03.07.02-72	N/A	September 3, 2010

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, July 08, 2010 4:02 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); CORNELL Veronica (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 371, FSAR Ch. 3, Supplement 3

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to the 9 questions of RAI No. 371 on April 26, 2010. AREVA NP submitted Supplement 1 on June 7, 2010, to provide a revised date for 1 of the questions (03.07.01-29) on June 7, 2010. On June 24, 2010, AREVA provided a revised response schedule in Supplement 2 for the other 8 questions based on the information presented at the June 9, 2010 public meeting on civil/structural replanning activities.

To provide for further interaction with the NRC on the response for question 03.07.01-29, a revised schedule is provided below. Dates for the other 8 questions remain unchanged.

The revised schedule for the technically correct and complete response to these questions has been changed and is provided below.

Question #	Interim Response Date	Response Date
RAI 371-03.07.01-28	N/A	November 12, 2010
RAI 371-03.07.01-29	N/A	September 17, 2010
RAI 371-03.07.02-66	July 29, 2010	February 17, 2011
RAI 371-03.07.02-67	July 29, 2010	January 20, 2011
RAI 371-03.07.02-68	July 29, 2010	January 20, 2011
RAI 371-03.07.02-69	October 18, 2010	January 20, 2011
RAI 371-03.07.02-70	N/A	September 3, 2010
RAI 371-03.07.02-71	N/A	September 3, 2010
RAI 371-03.07.02-72	N/A	September 3, 2010

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, June 24, 2010 12:58 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); CORNELL Veronica (EXT); RYAN Tom (AREVA NP INC); GARDNER George Darrell (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 371, FSAR Ch. 3, Supplement 2

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to RAI No. 371 on April 26, 2010. AREVA NP submitted Supplement 1 to the response on June 7, 2010, to provide a schedule for the remaining 9 questions, 8 of which were affected by the work underway to address NRC comments from the April 26, 2010, audit.

Based upon the civil/structural re-planning activities and revised RAI response schedule presented to the NRC during the June 9, 2010, Public Meeting, and to allow time to interact with the NRC on the responses, the schedule has been changed. The schedule for 03.07.01-29 remains unchanged.

Prior to submittal of the final RAI response, AREVA NP will provide an interim RAI response that includes:

(1) a description of the technical work (e.g., methodology)
(2) U.S. EPR FSAR revised pages, as applicable

The revised schedule for an interim response and the technically correct and complete response to these questions is provided below.

Question #	Interim Response Date	Response Date
RAI 371-03.07.01-28	N/A	November 12, 2010
RAI 371-03.07.01-29	N/A	July 8, 2010
RAI 371-03.07.02-66	July 29, 2010	February 17, 2011
RAI 371-03.07.02-67	July 29, 2010	January 20, 2011
RAI 371-03.07.02-68	July 29, 2010	January 20, 2011
RAI 371-03.07.02-69	October 18, 2010	January 20, 2011
RAI 371-03.07.02-70	N/A	September 3, 2010
RAI 371-03.07.02-71	N/A	September 3, 2010
RAI 371-03.07.02-72	N/A	September 3, 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: Monday, June 07, 2010 5:07 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); CORNELL Veronica (EXT); VAN NOY Mark (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 371, FSAR Ch. 3, Supplement 1

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to RAI No. 371 on April 26, 2010.

As agreed with NRC, AREVA NP is providing a revised date for RAI 371 Supplement 1 Question 03.07.01-29 to allow time to interact with the NRC on the response.

The schedule for technically correct and complete responses to the remaining question has been changed and is provided below. The dates for questions 03.07.02-66 through 03.03.02-69 will be revised based on the information that will be presented at the June 9, 2010 public meeting and subsequent NRC feedback.

Question #	Response Date
RAI 371-03.07.01-28	August 3, 2010
RAI 371-03.07.01-29	July 8, 2010
RAI 371-03.07.02-66	July 27, 2010
RAI 371-03.07.02-67	July 27, 2010
RAI 371-03.07.02-68	August 3, 2010
RAI 371-03.07.02-69	August 3, 2010
RAI 371-03.07.02-70	August 3, 2010
RAI 371-03.07.02-71	August 3, 2010
RAI 371-03.07.02-72	August 3, 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: Monday, April 26, 2010 12:45 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); RYAN Tom (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 371, FSAR Ch. 3

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 371 Response US EPR DC.pdf" provides a schedule since a technically correct and complete response to the 9 questions is not provided.

The following table indicates the respective pages in the response document, "RAI 371 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 371-03.07.01-28	2	3
RAI 371-03.07.01-29	4	4
RAI 371-03.07.02-66	5	5
RAI 371-03.07.02-67	6	6
RAI 371-03.07.02-68	7	7
RAI 371-03.07.02-69	8	9
RAI 371-03.07.02-70	10	10
RAI 371-03.07.02-71	11	11

RAI 371-03.07.02-72	12	12

A complete answer is not provided for 9 of the 9 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 371-03.07.01-28	August 3, 2010
RAI 371-03.07.01-29	June 7, 2010
RAI 371-03.07.02-66	July 27, 2010
RAI 371-03.07.02-67	July 27, 2010
RAI 371-03.07.02-68	August 3, 2010
RAI 371-03.07.02-69	August 3, 2010
RAI 371-03.07.02-70	August 3, 2010
RAI 371-03.07.02-71	August 3, 2010
RAI 371-03.07.02-72	August 3, 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: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Thursday, March 25, 2010 2:05 PM
To: ZZ-DL-A-USEPR-DL
Cc: Chakravorty, Manas; Hawkins, Kimberly; Miernicki, Michael; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 371 (4273,4271,4280), FSAR Ch. 3

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on February 25, 2010, and on March 24, 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: 3001

Mail Envelope Properties (1F1CC1BBDC66B842A46CAC03D6B1CD4104622987)

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Response to

Request for Additional Information No. 371,
Question 03.07.02-66

3/25/2010

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 03.07.01 - Seismic Design Parameters
SRP Section: 03.07.02 - Seismic System Analysis

Application Section: 03.07

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

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Question 03.07.02-66:

RAI from Public Meeting 12/14-15, 2009

The new FEM is composed entirely of plate and shell elements (all nodes having 6 DOF) with no brick elements (all nodes having 3 DOF), particularly for the basemat/wall elements of the model. Therefore, there is no issue associated with this model concerning connections between adjoining nodes having different DOFs. These elements, however, have effectively zero thickness leading to the following two problems:

a. When a plate element of a section of the basemat of one thickness is connected to an adjacent element of a different thickness, the centerlines of the adjacent elements are connected continuously in a single plane. However, the actual basemat is typically poured with the bottom of the basemat at one elevation. If the basemat has a varying thickness, the actual centerline does not lie in a single plane but its location changes as the thickness of the mat changes. As this has the potential to introduce non-conservative errors in the design loads for the basemat, the staff requests that the applicant evaluate the impact of the analysis simplification regarding the location of the basemat centerline on the bending evaluation of the basemat and the use of the analysis results for the design of the mat.

b. In embedding the model into the foundation, the basemat can be located with its centerline at the elevation of the nominal bottom of the basemat in which case the length of the attached walls must be increased affecting their frequency response or the centerline can be located at its actual elevation somewhat above the foundation bottom. This latter method leaves the effective lengths of attached walls approximately correct but the seismic input to the model is at an incorrect elevation. In either case the assumptions used can lead to non-conservative structural accelerations and an under prediction of seismic loads acting on the structure. The staff requests that the applicant describe the details of the placement of the embedded model into the foundation material using these plate elements and its potential effect on the accuracy of the analysis results and the impact on the building's seismic design loads.

Response to Question 03.07.02-66:

Item a:

The Nuclear Island (NI) Basemat Structures structural analysis process consists of a 3D finite element model (FEM) used for basemat design and a fixed base 3D FEM model used for the design of the superstructure. The 3D basemat FEM represents the superstructure, foundation mat, and the nonlinearity associated with the mat to soil interface. The model construction is consistent with the soil structure interaction (SSI) model, with the exception of the foundation. The foundation is represented by solid elements that replace the shells used in the SSI analysis. The 3D superstructure FEM represents the superstructure geometry and loadings in sufficient granularity for design of the superstructure structural components. The model construction is consistent with the previous static model, except that the model is only fixed base. Additional details of each model are discussed in the following sections.

<u>3D FEM Basemat Foundation Model</u>

The 3D basemat FEM is developed for the analysis and design of the NI Common Basemat foundation. The basemat foundation consists of solid elements, five layers through the thickness on average, connected to the shell/beam element representation of the superstructure

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using the ANSYS code. ANSYS multi point constraints (MPCs) are used in the transitioning of shells/beams (six degrees of freedom (DOF) elements representing walls and columns) to basemat solid elements (three DOFs). The 3D basemat FEM, except for the solid element foundation, is the same as the SSI model described in U.S. EPR FSAR Tier 2, Section 3.7.2.3.1.2. Out of plane cracking of walls and diaphragms is explicitly modeled. The ANSYS computer code is used to analyze of the model and is described in a new U.S. EPR FSAR Tier 2, Section 3.7.2.3.1.4. Figure 03.07.02-66-1 and Figure 03.07.02-66-2 show the solid element portion of the foundation basemat model and the full foundation basemat model, respectively. The solid element basemat and foundation basemat model with solid element basemat will be added as U.S. EPR FSAR Tier 2, Figures 3.7.2-151 and Figure 3.7.2-152, respectively.

A study was performed to select the best methodology, elements and meshing for representing the basemat. Solid elements were selected because:

- They are better able to represent the geometry, mat elevations and varying thicknesses.
- They more accurately produce forces and moments for design, as a result of the large thickness of the basemat, when compared to the element span.

The model includes seismic and static loadings. Seismic loads are developed from a nonlinear time history analysis using lumped masses to represent the dead loads, water in pools under normal operating conditions, 25 percent of the live loads, 75 percent of the maximum precipitation load and miscellaneous dead loads of at least 50 psf. The concrete only mass of the structure is accounted for by the material weight densities. The seismic loads and application of the mass in the model are similar to the 3D FEMs for Dynamic Analysis described in U.S. EPR FSAR Tier 2, Section 3.7.2.3.1.2.

The static loads are the hydrostatic loads (buoyancy effects) resulting from a flood water level of elevation -1.0 ft below finished grade and the at-rest earth pressure due to the effects of embedded soil mass on the outer walls in contact with soil. The ANSYS model is first loaded statically by accelerating the lumped and distributed masses vertically, as described in U.S. EPR FSAR Tier 2, Section 3.7.2.3.1.2. These static loads are added before a nonlinear time-history analysis is performed by applying the three translational seismic motions simultaneously. The input motions are in-column ground motions obtained from SHAKE91 analysis runs at the bottom of the NI common basemat foundation level in the three translational directions derived using the NEI approach described in U.S. EPR FSAR Tier 2, Section 2.5.2.6. The compatibility between the basemat foundation model and the SASSI dynamic model for the seismic base reactions was confirmed as part of the analysis.

Springs are used to represent the soil supporting the model. These springs allow for the compression only for the concrete/soil interface in the vertical direction. The sliding coefficient of friction interface between the foundation concrete basemat and underlying soil in the seismic analysis is modeled using sliding/contact elements. A parametric comparison of different soil spring formulations was performed for the seismic model considering Gazetas, Wong/Luco, ASCE, Army-Navy and Bowles methodologies. The Gazetas formulation produced displacements and base reactions similar to SASSI and, therefore, was selected and used in the model. Development of the dynamic soil springs is based on the strain compatible shear wave velocities in U.S. EPR FSAR Tier 2, Table 3.7.1-6. The full value of the resulting shear modulus is used.

Soil springs for the static basemat analysis are developed similarly to the dynamic seismic analysis soil springs except one half of the strain compatible shear modulus was used for the seismic soil cases. For the high frequency soil cases, spring development is based on a site

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specific rock site distribution. U.S. EPR FSAR Tier 2, Section 3.8.5.4.2 described the development process.

The distribution for seismic and static vertical soil springs is elliptical in nature as described by the equation in U.S. EPR FSAR Tier 2, Section 3.8.5.4.2.

Soil loads for design of embedded walls due to seismic are obtained from the SSI analysis described in U.S. EPR FSAR Tier 2, Section 3.7.2.4. Soil pressures on the embedded walls are included in the seismic and static models. The seismic model uses a geotechnical approach where the lateral soil pressures are calculated by the model based on wall displacements that occur during the application of the seismic input motions. Figure 03.07.02-66-3 shows the wall movement versus soil pressure coefficients used in the analysis. The sidewall spring elements utilizing this idealize curve is based on Design Manual 7.02, Foundations & Earth Structures, Naval Facilities Engineering Command, Reference [1], and produce an initial pressure based on an at-rest coefficient, $K_o = 0.5$. Upon application of the seismic loading, the building displaces and the pressure increases on the walls moving into the soil and decreases for walls moving away. The minimum pressure is based on the active soil pressure coefficient $K_a = 0.33$ and the maximum pressure is based on a passive coefficient $K_p = 3.0$. The magnitude of displacement required to fully mobilize the shear strength based on loose cohesionless soil is 0.006H (2.799in) for the passive state and 0.002H (0.933in) for the active state, where H equals the depth of embedment.

Seismic loads produced by this analytical model are the resultants of the seismic motions with time. The critical seismic loads used in the static portion of the basemat design will be the maximum/minimum moments and shears for each element that forms the basemat of the model.

Static loads other than seismic, as defined in U.S. EPR FSAR Tier 2, Sections 3.8.1.3, 3.8.3.3 and 3.8.4.3; are included in the load combinations for the NI basemat design. These non-seismic static loads are analyzed statically with the basemat model before combining them with the seismic loads. The critical seismic and static loads are combined during post-processing for each load combination by superposition.

<u>Fixed based 3D FEM Superstructure Model</u>

The superstructure model described in U.S. EPR FSAR Tier 2, Section 3.7.2.3.1.1 and shown in Figure 3.7.2-5 is a finite element model of the NI Common Basemat Structure developed using ANSYS. The model consists of solid, shell and beam elements. Solid elements are primarily used to model containment and the foundation basemat. The remaining walls and slabs are modeled using shell elements. The beams and columns in the NI Common Basemat Structure are modeled with beam elements.

Typically, an element size of 1.5 m is used to mesh the building. The size varies depending on geometry and location. Containment is modeled using five layers of solid elements through the cylindrical wall thickness and four layers through the dome, while the basemat uses three, four and five layers of solid elements in different locations.

The superstructure model is used to design the structural members of the NI Common Basemat Structure, excluding the basemat. Since the superstructure is not used to design the basemat and has only a small amount of uplift, it is not necessary to consider the effects of soil springs in the model. Therefore, the nodes at the bottom surface of the basemat are fully constrained in

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the X, Y, and Z directions. Fixed-base analyses are performed for each of the seismic soil cases in U.S. EPR FSAR Tier 2, Table 3.7.1-6.

Loads are applied to the model by accelerating mass, applying point loads to nodes, and applying loads to the surface of elements. The following loads are considered in the superstructure model:

- Dead loads consist of the self weight of the structure (including grating), as well as additional uniform and concentrated dead loads to account for equipment and other permanent items having significant mass, such as NSSS components, vent stack, spent fuel racks, spent fuel, and the reactor building polar crane.

  NSSS components are applied to the superstructure model as concentrated loads, except for the weight of the reactor pressure vessel, which is applied as a uniform surface load.

  The vent stack is not explicitly included in the superstructure model. Instead, the reactions at the base of the vent stack due to the dead weight are applied as point loads in the model.

  The total weight of the spent fuel and spent fuel racks is applied as a uniform surface load on the floor of the spent fuel pool.

  The total weight of the reactor building polar crane is considered. The remaining dead loads are applied either as concentrated loads or as uniform surface loads.

- Live loads are applied as uniform and concentrated loads, however most live loads are applied as uniform surface loads. This includes the precipitation load on the roof of the building.

  The base reactions due to the live load of the vent stack are applied as concentrated loads in the model.

  The maximum payload of the reactor building polar crane is considered.

- Hydrostatic loads are applied as uniform surface loads on the pool floor and a linearly varied surface pressure load on the pool walls.

- Static lateral soil loads are applied to the exterior subsurface walls as a linearly varied surface load. The loading is calculated considering an at-rest pressure coefficient of K_o = 0.5.

  Safe shutdown earthquake (SSE) loads are applied by multiplying dead and live load (25 percent live load and 75 percent precipitation load) by the zero period accelerations (ZPAs). This includes pool loads, spent fuel rack impact loads, polar crane and vent stack loads. A set of ZPAs for each soil case considered in the analysis is developed separately by the SSI seismic analysis of the structure. The ZPAs are calculated at each node of a seismic analysis dynamic model. The dynamic model is described in U.S. EPR FSAR Tier 2, Section 3.7.2.3.1.2. The ZPAs are extracted from nodes in the dynamic model and mapped to the centroid of every structural element and node of the superstructure model. The SSE load is applied as nodal forces in the three earthquake directions by multiplying the appropriate element centroidal acceleration by the mass of each element, divided by the number of nodes of the element to account for the SSE loading on the dead weight of the structure. The concentrated and surface loads representing the dead and live loads are multiplied by the appropriate ZPA the same as the structural element mass to account for the SSE loads due to dead and live loads.

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Soil loads on the exterior walls due to SSE loadings are considered in the analysis. The pressure distributions and magnitudes are obtained for the SSI analysis described in U.S. EPR FSAR Tier 2, Section 3.7. When pressures are less than the value that corresponds to $K_p = 3.0$, the pressures are scaled up to the value that corresponds to $K_p = 3.0$.

NSSS seismic loads are applied as concentrated loads.

Wind and tornado loads are applied as uniform surface and linearly varied loads on the appropriate exterior, above grade walls and slabs.

Normal and accident pipe reactions for the NSSS system are applied as concentrated loads.

- Tendon loads (post-tensioning).
- Pressure loads (test, variant and design).
- Temperature loads (operating and design).

The superstructure model is solved independently for each design load. The results for the independent loads are combined during post-processing for each load combination by superposition. For load combinations that include SSE loads, the model is solved for each independent SSE load for each direction (north, south, east, west, up down) and each soil case. The results are combined using the square root sum of the squares (SRSS) method described in the Response to RAI 376, Question 03.08.03-24 to obtain the worst case SSE loads. The resulting worse case seismic loads are combined using superposition with results from other independent loads for each applicable load combination.

Item b:

The dynamic FEM was used in the NI basemat SSI analysis consists entirely of shell elements. Basemat shell elements are located with their centerline at the elevation of the nominal bottom of the basemat, which is appropriate for input of ground motions. To compensate for longer walls that result from using the nominal bottom of the basemat elevation, wall elements are modeled with increased stiffnesses that are less than ten times the actual stiffness, from the top of the mat through the basemat thickness. The stiffness of the extended walls establishes compatibility between the dynamic and static models. The ANSYS basemat FEM described in Item (a) of this response is used to develop forces and moments for design of the basemat.

Reference:

1. Design Manual 7.02, Foundations & Earth Structures, Naval Facilities Engineering Command

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 3.8.5.4.2 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR FSAR Tier 2, Section 3.7.2.3.1.4 and Figures 3.7.2-151 and 3.7.2-152 will be added as described in the response and indicated on the enclosed markup.

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Figure 03.07.02-66-1 - Solid Element Basemat

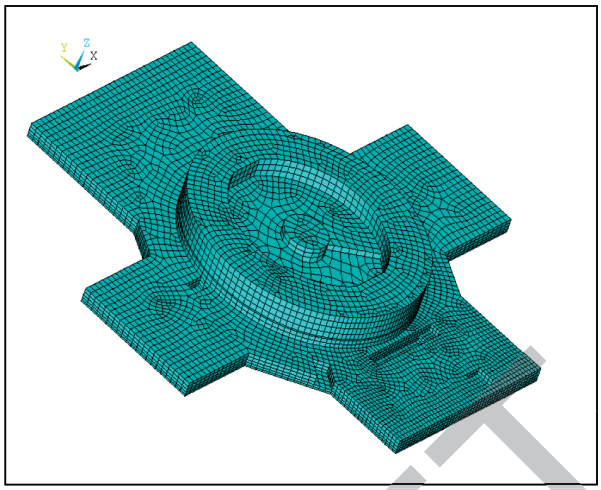

Figure 03.07.02-66-2 - Foundation Basemat Model with Solid Element Basemat

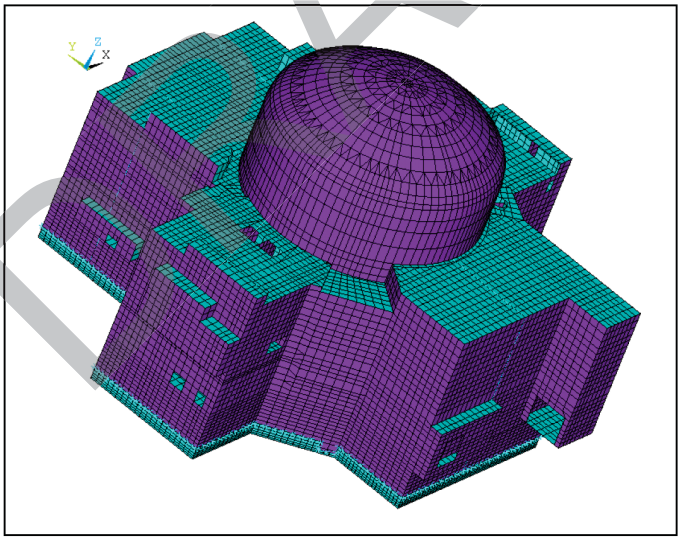

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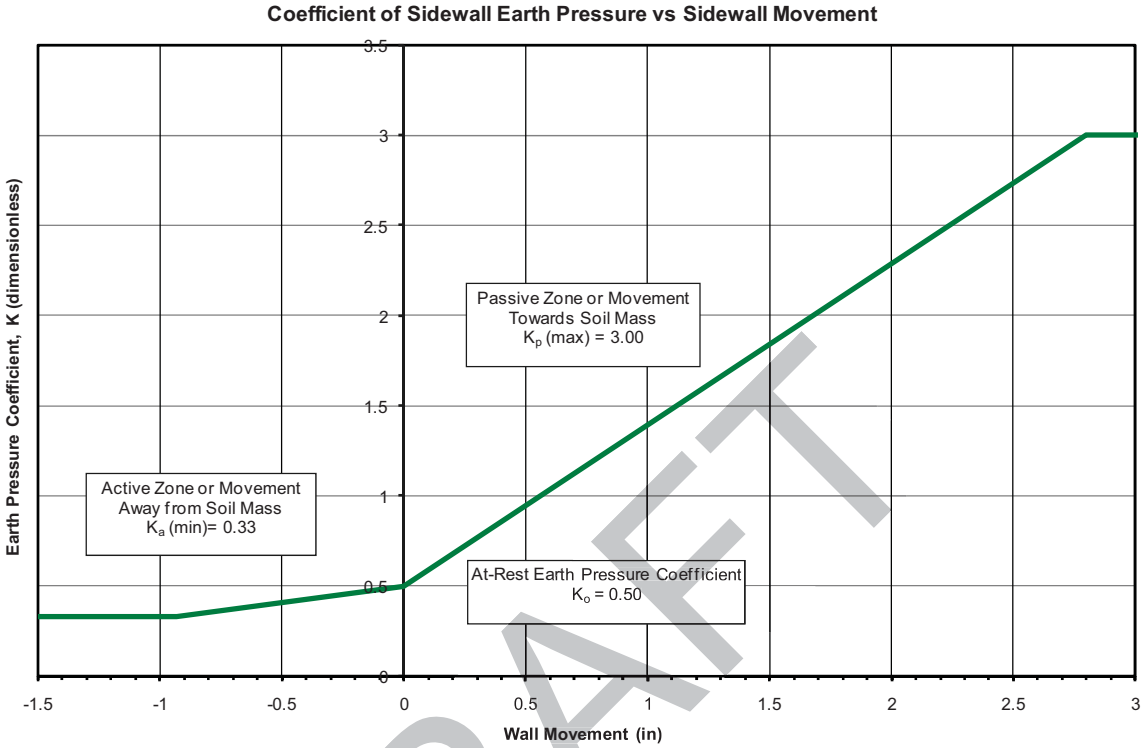
Figure 03.07.02-66-3 - Foundation Basemat Model Side Wall Soil Pressures



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U.S. EPR Final Safety Analysis Report Markups

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(~~4~~2) Simplified Stick Model for Reactor Coolant System

Figure 3.6.3-1 shows a plan view of the configuration of the RCS. A simplified stick model of the RCS is developed for the purpose of the SSI analysis of the NI Common Basemat Structures. The simplified stick model is shown in Figure 3.7.2-56. The simplified stick model is coupled to appropriate nodal locations of the ~~stick model, STICK-1T,~~dynamic 3D FEM of the RBIS. The modal frequencies of the simplified RCS stick model are shown in Table 3.7.2-4.

(~~5~~3) Stick Model for NAB

The stick model for the NAB is developed in a manner similar to that for the ~~NI Common Basemat Structures~~RBIS stick model. Dynamic compatibility between the stick model and 3D FEM is ensured by comparing the ISRS generated at selected locations for both models. ~~Figure 3.7.2-66—Elevation View of NAB Stick Model in X-Z Plane and~~ Figure 3.7.2-67—Elevation View of NAB Stick Model in Y-Z Plane, shows elevation views of the stick model in the global X-Z and Y-Z plane~~, respectively~~.

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3.7.2.3.1.4 Finite Element Model for NI Common Basemat Foundation

The 3D basemat FEM is used for the analysis and design of the NI Common Basemat foundation. The FE discretization is selected so that the elements representing elevations and varying thickness of the basemat are able to produce reliable forces and moments for design. The 3D basemat FEM consists of solid elements connected to the shell or beam element of the SASSI dynamic model described in Section 3.7.2.3.1.2 using the ANSYS code. Lumped masses representing the dead and live structural loads are applied to the model similar to the 3D FEMs for the Dynamic Analysis described in Section 3.7.2.3.1.2. Representations of the FEM are shown in Figure 3.7.2-151—Solid Element Basemat and Figure 3.7.2-152— Foundation Basemat Model with Solid Element Basemat.

The model has soil spring dashpot elements in the three translational directions at the bottom to idealize the soil column behavior and sidewall spring elements for the active, at-rest and passive states of earth pressure caused by the movement of the NI sidewalls against embedded soil mass. A parametric comparison of different soil spring formulations was performed for the seismic model. The Gazetas formulation produced displacements and base reactions similar to SASSI and, therefore, was selected and used in the model. The distribution for seismic and static vertical soil springs is elliptical in nature as described by the equation in Section 3.8.5.4.2. The model represents the sliding interface between the foundation concrete basemat and the underlying soil using sliding elements, and allows for basemat uplift through compression only vertical springs. The ANSYS model is loaded statically by accelerating the lumped and distributed masses described in Section 3.7.2.3.1.2 before a nonlinear time-history analysis is performed. The input motions are in-column

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ground motions obtained from SHAKE91 analysis runs at the bottom of the NI Common Basemat foundation level in the three translational directions derived using the NEI approach in Section 2.5.2.6.

3.7.2.3.2 Seismic Category I Structures – Not on Nuclear Island Common Basemat

~~Unlike the stick model approach utilized for the NI Common Basemat Structures and NAB,~~ 3D FEM's for the EPGB and ESWB are developed with GTSTRUDL code, Version ~~27~~29, for use in both the equivalent static analysis and SSI analysis. For SSI analysis, the GTSTRUDL FEM's are translated to a format suitable for the Bechtel code SASSI 2000, Version 3.1. Two 3D FEMs are developed for each structure, one for the SSI analysis based on the EUR motions and the other for the HF motion in consideration of the high frequency transmission capability of the model.

The reinforced concrete base mat, floor slabs, and walls of both structures are modeled in GTSTRUDL using shell elements, SBHQ6 and SBHT6, to accurately represent the structure and calculate both in-plane and out-of-plane effects from applied loads. For the EPGB, modifications are made to the slab stiffness at elevation +51 ft, 6 inches to accurately represent the stiffness of composite beams. For the ESWB, two additional modeling features are used:

- Space frame elements are used to simulate the fill support beams and the distribution header supports.
- ~~Rigid~~In the lateral directions, the convective water mass is not included and only the rigid water mass, calculated in accordance with the procedure in ASCE 4-98, Reference 1 and ACI 350.3 (Reference 3), is lumped on the appropriate basin walls. The entire water mass is considered in the vertical direction. Both low water and high water level are separately considered.

Figure 3.7.2-57—Isometric View of GTSTRUDL FEM for Emergency Power Generating Building (EUR Motions) and Figure 3.7.2-58—Section View of GTSTRUDL FEM for Emergency Power Generating Building (EUR Motions) illustrate an isometric view and a section view of the 3D FEM of the EPGB used in SSI analysis based on the EUR motions. Figure 3.7.2-59—Isometric View of GTSTRUDL FEM for Essential Service Water Building (EUR Motions) and Figure 3.7.2-60—Section View of GTSTRUDL FEM for Essential Service Water Building (EUR Motions), depict the 3D FEM of the ESWB used in SSI analysis based on the EUR motions. Figure 3.7.2-135—Isometric View of GTSTRUDL FEM for Emergency Power Generating Building (HF Motion) and Figure 3.7.2-136—Isometric View of GTSTRUDL FEM for Essential Service Water Building (HF Motion) illustrate an isometric view of the 3D FEM of the EPGB and ESWB used in SSI analysis based on the HF motion.

For walls and slabs, adjustment is made to account for cracked section properties. Specifically, a value of $0.5E_c$ is typically used to determine out-of-plane stiffness of

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Figure 3.7.2-151—Solid Element Basemat

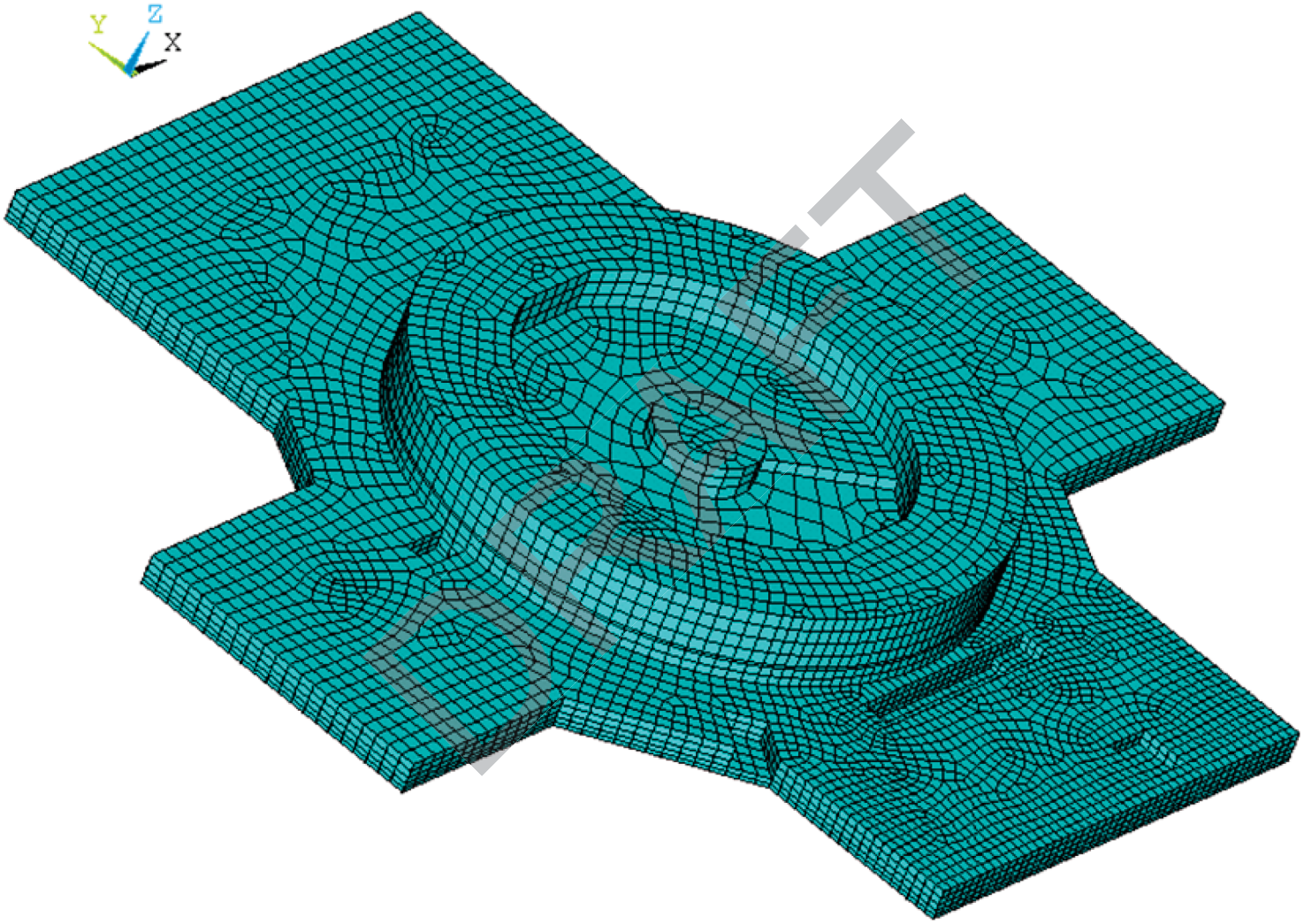

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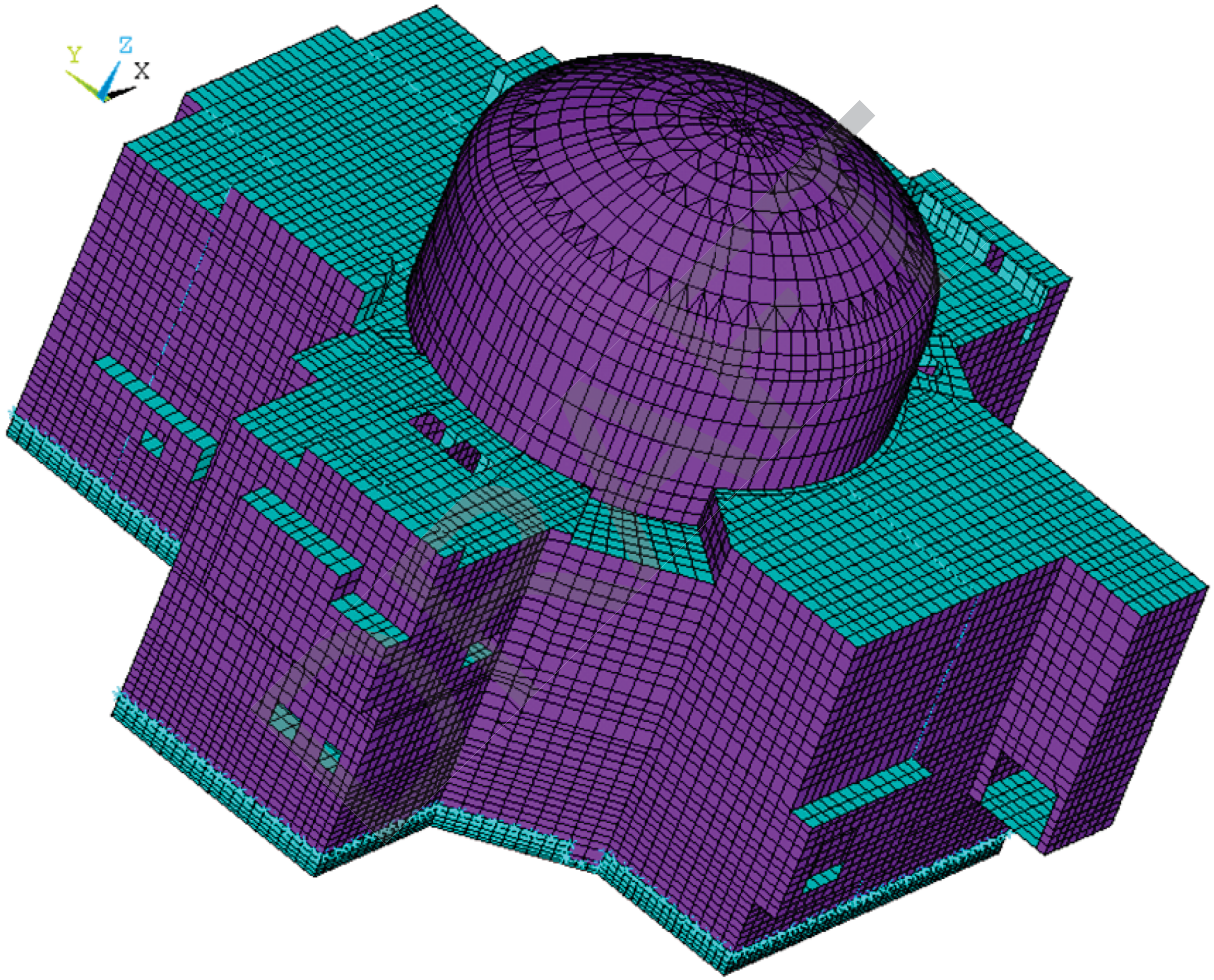
Figure 3.7.2-152—Foundation Basemat Model with Solid Element Basemat



A differential settlement evaluation is performed for the Seismic Category I structures considering both short term (elastic) and long term (heave and consolidation) effects. The effects of differential foundation settlements are applied concurrently with the dead load using the same load factors. The U.S. EPR design requires separate Seismic Category I structures to be connected by site-specific designed Seismic Category I umbilicals (i.e., ductbank, embedded piping, and/or structural galleries containing piping, cable tray, and/or ductwork). The effects of site-specific differential settlement between the individual U.S. EPR Seismic Category I structures and the site-specific Seismic Category I umbilicals will be considered in the design of the connections and the construction sequence. ~~Also, the effects of varying settlements between adjacent foundations are considered for the design of mechanical and electrical systems (e.g., piping, cables) that are routed between structures founded on separate basemats.~~ See Section 3.8.4.4.5 for analysis and design procedures for Seismic Category I buried items that interface with structures on separate foundations.

3.8.5.4.2 Nuclear Island Common Basemat Structure Foundation Basemat

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The seismic design loads for the NI Common Basemat are obtained using the 3D FEM for NI Common Basemat Foundation described in Section 3.7.2.3.1.4. The NI Common Basemat Structure foundation basemat is analyzed and designed using the ANSYS V10.0 SP1 finite element overall computer model (a static model) for NI Common Basemat Structure Seismic Category I structures, which is described in Sections 3.8.1.4.1 and 3.8.5.3. The NI Common Basemat Structure model includes the RCB, RB internal structures, RSB, FB, and SBs, as well as the NI Common Basemat Structure foundation basemat. ~~This model is also used to determine the static bearing pressure on the supporting soils. The dynamic model is used to determine dynamic soil bearing pressures as well as sliding and overturning factors of safety.~~

ANSYS SOLID45 solid elements are used to model the concrete basemat foundation in the NI Common Basemat Structure static analysis. SOLID45 is a three-dimensional, eight-node element that is suitable for moderately thick structures. Depending on the thickness of the basemat, between three to five layers of SOLID45 elements are used in the model, with an average of four elements in the typical 10 feet thick basemat areas. Figure 3.8-103—Nuclear Island Common Basemat Structure Foundation Basemat ANSYS Model illustrates the model used for design of the basemat.

Springs are used to represent soil that provides support for the concrete foundation basemat in the ANSYS model. These springs represent the compressibility of the soil and were developed to reflect the pressure distribution under the NI Common Basemat Structure. Springs values vary for ~~each soil case based on the soil properties and the spring location under the modeled foundation~~each soil case and are based on the soil properties delineated in Section 2.5 and Table 3.7.1-6. The distribution used is elliptical in nature and takes the form of:

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~~results generated by the NI Common Basemat Structure static model. Seismic forces were conservatively applied using maximum ZPA accelerations from the soil structural interaction (SSI) analysis for points throughout the structure. These accelerations are applied to the building masses simultaneously, without consideration of timing. This methodology results in conservative sets of seismic forces, in some cases base shears are 20 percent to 55 percent larger than those calculated by the SSI analysis, applied to the structure. When these conservatively high forces are applied to soils represented by stiff springs the resulting overturning moment is exaggerated and skews the analysis results. The introduction of tri-linear springs to the model mitigates the exaggerated response.~~

~~Tri-linear springs development uses the linear development as the starting point. The subsurface soil is assumed to be relatively high plasticity clay. Based on the modulus degradation for clays with plasticity index in the range 50 to 70, a relationship is developed between displacement of the foundation basemat and the corresponding average reaction imposed by the underlying soil medium on the foundation basemat. Using an incremental approach, the methodology calculates the reaction at the base of the foundation basemat for a small increment of basemat displacement, using the appropriate soil spring associated with the shear modulus at this step. In the next incremental step, the solution is advanced using a reduced shear modulus consistent with the shear strain at a representative depth associated with the soil reaction from the previous step. For the two aforementioned soil cases (4u and 2sn4u) the resultant bearing pressure versus subgrade modulus values are provided in Table 3.8-14—Tri-Linear Subgrade Modulus vs. Bearing Pressures.~~

The results of the soil spring analyses are used in determining forces and moments in the basemat for concrete design and for determining the acceptability of the supporting soil media under static loading conditions.

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~~A FEM model for SSI analysis of the embedded portions of the NI common basemat was used to evaluate the soil bearing pressures, sliding and overturning due to seismic events. This model explicitly represents the transient nature of the seismic loadings, the properties of the soils, and the dynamic characteristics of the structure. This approach produces a more realistic picture of the NI Common Basemat Structure response to seismic loadings than is possible using the static model alone.~~

~~The NI Common Basemat Structure superstructure is modeled using lumped parameter systems identical to those used for the soil-structure interaction analysis. The masses, stiffnesses, and eccentricities of the buildings are mathematically computed, and spatially arranged to represent the dynamic characteristics of the NI Common Basemat structures.~~

~~The model is excited by simultaneous application of three EUR seismic transients (CSDRS) to the base of the foundation basemat for soil cases 2sn4u, 4u, and 5a~~

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~~representing soft, medium and hard soils. Transients are applied, one each, in the three principal building directions. The weight of the building, including the water in the in-containment refueling water storage tank (IRWST), fuel pool, and the four emergency feedwater storage tanks (because this water is always present within the NI Common Basemat Structure), and full buoyancy are the other loadings included in this analysis.~~

Section 3.8.1, Section 3.8.3, and Section 3.8.4 provide descriptions of interfacing structures that induce loads on the NI Common Basemat Structure foundation basemat. The figures in those sections illustrate the concrete shear walls and columns that transfer loads to the NI Common Basemat Structure foundation basemat. The tendon gallery beneath the NI Common Basemat Structure foundation basemat is relied upon as a shear key to aid in resisting lateral forces on the basemat.

A differential settlement evaluation is performed for the NI common basemat structure considering both short term (elastic) and long term (heave and consolidation) effects. The evaluation accounts for the construction sequence, building stiffness, and time duration for loading the NI common basemat structure. The evaluation considers a soft soil site consistent with the soft soil case, 1n2ue, addressed in Table 3.7.1-6. A comparison of the angular distortion (measure of curvature) of the basemat for various soil cases demonstrates that the soft soil site will control the design for settlement.

The resulting forces and moments throughout the structure are captured by applying soil springs to the 3D finite element structural model of the basemat and superstructure used for designing the basemat. The soil springs are developed to capture the short and long term responses of the soil.

A construction sequence is evaluated for the NI common basemat structure, which assumes that the concrete for the mat foundation is in a single placement prior to the start of placement of concrete for the superstructure. It is assumed that concrete placement for the superstructure continues so that the superstructure is erected uniformly.

The construction sequence considers 11 steps for the NI common basemat structure:

1. Basemat only.
2. Walls up to elevation -16 ft.
3. Floor slabs at elevation -16 ft.
4. Walls up to grade elevation.
5. Floor slabs at grade elevation.

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