ArevaEPRDCPEm Resource

From: WELLS Russell (AREVA) [Russell.Wells@areva.com]
Sent: Wednesday, April 20, 2011 11:01 AM
To: Tesfaye, Getachew
Cc: GUCWA Len (EXTERNAL AREVA); BENNETT Kathy (AREVA); DELANO Karen (AREVA); ROMINE Judy (AREVA); RYAN Tom (AREVA)
Subject: Response to U.S. EPR Design Certification Application RAI No. 266, FSAR Ch 6, Supplement 9
Attachments: RAI 266 Supplement 9 Response US EPR DC - Public.pdf

Getachew,

AREVA NP, Inc. provided a response to 1 of the 15 questions of RAI No. 266 on October 12, 2009. Supplement 1 response to RAI No. 266 was sent on November 4, 2009 to provide a response schedule for Questions 06.02.01.02-2, 06.02.01.02-3, 06.02.01.02-4. Supplement 2 response to RAI No. 266 was sent on December 10, 2009 to address 1 of the remaining questions. Supplement 3 response to RAI No. 266 was sent on December 18, 2009 to address 2 of the remaining questions. Supplement 4 response to RAI No. 266 was sent on February 25, 2010 to address 6 of the remaining questions and to provide a revised schedule for responding to one question. Supplement 5 response to RAI No. 266 was sent on May 5, 2010 to provide a revised response schedule for the remaining 5 questions. Supplement 6 response to RAI No. 266 was sent on June 30, 2010 to provide revised response dates for the remaining 5 questions. Supplement 7 response to RAI No. 266 was sent on August 4, 2010 to address 1 of the 5 remaining questions. Supplement 8 response to RAI No. 266 was sent on August 25, 2010 to address the 4 remaining questions.

The attached file, "RAI 266 Supplement 9 Response US EPR DC - Public.pdf," supersedes the response to Questions 06.02.01.02-2, 06.02.01.02-3 and 06.02.01.02-4 provided in the Supplement 8 response on August 25, 2010. Because the response file contains security-related sensitive information that should be withheld from public disclosure in accordance with 10 CFR 2.390, a public version is provided with the security-related sensitive information redacted. This email and attached file do not contain any security-related information. An unredacted security-related version is provided under separate email.

The following table indicates the respective pages in the response document, "RAI 266 Supplement 9 Response US EPR DC - Public.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 266 — 06.02.01.02-2	2	11
RAI 266 — 06.02.01.02-3	12	16
RAI 266 — 06.02.01.02-4	17	17

This concludes the formal AREVA NP response to RAI No. 266, and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

Russ Wells
U.S. EPR Design Certification Licensing Manager
AREVA NP, Inc.
3315 Old Forest Road, P.O. Box 10935
Mail Stop OF-57
Lynchburg, VA 24506-0935
Phone: 434-832-3884 (work)

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

From: BRYAN Martin (External RS/NB)
Sent: Wednesday, August 25, 2010 8:30 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); GUCWA Len (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 266, FSAR Ch 6, Supplement 8

Getachew,

AREVA NP, Inc. provided a response to 1 of the 15 questions of RAI No. 266 on October 12, 2009. Supplement 1 response to RAI No. 266 was sent on November 4, 2009 to provide a response schedule for Questions 06.02.01.02-2, 06.02.01.02-3, 06.02.01.02-4. Supplement 2 response to RAI No. 266 was sent on December 10, 2009 to address 1 of the remaining questions. Supplement 3 response to RAI No. 266 was sent on December 18, 2009 to address 2 of the remaining questions. Supplement 4 response to RAI No. 266 was sent on February 25, 2010 to address 6 of the remaining questions and to provide a revised schedule for responding to one question. Supplement 5 response to RAI No. 266 was sent on May 5, 2010 to provide a revised response schedule for the remaining 5 questions. Supplement 6 response to RAI No. 266 was sent on June 30, 2010 to provide revised response dates for the remaining 5 questions. Supplement 7 response to RAI No. 266 was sent on August 4, 2010 to address 1 of the 5 remaining questions.

The attached file, "RAI 266 Supplement 8 Response US EPR DC (Public).pdf," provides a technically correct and complete response to the remaining 4 questions. Since the response contains security-related sensitive information (SUNSI) that should be withheld from public disclosure in accordance with 10 CFR 2.390, the attached file is a public version with the SUNSI redacted. This email does not contain any security-related information. The unredacted SUNSI version is provided under separate email.

The following table indicates the respective pages in the response document, "RAI 266 Supplement 8 Response US EPR DC (Public).pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 266 — 06.02.01.02-2	2	12
RAI 266 — 06.02.01.02-3	13	17
RAI 266 — 06.02.01.02-4	18	18
RAI 266 — 06.02.02-33	19	21

This concludes the formal AREVA NP response to RAI No. 266, and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

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

From: BRYAN Martin (EXT)
Sent: Wednesday, August 04, 2010 6:18 PM

To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); GUCWA Len T (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 266, FSAR Ch 6, Supplement 7

Getachew,

AREVA NP, Inc. provided a response to 1 of the 15 questions of RAI No. 266 on October 12, 2009. Supplement 1 response to RAI No. 266 was sent on November 4, 2009 to provide a response schedule for Questions 06.02.01.02-2, 06.02.01.02-3, 06.02.01.02-4. Supplement 2 response to RAI No. 266 was sent on December 10, 2009 to address 1 of the remaining questions. Supplement 3 response to RAI No. 266 was sent on December 18, 2009 to address 2 of the remaining questions. Supplement 4 response to RAI No. 266 was sent on February 25, 2010 to address 6 of the remaining questions and to provide a revised schedule for responding to one question. Supplement 5 response to RAI No. 266 was sent on May 5, 2010 to provide a revised response schedule for the remaining 5 questions. Supplement 6 response to RAI No. 266 was sent on June 30, 2010 to provide revised response dates for the remaining 5 questions.

On July 21, 2010, a telecon was held between the staffs of AREVA NP and the NRC and it was agreed to finalize the response to Question 06.02.01.04-4, but additional interaction is needed for Question 06.02.02-33.

The attached file, "RAI 266 Supplement 7 Response US EPR DC.pdf," provides a technically correct and complete response to Question 06.02.01.04-4.

The following table indicates the respective pages in the response document, "RAI 266 Supplement 7 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 266 — 06.02.01.04-4	2	24

The response schedule for the 4 remaining RAI 266 questions is changed and is provided below:

Question #	Final Response Date
RAI 266 — 06.02.02-33	**August 25, 2010**
RAI 266 — 06.02.01.02-2	August 25, 2010
RAI 266 — 06.02.01.02-3	August 25, 2010
RAI 266 — 06.02.01.02-4	August 25, 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: Wednesday, June 30, 2010 12:03 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); GUCWA Len T (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 266, FSAR Ch 6, Supplement 6

Getachew,

AREVA NP, Inc. provided a response to 1 of the 15 questions of RAI No. 266 on October 12, 2009. Supplement 1 response to RAI No. 266 was sent on November 4, 2009 to provide a response schedule for Questions 06.02.01.02-2, 06.02.01.02-3, 06.02.01.02-4. Supplement 2 response to RAI No. 266 was sent on December 10, 2009 to address 1 of the remaining questions. Supplement 3 response to RAI No. 266 was sent on December 18, 2009 to address 2 of the remaining questions. Supplement 4 response to RAI No. 266 was sent on February 25, 2010 to address 6 of the remaining questions and to provide a revised schedule for responding to one question. Supplement 5 response to RAI No. 266 was sent on May 5, 2010 to provide a revised response schedule for the remaining 5 questions.

As agreed with NRC, AREVA NP is providing a revised date for RAI 266 Supplement 6 at this time to accommodate interactions with the NRC on the responses to questions 06.02.01.04-4 and 06.02.02-33. The responses to the 3 remaining RAI 266 questions are dependent upon ongoing evaluations and subcompartment pressure analyses. The revised schedule for a technically correct and complete response to RAI 266 is provided below. The bases for the schedule change were discussed with NRC staff on June 30, 2010.

Question #	Response Date
RAI 266 — 06.02.01.04-4	August 4, 2010
RAI 266 — 06.02.02-33	August 4, 2010
RAI 266 — 06.02.01.02-2	August 25, 2010
RAI 266 — 06.02.01.02-3	August 25, 2010
RAI 266 — 06.02.01.02-4	August 25, 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: Wednesday, May 05, 2010 5:54 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); GUCWA Len T (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 266, FSAR Ch 6, Supplement 5

Getachew,

AREVA NP, Inc. provided a response to 1 of the 15 questions of RAI No. 266 on October 12, 2009. Supplement 1 response to RAI No. 266 was sent on November 4, 2009 to provide a response schedule for Questions 06.02.01.02-2, 06.02.01.02-3, 06.02.01.02-4. Supplement 2 response to RAI No. 266 was sent on December 10, 2009 to address 1 of the remaining questions. Supplement 3 response to RAI No. 266 was sent on December 18, 2009 to address 2 of the remaining questions. Supplement 4 response to RAI No. 266 was sent on February 25, 2010 to address 6 of the remaining questions and to provide a revised schedule for responding to one question.

The responses to the 5 remaining RAI 266 questions are primarily dependent upon ongoing subcompartment pressure analyses and an analysis of the main steam line break using FSAR Chapter 15 assumptions. Because of these ongoing activities, AREVA NP is not providing a response at this time. The revised schedule for a technically correct and complete response to RAI 266 is provided below. The schedule for responding to Questions 06.02.01.02-2, 06.02.01.02-3, 06.02.01.02-4 and 06.02.01.04-4 has been revised while the schedule for providing a technically correct and complete response to Question 06.02.02-33 is unchanged. The bases for the schedule change were discussed with NRC staff during an audit conducted on April 30, 2010.

Question #	Response Date
RAI 266 — 06.02.01.02-2	June 30, 2010
RAI 266 — 06.02.01.02-3	June 30, 2010
RAI 266 — 06.02.01.02-4	June 30, 2010
RAI 266 — 06.02.01.04-4	June 30, 2010
RAI 266 — 06.02.02-33	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: DUNCAN Leslie E (AREVA NP INC)
Sent: Thursday, February 25, 2010 7:02 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); ROMINE Judy (AREVA NP INC); GUCWA Len T (EXT); BRYAN Martin (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 266, FSAR Ch 6, Supplement 4

Getachew,

AREVA NP, Inc. provided a response to 1 of the 15 questions of RAI No. 266 on October 12, 2009. Supplement 1 response to RAI No. 266 was sent on November 4, 2009 to provide a response schedule for Questions 06.02.01.02-2, 06.02.01.02-3, 06.02.01.02-4. Supplement 2 response to RAI No. 266 was sent on December 10, 2009 to address 1 of the remaining questions. Supplement 3 response to RAI No. 266 was sent on December 18, 2009 to address 2 of the remaining questions. The attached file, "RAI 266 Supplement 4 Response US EPR DC.pdf," provides a technically correct and complete response to 6 of the remaining 11 questions and a revised schedule for responding to Question 06.02.01.04-4.

The following table indicates the respective pages in the response document, "RAI 266 Supplement 4 Response US EPR DC.pdf," that contain AREVA NP's responses to the subject questions.

Question #	Start Page	End Page
RAI 266 — 06.02.01-48	2	3
RAI 266 — 06.02.01.03-2	4	19
RAI 266 — 06.02.01.03-3	20	20
RAI 266 — 06.02.01.04-2	21	29
RAI 266 — 06.02.01.04-3	30	30
RAI 266 — 06.02.01.04-4	31	31

RAI 266 — 06.02.01.04-5	32	37

The schedule for responding to the remaining RAI No. 266 questions is provided below. The schedule for responding to Question 06.02.01.04-4 was revised while the schedule for providing technically correct and complete responses to the remaining RAI No. 266 questions is unchanged.

Question #	Response Date
RAI 266 — 06.02.01.02-2	May 5, 2010
RAI 266 — 06.02.01.02-3	May 5, 2010
RAI 266 — 06.02.01.02-4	May 5, 2010
RAI 266 — 06.02.01.04-4	May 5, 2010
RAI 266 — 06.02.02-33	June 30, 2010

Sincerely,

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

From: Pederson Ronda M (AREVA NP INC)
Sent: Friday, December 18, 2009 3:59 PM
To: 'Tesfaye, Getachew'
Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); BEELMAN Ronald J (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 266, FSAR Ch 6, Supplement 3

Getachew,

AREVA NP, Inc. provided a response to 1 of the 15 questions of RAI No. 266 on October 12, 2009. Supplement 1 response to RAI No. 266 was sent on November 4, 2009 to provide a response schedule for Questions 06.02.01.02-2, 06.02.01.02-3, 06.02.01.02-4. Supplement 2 response to RAI No. 266 was sent on December 10, 2009 to address 1 of the remaining questions. The attached file, "RAI 266 Supplement 3 Response US EPR DC.pdf," provides a technically correct and complete response to 2 of the remaining 13 questions.

The following table indicates the respective pages in the response document, "RAI 266 Supplement 3 Response US EPR DC.pdf," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 266 — 06.02.01.04-6	2	2
RAI 266 — 06.02.01.04-7	3	3

The schedule for technically correct and complete responses to the remaining RAI No. 266 questions remains unchanged and is provided below.

Question #	Response Date
RAI 266 — 06.02.01-48	February 25, 2010
RAI 266 — 06.02.01.02-2	May 5, 2010
RAI 266 — 06.02.01.02-3	May 5, 2010
RAI 266 — 06.02.01.02-4	May 5, 2010

RAI 266 — 06.02.01.03-2	February 25, 2010
RAI 266 — 06.02.01.03-3	February 25, 2010
RAI 266 — 06.02.01.04-2	February 25, 2010
RAI 266 — 06.02.01.04-3	February 25, 2010
RAI 266 — 06.02.01.04-4	February 25, 2010
RAI 266 — 06.02.01.04-5	February 25, 2010
RAI 266 — 06.02.02-33	June 30, 2010

Sincerely,

Ronda Pederson
ronda.pederson@areva.com
Licensing Manager, U.S. EPR Design Certification
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: Thursday, December 10, 2009 6:06 PM
To: 'Tesfaye, Getachew'
Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); BEELMAN Ronald J (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 266, FSAR Ch 6, Supplement 2

Getachew,

The response to RAI No. 266, Supplement 2, is submitted via AREVA NP Inc. letter, "Response Supplement 2 to U.S. EPR Design Certification Application RAI No. 266," NRC 09:123, dated December 10, 2009.

AREVA NP considers the information in the requested proprietary data files for the response to RAI No. 266 Question 06.02.01 - 47 submitted via that letter to be proprietary in their entirety and thus no non-proprietary version is provided. An affidavit to support withholding of information from public disclosure, per 10 CFR 2.390(b), is provided as an enclosure to that letter. The 2-page response document, alone, does not contain any proprietary information.

The following table indicates the respective page in the response document, "RAI 266 Supplement 2 Response US EPR DC.pdf," that contains AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 266 — 06.02.01 - 47	2	2

A response to Question 06.02.01.03 – 2 cannot be provided at this time. The schedule for technically correct and complete responses to the remaining RAI No. 266 questions has been changed and is provided below.

Question #	Response Date
RAI 266 — 06.02.01-48	February 25, 2010
RAI 266 — 06.02.01.02-2	May 5, 2010
RAI 266 — 06.02.01.02-3	May 5, 2010

RAI 266 — 06.02.01.02-4	May 5, 2010
RAI 266 — 06.02.01.03-2	February 25, 2010
RAI 266 — 06.02.01.03-3	February 25, 2010
RAI 266 — 06.02.01.04-2	February 25, 2010
RAI 266 — 06.02.01.04-3	February 25, 2010
RAI 266 — 06.02.01.04-4	February 25, 2010
RAI 266 — 06.02.01.04-5	February 25, 2010
RAI 266 — 06.02.01.04-6	December 18, 2009
RAI 266 — 06.02.01.04-7	December 18, 2009
RAI 266 — 06.02.02-33	June 30, 2010

Sincerely,

Ronda Pederson
ronda.pederson@areva.com
Licensing Manager, U.S. EPR Design Certification
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: Wednesday, November 04, 2009 3:20 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. 266, FSAR Ch 6, Supplement 1
Getachew,

AREVA NP, Inc. provided a response to 1 of the 15 questions of RAI No. 266 on October 12, 2009. As indicated in our response, a schedule for the response to Questions 06.02.01.02-2, 06.02.01.02-3, 06.02.01.02-4, would be provided by November 5, 2009. Accordingly, the schedule for the response to these questions is provided in the attached file, RAI 266 Supplement 1 Response US EPR DC.pdf" and reflected in the below table.

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

Question #	**Response Date**
RAI 266 — 06.02.01-47	December 10, 2009
RAI 266 — 06.02.01-48	February 25, 2010
RAI 266 — 06.02.01.02-2	May 5, 2010
RAI 266 — 06.02.01.02-3	May 5, 2010
RAI 266 — 06.02.01.02-4	May 5, 2010
RAI 266 — 06.02.01.03-2	December 10, 2009
RAI 266 — 06.02.01.03-3	February 25, 2010
RAI 266 — 06.02.01.04-2	February 25, 2010
RAI 266 — 06.02.01.04-3	February 25, 2010
RAI 266 — 06.02.01.04-4	February 25, 2010
RAI 266 — 06.02.01.04-5	February 25, 2010
RAI 266 — 06.02.01.04-6	December 18, 2009
RAI 266 — 06.02.01.04-7	December 18, 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: Monday, October 12, 2009 6:38 PM
To: Tesfaye, Getachew
Cc: BEELMAN Ronald J (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. 266, FSAR Ch. 6

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 266 Response US EPR DC.pdf" provides technically correct and complete responses to 1 of the 15 questions.

The following table indicates the respective pages in the response document, "RAI 266 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 266 — 06.02.01-47	2	2
RAI 266 — 06.02.01-48	3	3
RAI 266 — 06.02.01.02-2	4	4
RAI 266 — 06.02.01.02-3	5	5
RAI 266 — 06.02.01.02-4	6	6
RAI 266 — 06.02.01.03-2	7	7
RAI 266 — 06.02.01.03-3	8	8
RAI 266 — 06.02.01.04-2	9	9
RAI 266 — 06.02.01.04-3	10	10
RAI 266 — 06.02.01.04-4	11	11
RAI 266 — 06.02.01.04-5	12	12
RAI 266 — 06.02.01.04-6	13	13
RAI 266 — 06.02.01.04-7	14	14
RAI 266 — 06.02.02-33	15	15
RAI 266 — 06.02.02-34	16	16

A complete answer is not provided for 14 of the 15 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 266 — 06.02.01-47	December 10, 2009
RAI 266 — 06.02.01-48	February 25, 2010
RAI 266 — 06.02.01.02-2	Schedule to be provided by November 5, 2009
RAI 266 — 06.02.01.02-3	Schedule to be provided by November 5, 2009
RAI 266 — 06.02.01.02-4	Schedule to be provided by November 5, 2009
RAI 266 — 06.02.01.03-2	December 10, 2009
RAI 266 — 06.02.01.03-3	February 25, 2010
RAI 266 — 06.02.01.04-2	February 25, 2010
RAI 266 — 06.02.01.04-3	February 25, 2010
RAI 266 — 06.02.01.04-4	February 25, 2010
RAI 266 — 06.02.01.04-5	February 25, 2010
RAI 266 — 06.02.01.04-6	December 18, 2009
RAI 266 — 06.02.01.04-7	December 18, 2009
RAI 266 — 06.02.02-33	June 30, 2010

Sincerely,

Ronda Pederson
ronda.pederson@areva.com
Licensing Manager, U.S. EPR Design Certification
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: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Thursday, September 10, 2009 9:10 AM
To: ZZ-DL-A-USEPR-DL
Cc: Jensen, Walton; Jackson, Christopher; Snodderly, Michael; Carneal, Jason; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 266(3408,3443,3444,3445,3446), FSAR Ch. 6
Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on August 3, 2009, and discussed with your staff on August 13, 2009. RAI Questions 06.02.01-47, 06.02.01-48, 06.02.01.04-2, 06.02.01.04-5, and 06.02.01.04-7 were revised as a result of that discussion. 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: 2871

Mail Envelope Properties (1F1CC1BBDC66B842A46CAC03D6B1CD4104429886)

Subject: Response to U.S. EPR Design Certification Application RAI No. 266, FSAR Ch 6, Supplement 9
Sent Date: 4/20/2011 11:01:19 AM
Received Date: 4/20/2011 11:01:38 AM
From: WELLS Russell (AREVA)

Created By: Russell.Wells@areva.com

Recipients:
"GUCWA Len (EXTERNAL AREVA)" <Len.Gucwa.ext@areva.com>
Tracking Status: None
"BENNETT Kathy (AREVA)" <Kathy.Bennett@areva.com>
Tracking Status: None
"DELANO Karen (AREVA)" <Karen.Delano@areva.com>
Tracking Status: None
"ROMINE Judy (AREVA)" <Judy.Romine@areva.com>
Tracking Status: None
"RYAN Tom (AREVA)" <Tom.Ryan@areva.com>
Tracking Status: None
"Tesfaye, Getachew" <Getachew.Tesfaye@nrc.gov>
Tracking Status: None

Post Office: AUSLYNCMX02.adom.ad.corp

Files	**Size**	**Date & Time**
MESSAGE	24948	4/20/2011 11:01:38 AM
RAI 266 Supplement 9 Response US EPR DC - Public.pdf	82728	

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

Response to

Request for Additional Information No. 266, Supplement 9

9/10/2009

U.S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 06.02.01 - Containment Functional Design
SRP Section: 06.02.01.02 - Sub-compartment Analysis
SRP Section: 06.02.01.03 - Mass and Energy Release Analysis for Postulated Loss-of-Coolant Accidents (LOCAs)
SRP Section: 06.02.01.04 - Mass and Energy Release Analysis for Postulated Secondary System Pipe Ruptures
SRP Section: 06.02.02 - Containment Heat Removal Systems

Application Section: FSAR Chapter 6

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

Question 06.02.01.02-2

This question relates to conservativeness of subcompartment differential pressure calculations in FSAR Section 6.2.1.2. In RAI #82 06.02.01.02-1a1, the staff requested additional justification that the use of the homogeneous equilibrium model (HEM) is conservative for the prediction of break flow for subcompartment analysis. AREVA supplied additional information in response to this RAI and also in response to RAI #1 06.02.01-8. The response to RAI #1 06.02.01-8 and RAI #82 06.02.01.02-1a1 are insufficient. AREVA has not submitted sufficient information to demonstrate that use of HEM for break flow is appropriate for subcompartment analysis. Use of other more conservative correlations is recommended in SRP 6.1.2-3. The values of break mass flux calculated by AREVA in FSAR table 6.2.1.2-2 using the HEM model are much lower than the break mass flux calculated by the staff using the SRP recommended models. In the response to RAI #82 06.02.01.02-a1, AREVA refers to the response to RAI #1 06.02.01-8 and to EPRI Report NP-2192 (Critical-Flow Data Review and Analysis). In the EPRI Report, predictions with HEM are compared with Marviken full scale test data. The measured flow rate is in many cases significantly higher than predicted by the HEM model. AREVA admits that HEM produces, in some of the subcompartments, significantly lower blow down flow than would be obtained using the models listed as acceptable in SRP 6.1.2-3, but states that the impact on the pressurization of critical rooms is negligible. AREVA did not present analyses to prove that the effect on the pressure loads is small if the recommended models were used. AREVA's answer does not provide justification that the use of HEM is conservative for the prediction of break flow for subcompartment analysis.

In order to resolve this issue, unless there is new convincing evidence or justification for use of the HEM, provide new subcompartment analyses using the models listed as acceptable in SRP 6.1.2-3 for the prediction of break flow for subcompartment analysis. The above questions are follow-up questions to previously issued RAIs and the containment audit held in Lynchburg on July 14 and 15, 2009.

Response to Question 06.02.01.02-2

This response supersedes the original Response to RAI 266, Supplement 8, Question 06.02.01.02-2, which was submitted on August 25, 2010.

The mass and energy release data used in subcompartment analyses have been revised for consistency with the methods of SRP 6.2.1.3. The scope of the postulated breaks was expanded to cover the high energy pipes inside the Reactor Building (RB), except those satisfying the leak-before-break (LBB) criteria, moderate energy pipes, and small bore pipes. The break mass and energy discharge rates were calculated using the Moody critical flow model in the saturated region and the Henry-Fauske model in the subcooled region. High energy pipes include the systems with maximum operating temperature exceeding 200°F, or the maximum operating pressure in exceeding 275 psig. Piping systems exceeding these conditions for less than two percent of the time, such as the safety injection system (SIS) and the residual heat removal system (RHRS), were considered in the moderate energy category. Small bore pipes included the pipes less than or equal to one inch in nominal size. Table 06.02.01.02-2-1 lists the subcompartments inside the RB with high energy lines and the associated bounding high energy line breaks (HELB). In addition to the bounding HELBs, Table 06.02.01.02-2-1 lists the net free volume of the room and the floor and ceiling elevations. The bounding HELB is the break yielding the highest subcompartment pressure. Typically, this

break has the maximum energy discharge rate. This break often yields the highest volumetric discharge rate after the fluid expands in the subcompartment. Where this does not occur, the break yielding the highest volume discharge rate is considered and listed in Table 06.02.01.02-2-1, as appropriate. The approach used to generate the data in Table 06.02.01.02-2-1 conforms to SRP 6.2.1.3 as follows:

1. Plant layout drawings were reviewed to identify the high energy pipes located in each RB room.
2. Full circumferential breaks were postulated on each high energy line, and the corresponding mass and energy discharge rates were calculated using the Moody critical flow model for saturated fluid systems and the Henry-Fauske for subcooled fluid systems.
3. A constant blowdown profile based on the initial conditions was assumed for the breaks analyzed, except for breaks on the main feedwater (MFW) piping, the letdown, and the charging piping. The computer program CRAFT2 determined the blowdown profile for the main feedwater system (MFWS). RELAP5-BW determines the blowdown profile for the letdown and the charging piping.
4. The constant blowdown profiles are based on frictionless flow without restriction. Unrestricted flow is assumed from both ends of the break, except where it is isolated by safety-related valves. The discharge rate is ramped from zero at break initiation to full flow at break formation.
5. The initial conditions were set to the system design conditions for the pipes, except some selected cases where the normal operating conditions at full power were used.

The break yielding the highest energy release rate in each subcompartment was selected as the bounding break for subcompartment analysis. This break generally produced the highest volumetric discharge rate after the fluid is expanded in the subcompartment. Where this did not occur, the break producing the highest volume discharge rate was also considered. Table 06.02.01.02-2-2 provides the pipe conditions and the calculated mass and energy discharge rates for the bounding HELBs yielding the highest pressure in the break compartment.

FSAR Impact:

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

Table 06.02.01.02-2-1—Reactor Building Rooms with High Energy Line Breaks
(2 Sheets)

Room Name	Bounding HELB	Room Volume (ft^3)	Floor Elevation (ft)	Height (ft)	Room Description
-8 ft Room 2	LCA90BR006	11464	-7.5	10.5	Access Area
-8 ft Room 3	JNG13BR004	21127	-7.5	10.5	Area for JND, JNG & JMQ (MHSI, LHSI, SAHRS) Pipe Penetrations
-8 ft Room 4	LCQ51BR103	21506	-7.5	10.5	Area for JND, JNG & JMQ (MHSI, LHSI, SAHRS) Pipe Penetrations
-8 ft Room 5	KBA14BR012	21502	-7.5	10.5	Area for Hot Pipe penetrations from UFA
-8 ft Room 7	LCQ51BR001	9210	-7.5	10.5	LCQ (SGBS) HX Room
-8 ft Room 9	KPL85BR004	3085	-7.5	9.2	KT (NI DVS) Floor Drain and Tank Room
-8 ft Room 11	KTA10BR027	3255	-7.5	9.2	KTA10 (NI DVS) Pumps Room
-8 ft Room 14	KBA12BR001	1542	-7.5	10.5	KBA12 (CVCS) HX Room
-8 ft Room 15	KBA11BR001	1471	-7.5	10.5	KBA11 (CVCS) HX Room
-8 ft Room 16	KBA11BR001	1584	-7.5	10.5	KBA (CVCS) Valve Room
-8 ft Room 17	KBA10BR004	1260	-7.5	10.5	KBA (CVCS) Valve Room
+5 ft Room 2	KBA10BR001	8340	4.9	12.0	JEB10 (RCP) Oil Collection Tank Area
+5 ft Room 3	JNA10BR001	8654	4.9	12.0	JEA10 (SG) Supports Area
+5 ft Room 4	JNA20BR001	8654	4.9	12.0	JEA20 (SG) Supports Area
+5 ft Room 5	LCQ20BR001	7376	4.9	12.0	JEB20 (RCP) Oil Collection Tank Area
+5 ft Room 6	LCQ40BR001	7251	4.9	12.0	JEB30 (RCP) Oil Collection Tank Area
+5 ft Room 7	JNA30BR001	8654	4.9	12.0	JEA30 (SG) Supports Area
+5 ft Room 8	JNA40BR001	8654	4.9	12.0	JEA40 (SG) Supports Area
+5 ft Room 9	JEB40BR008	9070	4.9	12.0	JEB40 (RCP) Oil Collection Tank Area
+5 ft Room 12	KAB60BR038	15763	4.9	10.3	Loop 1 Annular Area 180-270 Deg
+5 ft Room 13	KAB60BR006	10677	4.9	10.3	Loop 2 Annular Area 270-0 Deg
+5 ft Room 14	LAR31BR006	12063	4.9	10.3	Loop 3 Annular Area 0-90 Deg
+5 ft Room 15	LAR41BR006	16196	4.9	10.3	Loop 4 Annular Area 90-180 Deg
+5 ft Room 16	LCQ40BR905	9234	4.9	15.0	LCQ50 (SGBS) Tank room
+5 ft Room 18	LCA90BR006	10470	4.9	10.3	Access to Personnel Airlock
+5 ft Room 20	KBA10BR002	2053	4.9	15.6	KBA (CVCS) Valve Room
+5 ft Room 21	KBA10BR003	4471	4.9	14.6	KBA (CVCS) Valve Room
+5 ft Room 22	KBA10BR003	2020	4.9	10.3	KBA10 (CVCS) HX Room
+5 ft Room 23	JNG13BR001	1986	4.9	10.3	JND & JNG (MHSI & LHSI) Valve 1 Room
+5 ft Room 24	JNG23BR001	1590	4.9	10.3	JND & JNG (MHSI & LHSI) Valve 2 Room
+5 ft Room 25	JNG33BR001	1590	4.9	10.3	JND & JNG (MHSI & LHSI) Valve 3 Room
+5 ft Room 26	JNG43BR001	1986	4.9	10.3	JND & JNG (MHSI & LHSI) Valve 4 Room
+17 ft Room 2	JNG13BR007	3645	16.9	11.6	JEB10 Pump (RCP) Room
+17 ft Room 3	KBA34BR019	3631	16.9	11.6	JEA10 (SG) Support Area
+17 ft Room 4	KBA34BR019	3754	16.9	11.6	JEA20 (SG) Support Area
+17 ft Room 5	JNG23BR007	4481	16.9	11.6	JEB20 Pump (RCP) Room
+17 ft Room 6	JNG33BR007	4481	16.9	11.6	JEB30 Pump (RCP) Room
+17 ft Room 7	LCQ30BR003	3754	16.9	11.6	JEA30 (SG) Support Area
+17 ft Room 8	LCQ40BR003	3631	16.9	11.6	JEA40 (SG) Support Area
+17 ft Room 9	JNG43BR007	3645	16.9	11.6	JEB40 Pump (RCP) Room
+17 ft Room 13	JNG13BR001	16101	16.9	11.6	JNG13 (LHSI) Tank & Loop 1 Annular Area

Table 06.02.01.02-2-1—Reactor Building Rooms with High Energy Line Breaks
(2 Sheets)

Room Name	Bounding HELB	Room Volume (ft^3)	Floor Elevation (ft)	Height (ft)	Room Description
+17 ft Room 14	LCA90BR006	16828	16.9	11.6	JNG23 (LHSI) Tank & Loop 2 Annular Area
+17 ft Room 15	JNG33BR001	17961	16.9	11.6	JNG33 (LHSI) Tank & Loop 3 Annular Area
+17 ft Room 16	JNG43BR001	20755	16.9	11.6	JNG43 (LHSI) Tank & Loop 4 Annular Area
+17 ft Room 18	LCQ52BR001	4255	21.9	9.3	Spray Lines Area
+17 ft Room 19	KBA35BR003	4934	21.9	9.3	Surge Line area
+29 ft Room 3	JEW50BR002	5456	28.5	16.7	JEB10 Pump (RCP) Room
+29 ft Room 4	LCQ10BR012	6437	28.5	16.7	JEA10 (SG) Room
+29 ft Room 5	LCQ10BR012	6628	28.5	16.7	JEA20 (SG) Room
+29 ft Room 6	KBA34BR022	6573	28.5	16.7	JEB20 Pump (RCP) Room
+29 ft Room 7	JEF10BR103	6573	28.5	16.7	JEB30 Pump (RCP) Room
+29 ft Room 8	LCQ30BR012	6628	28.5	16.7	JEA30 (SG) Room
+29 ft Room 9	LCQ30BR012	6437	28.5	16.7	JEA40 (SG) Room
+29 ft Room 10	KBA34BR023	5462	28.5	16.7	JEB40 Pump (RCP) Room
+29 ft Room 14	LAR11BR006	27637	28.5	16.7	JNG13 (LHSI) Tank & Loop 1 Annular Area
+29 ft Room 15	LCA90BR006	23839	28.5	16.7	JNG23 (LHSI) Tank & Loop 2 Annular Area
+29 ft Room 16	LAR31BR006	26046	28.5	16.7	JNG33 (LHSI) Tank & Loop 3 Annular Area
+29 ft Room 17	QNJ41BR016	32767	28.5	16.7	JNG43 (LHSI) Tank & Loop 4 Annular Area
+29 ft Room 18	LCQ52BR001	7564	32.2	14.2	Spray Lines Area
+29 ft Room 19	KBA35BR003	7564	32.2	14.2	Surge Line area
+45 ft Room 1	JEW50BR021	6213	45.3	15.4	JEB10 Pump (RCP) Room
+45 ft Room 2	LAB60BR005	7195	45.3	18.7	JEA10 (SG) Room
+45 ft Room 3	LAB70BR005	7408	45.3	18.7	JEA20 (SG) Room
+45 ft Room 4	JEW50BR001	8574	45.3	18.7	JEB20 Pump (RCP) Room
+45 ft Room 6	LAB80BR005	7408	45.3	18.7	JEA30 (SG) Room
+45 ft Room 7	LAB90BR005	7195	45.3	18.7	JEA40 (SG) Room
+45 ft Room 12	LAB60BR005	22312	45.3	15.4	JNG13 (LHSI) Tank & Loop 1 Annular Area
+45 ft Room 13	LAB70BR005	24143	45.3	16.1	JNG23 (LHSI) Tank & Loop 2 Annular Area
+45 ft Room 14	LAB80BR005	25606	45.3	16.1	JNG33 (LHSI) Tank & Loop 3 Annular Area
+45 ft Room 15	LAB90BR005	24261	45.3	15.4	JNG43 (LHSI) Tank & Loop 4 Annular Area
+45 ft Room 18	JEF10BR103	6450	49.1	16.2	JEF10 (RCS) Pressurizer Room
+64 ft Room 1	LAB60BR005	4992	64.0	15.1	JEA10 (SG) Room
+64 ft Room 2	LAB70BR005	5004	64.0	15.1	JEA20 (SG) Room
+64 ft Room 5	LAB80BR005	5004	64.0	15.1	JEA30 (SG) Room
+64 ft Room 6	LAB90BR005	4992	64.0	15.1	JEA40 (SG) Room
+64 ft Room 10	LCA90BR006	25408	64.0	12.8	Annular Area, 240-0 Deg
+64 ft Room 11	LAR31BR006	14451	64.0	12.8	Annular Area, 0-120 Deg
+64 ft Room 12	LAR41BR006	47590	64.0	15.1	Access to Equipment Hatch
+64 ft Room 14	JEF10BR004	5509	67.9	13.6	JEF10 (RCS) Pressurizer Room
+64 ft Room 16	LAR11BR006	7373	64.0	12.8	Access to Emergency Airlock
+79 ft Room 5	KPL85BR030	11177	79.1	24.0	JEA30 (SG) Room
+79 ft Room 9	LCA90BR006	37699	79.1	14.4	Annular Area, 240-0 Deg
+79 ft Room 10	KPL85BR030	29874	79.1	14.4	Annular Area, 0-120 Deg
+79 ft Room 12	JEF10BR006	3168	83.2	8.7	Pressurizer Head & Safety Relief Valves Room

Table 06.02.01.02-2-2—Mass and Energy Discharge Rates for Bounding High Energy Line Breaks (2 Sheets)

Pipe Name	Pipe Size (in)	Pipe Schedule	Pipe Area (ft^2)	Pressure (psia)	Temp. (F)	Enthalpy (Btu/lb)	Mass Flux (lb/ft^2-s)	Mass Disch. (lb/s)	Energy Disch. (Btu/s)	Break Config. (1)	Break Opening Time (s)	Notes
JEB40BR008	3	XXS	0.0289	2250	566	566.7	22402.5	1292.7	7.325E+05		0.003	
JEF10BR004	6	160	0.1469	2250	652	1116.0	5133.8	753.9	8.414E+05	SE	0.003	
JEF10BR006	6	160	0.1469	2250	652	1116.0	5133.8	753.9	8.414E+05	SE	0.003	
JEF10BR103	4	160	0.0645	2250	652	1116.0	5133.8	331.0	3.694E+05	SE	0.002	
JEW50BR001	2	160	0.0156	2550	212	185.8	38741.9	1205.6	2.240E+05		0.001	
JEW50BR002	2	40S	0.0233	190	212	180.6	9874.0	460.2	8.310E+04		0.010	
JEW50BR021	2	40S	0.0233	190	212	180.6	9874.0	460.2	8.310E+04		0.010	
JNA10BR001	10	160	0.3941	2250	626	651.8	15831.9	6238.7	4.066E+06	SE	0.006	
JNA20BR001	10	160	0.3941	2250	626	651.8	15831.9	6238.7	4.066E+06	SE	0.006	
JNA30BR001	10	160	0.3941	2250	626	651.8	15831.9	6238.7	4.066E+06	SE	0.006	
JNA40BR001	10	160	0.3941	2250	626	651.8	15831.9	6238.7	4.066E+06	SE	0.006	
JNG13BR001	12	80S	0.7058	815	140	110.0	22292.1	31469.3	3.462E+06		0.010	
JNG13BR004	2	40S	0.0233	815	140	110.0	22292.1	1038.9	1.300E+06		0.002	
JNG13BR007	10	160	0.3941	2250	566	566.7	22402.5	8828.0	5.003E+06	SE	0.006	
JNG23BR001	12	80S	0.7058	815	140	110.0	22292.1	31469.3	3.462E+06		0.010	
JNG23BR007	10	160	0.3941	2250	566	566.7	22402.5	8828.0	5.003E+06	SE	0.006	
JNG33BR001	12	80S	0.7058	815	140	110.0	22292.1	31469.3	3.462E+06		0.010	
JNG33BR007	10	160	0.3941	2250	566	566.7	22402.5	8828.0	5.003E+06	SE	0.006	
JNG43BR001	12	80S	0.7058	815	140	110.0	22292.1	31469.3	3.462E+06		0.010	
JNG43BR007	10	160	0.3941	2250	566	566.7	22402.5	8828.0	5.003E+06	SE	0.006	
KAB60BR006	12	STD	0.7854	190	338	309.3	6430.6	10101.2	3.125E+06		0.034	
KAB60BR038	12	STD	0.7854	190	338	309.3	6430.6	10101.2	3.125E+06		0.034	
KBA10BR001	4	160	0.0645	2250	566	566.7	22402.5	2888.5	1.637E+06		0.003	
KBA10BR002	4	XXS	0.0542	2250	566	566.7					0.009	(3)
KBA10BR003	4	XXS	0.0542	2250	566	566.7					0.009	(3)
KBA10BR004	4	XXS	0.0542	2250	566	566.7				SE	0.009	(3)
KBA11BR001	3	XXS	0.0289	2250	566	566.7				SE	0.009	(3)
KBA12BR001	3	XXS	0.0289	2250	566	566.7				SE	0.009	(3)
KBA14BR012	6	40S	0.2006	380	340	311.7	11773.0	4724.0	1.473E+06		0.009	
KBA34BR019	3	XXS	0.0289	2250	487	472.6	28080.9	1620.4	7.658E+05		0.003	
KBA34BR022	4	160	0.0645	2250	566	566.7	22402.5	2888.5	1.637E+06		0.003	
KBA34BR023	4	160	0.0645	2250	566	566.7	22402.5	2888.5	1.637E+06		0.003	

Table 06.02.01.02-2-2—Mass and Energy Discharge Rates for Bounding High Energy Line Breaks (2 Sheets)

Pipe Name	Pipe Size (in)	Pipe Schedule	Pipe Area (ft^2)	Pressure (psia)	Temp. (F)	Enthalpy (Btu/lb)	Mass Flux (lb/ft^2-s)	Mass Disch. (lb/s)	Energy Disch. (Btu/s)	Break Config. (1)	Break Opening Time (s)	Notes
KBA35BR003	4	160	0.0645	2250	652	1116.0	5133.8	331.0	3.694E+05	SE	0.003	
KPL85BR004	2	40S	0.0233	190	212	1198.1	392.0	18.3	2.189E+04		0.010	
KPL85BR030	2	40S	0.0233	365	450	1204.7	746.5	34.8	4.191E+04		0.005	
KTA10BR027	4	40S	0.0884	130	305	275.0	6474.5	1144.8	3.149E+05		0.025	
LAB60BR005	20	120	1.5763	1133	446	426.6					0.018	(2)
LAB70BR005	20	120	1.5763	1133	446	426.6					0.018	(2)
LAB80BR005	20	120	1.5763	1133	446	426.6					0.018	(2)
LAB90BR005	20	120	1.5763	1133	446	426.6					0.018	(2)
LAR11BR006	4	160	0.0645	1305	578	586.3	8890.1	1146.2	6.720E+05		0.005	
LAR31BR006	4	160	0.0645	1305	578	586.3	8890.1	1146.2	6.720E+05		0.005	
LAR41BR006	4	160	0.0645	1305	578	586.3	8890.1	1146.2	6.720E+05		0.005	
LCA90BR006	6	STD	0.2006	575	420	397.1	11865.4	4761.0	1.891E+06		0.007	
LCQ10BR012	2	160	0.0156	1305	578	586.3	8890.1	276.6	1.622E+05		0.003	
LCQ20BR001	4	120	0.0717	1305	578	586.3	8890.1	1275.0	7.475E+05		0.004	
LCQ30BR003	4	120	0.0717	1305	578	586.3	8890.1	1275.0	7.475E+05		0.004	
LCQ30BR012	2	160	0.0156	1305	578	586.3	8890.1	276.6	1.622E+05		0.003	
LCQ40BR001	4	120	0.0717	1305	578	586.3	8890.1	1275.0	7.475E+05		0.004	
LCQ40BR003	4	120	0.0717	1305	578	586.3	8890.1	1275.0	7.475E+05		0.004	
LCQ40BR905	16	60	1.1767	265	420	1202.2	543.8	1279.6	1.538E+06		0.031	
LCQ51BR001	6	STD	0.2006	265	406	381.7	4062.5	1630.1	6.221E+05		0.016	
LCQ51BR103	6	STD	0.2006	315	338	309.5	10467.3	4200.1	1.300E+06		0.014	
LCQ52BR001	12	60	0.7372	200	382	1198.8	412.2	607.7	7.285E+05		0.036	
QNJ41BR016	8	STD	0.3474	195	338	309.3	6639.2	4613.0	1.427E+06		0.027	

Notes:

1. "SE" indicates single-ended break where one end of the break is isolated by safety related valves. A blank indicates "double-ended" break.
2. Detailed mass and energy release rates generated by CRAFT2. See Table 06.02.01.02-2-3.
3. Detailed mass and energy release rates generated by RELAP. See Table 06.02.01.02-2-4.

Table 06.02.01.02-2-3—Mass and Energy Discharge Rates for Feedwater Lines (LABn0BR005)
(2 Sheets)

Time (s)	Discharge Rate (lb/s)	Discharge Enthalpy (Btu/lb)
0.000	0	435.6
0.004	6772	435.6
0.008	23270	437.2
0.012	43239	439.6
0.016	42335	440.5
0.020	41589	441.5
0.024	42731	443.0
0.028	40484	443.5
0.032	42311	445.3
0.036	40084	445.7
0.040	41547	447.4
0.044	39986	448.0
0.048	40510	449.3
0.052	40050	450.4
0.056	39489	451.3
0.060	39714	452.6
0.064	38571	453.4
0.068	39292	454.9
0.072	38116	455.6
0.076	38391	456.9
0.080	37565	457.8
0.084	37622	459.0
0.088	37768	460.2
0.092	37233	461.2
0.096	37746	462.5
0.100	36977	463.4
0.117	37115	466.2
0.133	36625	470.0
0.150	36154	473.5
0.167	35718	476.8
0.183	35371	480.1
0.200	35014	483.3
0.217	34349	486.2
0.233	33843	488.9
0.250	33483	491.5
0.267	33072	493.9
0.283	32663	496.0
0.300	32390	498.1
0.317	32125	500.1
0.333	31808	501.9
0.350	31556	503.7

Table 06.02.01.02-2-3—Mass and Energy Discharge Rates for Feedwater Lines (LABn0BR005)
(2 Sheets)

Time (s)	Discharge Rate (lb/s)	Discharge Enthalpy (Btu/lb)
0.367	31321	505.3
0.383	31091	506.8
0.400	30891	508.2
0.417	30677	509.5
0.433	30464	510.7
0.450	30279	511.9
0.467	30104	513.0
0.483	29936	514.1
1.000	24529	530.0
10.0	24529	530.0

Table 06.02.01.02-2-4—Mass and Energy Discharge Rates for Letdown and Charging Lines (2 Sheets)

Time (s)	Pipe Name					
	KBA10BR002 / KBA10BR003		KBA10BR004		KBA11BR001 / KBA12BR001	
	Discharge Rate Rate (lb/s)	Discharge Enthalpy (Btu/lb)	Discharge Rate Rate (lb/s)	Discharge Enthalpy (Btu/lb)	Discharge Rate Rate (lb/s)	Discharge Enthalpy (Btu/lb)
0.00	0.0	565.5	0.0	566.9	0.0	566.9
2.00E-03	45.8	565.5	17.8	566.9	17.8	566.9
0.10	751.2	562.3	371.1	563.3	301.6	566.0
0.20	831.9	564.2	474.5	564.5	429.5	568.5
0.30	822.9	556.5	523.1	565.3	430.1	569.0
0.40	800.8	549.1	519.8	565.7	429.7	569.3
0.50	796.9	543.6	519.0	566.2	429.3	569.6
0.60	794.6	539.5	518.6	566.4	429.1	569.7
0.70	795.9	535.4	518.3	566.6	428.8	570.0
0.80	795.3	531.7	518.0	566.8	428.7	570.0
0.90	794.2	528.1	517.9	566.8	428.6	570.1
1.00	792.0	524.9	517.8	566.9	428.6	570.1
1.20	786.6	520.7	517.7	567.0	428.4	570.2
1.40	802.6	512.5	517.6	567.0	428.3	570.3
1.60	874.5	498.3	517.5	567.1	428.3	570.3
1.80	880.5	490.7	517.5	567.1	428.3	570.3
2.00	886.5	483.5	517.3	567.3	428.3	570.3
2.20	892.5	476.5	517.5	567.1	428.2	570.4
2.40	898.5	469.7	517.5	567.1	428.4	570.1
2.60	903.5	463.5	517.5	567.1	428.0	570.7
2.80	908.0	458.0	517.5	567.1	428.5	570.0
3.00	910.5	453.8	517.5	567.1	428.0	570.7
3.20	913.5	449.5	517.5	567.1	428.5	570.0
3.40	915.0	446.3	517.5	567.1	428.0	570.7
3.60	916.5	443.5	517.5	567.1	428.5	570.0
3.80	918.0	440.9	517.5	567.1	428.0	570.7
4.00	918.5	439.0	517.5	567.1	428.0	570.7
4.20	919.5	437.2	517.5	567.1	428.5	569.9
4.40	920.0	435.7	517.0	567.6	428.0	570.7
4.60	920.5	434.4	517.5	567.1	428.5	570.0
4.80	921.0	433.2	517.5	567.1	428.0	570.7
5.00	921.5	432.0	517.5	567.1	428.5	570.0
5.20	921.5	431.1	517.5	567.1	428.0	570.7
5.40	922.0	430.2	517.5	567.1	428.5	570.0
5.60	922.0	429.4	517.5	567.1	428.0	570.7
5.80	922.5	428.5	517.5	567.1	428.5	570.0
6.00	922.5	427.8	517.5	567.1	428.0	570.7
6.20	922.5	427.2	517.5	567.1	428.5	570.0
6.40	923.0	426.4	517.5	567.1	428.0	570.7

Table 06.02.01.02-2-4—Mass and Energy Discharge Rates for Letdown and Charging Lines (2 Sheets)

Time (s)	Pipe Name					
	KBA10BR002 / KBA10BR003		KBA10BR004		KBA11BR001 / KBA12BR001	
	Discharge Rate Rate (lb/s)	Discharge Enthalpy (Btu/lb)	Discharge Rate Rate (lb/s)	Discharge Enthalpy (Btu/lb)	Discharge Rate Rate (lb/s)	Discharge Enthalpy (Btu/lb)
6.60	923.5	425.5	517.5	567.1	428.0	570.7
6.80	923.0	425.2	517.0	567.6	428.5	569.9
7.00	923.5	424.4	517.5	567.1	428.0	570.7
7.20	923.5	423.8	517.5	567.1	428.5	570.0
7.40	924.0	423.1	517.5	567.1	428.0	570.7
7.60	923.5	422.8	517.5	567.1	428.5	570.0
7.80	924.0	422.1	517.5	567.1	428.0	570.7
8.00	924.5	421.3	517.5	567.1	428.5	570.0
8.20	924.0	421.1	517.5	567.1	428.0	570.7
8.40	924.5	420.4	517.5	567.1	428.5	570.0
8.60	924.5	420.0	517.5	567.1	428.0	570.7
8.80	924.5	419.5	517.5	567.1	428.5	570.0
9.00	925.0	418.9	517.5	567.1	428.0	570.7
9.20	925.0	418.5	517.0	567.6	428.0	570.7
9.40	925.0	418.1	517.5	567.1	428.5	570.0
9.60	925.0	417.7	517.5	567.1	428.0	570.6
9.80	925.0	417.3	517.5	567.1	428.5	570.0
10.00	925.5	416.7	517.5	567.1	428.0	570.7

Question 06.02.01.02-3

This question relates to conservativeness of subcompartment differential pressure calculations in FSAR Section 6.2.1.2. In RAI #82 6.01.02.02-1a3 the staff noted that not all subcompartments with high energy lines are considered in the for pressure evaluation. AREVA has limited the subcompartment analysis to those compartments that support the nuclear steam supply system components. Subcompartments that experience a pressure load but do not support NSSS components are omitted. SRP 6.2.1.2 defines subcompartments as any fully or partially enclosed volume within the primary containment that houses high-energy piping and which limit the flow of fluid to the main containment in the event of a pipe rupture within the volume. The NRC staff is required to review the noding scheme, initial thermodynamic condition, vent flow path and distribution of mass and energy released, design pressure, ITAAC and COL action items and certification requirements and restrictions for all subcompartments with high energy lines. AREVA has not provided sufficient information for the staff to perform this review.

In order to resolve this issue for all subcompartments with high energy lines, provide evaluations of the potential pressure loads including the accident pressures and comparisons of the calculated subcompartment pressure with the maximum pressure allowed. The above questions are follow-up questions to previously issued RAIs and the containment audit held in Lynchburg on July 14 and 15, 2009.

Response to Question 06.02.01.02-3

This response supersedes the original Response to RAI 266, Supplement 8, Question 06.02.01.02-3, which was submitted on August 25, 2010.

In the Response to RAI 82, Question 06.02.01-1a.3, the subcompartments with high energy lines have been evaluated for subcompartment pressurization. Subcompartments are individual rooms that are fully or partially enclosed volumes within the Reactor Building (RB). Consistent with this definition and to capture the pressure gradients in individual subcompartments, rooms that span several levels, such as the steam generator (SG) rooms, are divided into individual subcompartments separated at level boundaries. Table 06.02.01.02-2-1 lists the subcompartments and the associated high energy line breaks (HELBs) analyzed, including the rooms in U.S. EPR FSAR Tier 2, Section 6.2.1.2.

Subcompartment analysis was performed in accordance with SRP 6.2.1.2 using the GOTHIC computer program. Two detailed RB GOTHIC models were created, one for the equipment area and one for the service area. In the equipment area model, the rooms in the equipment area (SG and reactor coolant pump (RCP) rooms) were modeled as individual nodes. The rooms in the service area and the dome region were lumped into large receiving volumes. In the service area model, the rooms in the service area and the pressurizer cavity were modeled as individual rooms, and the rooms in the equipment area and the dome were lumped into large receiving volumes. The approach used in developing the GOTHIC models and the subsequent analysis conforms to SRP 6.2.1.2 as follows:

- Each HELB room and the rooms in the surrounding area were modeled as individual nodes to minimize the pressure gradients in the nodes. When necessary, nodalization sensitivity runs were made by subdividing the HELB room into smaller nodes to capture the peak pressure. This was applied to the rooms with subcompartment pressure exceeding 3.5 psig.

Rooms below 3.5 psig were unaffected by local pressure gradients and were excluded from the nodalization sensitivity study.

- The initial room conditions were set to air with zero percent relative humidity, maximum operating temperature (140°F in the equipment area and 130°F in the service area), and minimum operating pressure (14.65 psia).
- Flow through the available flow paths were based on homogeneous flow in thermal equilibrium with 100 percent water entrainment. Critical flow conditions were assumed to be governed by the homogeneous equilibrium model for air-steam-water mixtures.

Table 06.02.01.02-3-1 summarizes the results of the subcompartment analysis. Table 06.02.01.02-3-1 includes the rooms with pressure in excess of five psig, including the critical rooms in U.S. EPR FSAR Tier 2, Table 6.2.1-10. The room pressure listed in Table 06.02.01.02-3-1 is the peak pressure resulting from the bounding HELB in the room. Critical rooms are the rooms bordering the critical sections, which are portions of the safety-significant structures (i.e., shear walls, floor slabs and roofs, and structure-to-structure connections as described in U.S. EPR FSAR Tier 2, Appendix 3E) that experience the largest structural demand with the highest loads and bending moments. Table 06.02.01.02-3-1 lists the room name, the bounding HELB in the room, and the resulting room pressure. The Response to Question 06.02.01.02-2, Table 06.02.01.02-2-1 provides room geometry data (volume and elevations). Table 06.02.01.02-3-2 shows the associated vent path data, including the vent area, loss coefficient, and inertia length.

U.S. EPR FSAR Tier 2, Section 3.8.1.4 provides information on the ultimate internal pressure load capability of the containment. The design criteria for RB subcompartments uses limits for allowable stresses, strains, deformations, and other design criteria for Seismic Category I concrete structures in accordance with ACI 349. Because this process involves different categories of loads and load combinations, a design margin for differential pressure alone can not be defined.

U.S. EPR FSAR Tier 1, Section 2.1 discusses ITAAC items relating to subcompartment pressurization. U.S. EPR FSAR Tier 1, Table 2.1.1-8, Item 2.4 states that the RB structures are designed and constructed to withstand design basis loads, including accident pressure and pipe break loads. Inspections, tests, and analysis include:

- An analysis of the RB structures for the design basis loads will be performed.
- During construction, deviations from the approved design will be analyzed for design basis loads to confirm that the approved design will withstand the design basis loads specified without loss of structural integrity or safety functions.

FSAR Impact:

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

Table 06.02.01.02-3-1—Critical Rooms with Pressure Greater than 5.0 psig

Room Name	Pressure (psia)	HELB Pipe	Room Description	Notes
-8 ft Room 2	25.3	LCA90BR006	Access Area	
-8 ft Room 7	22.2	LCQ51BR001	LCQ (SGBS) HX Room	
-8 ft Room 14	32.2	KBA12BR001	KBA12 (CVCS) HX Room	
-8 ft Room 15	32.2	KBA11BR001	KBA11 (CVCS) HX Room	
-8 ft Room 16	32.2	KBA11BR001	KBA (CVCS) Valve Room	
-8 ft Room 17	39.4	KBA10BR004	KBA (CVCS) Valve Room	
+5 ft Room 16	26.9	LCQ40BR905	LCQ50 (SGBS) Tank room	
+5 ft Room 20	23.1	KBA10BR002	KBA (CVCS) Valve Room	
+5 ft Room 21	21.7	KBA10BR003	KBA (CVCS) Valve Room	
+5 ft Room 22	25.5	KBA10BR003	KBA10 (CVCS) HX Room	
+45 ft Room 2	22.4	LAB60BR005	JEA10 (SG) Room	
+45 ft Room 3	22.3	LAB70BR005	JEA20 (SG) Room	
+45 ft Room 6	22.3	LAB80BR005	JEA30 (SG) Room	(1)
+45 ft Room 7	22.6	LAB90BR005	JEA40 (SG) Room	
+64 ft Room 1	25.4	LAB60BR005	JEA10 (SG) Room	
+64 ft Room 2	25.2	LAB70BR005	JEA20 (SG) Room	
+64 ft Room 5	25.2	LAB80BR005	JEA30 (SG) Room	
+64 ft Room 6	26.0	LAB90BR005	JEA40 (SG) Room	
+64 ft Room 14	22.6	JEF10BR004	JEF10 (RCS) Pressurizer Room	
+79 ft Room 12	23.6	JEF10BR006	Pressurizer Head & Safety Relief Valves Room	

Notes:

1. Room pressure is based on the results for the bounding room +45 ft Room 7.

Table 06.02.01.02-3-2—Vent Paths Associated with Critical Rooms (2 Sheets)

	From		To		Vent Path							
Vent Path No.	El. (ft)	Room Name	El. (ft)	Room Name	Area (ft^2)	Forward Loss Coeff.	Reverse Loss Coeff.	Inertia Length (ft)	Type	Burst Pres. (psi) (1)	Opening Time (s) (1)	Orient. (2)
VP07-1					23.17	2.34	1.59	20.43				H
VP07-15					13.24	2.61	2.26	20.68				H
VP07-19					5.92	2.72	2.68	16.16		1.74	0.50	H
VP07-2					30.89	2.70	2.73	39.35				H
VP07-20					5.92	2.71	2.68	15.32		1.74	0.50	H
VP07-21					5.92	2.71	2.66	15.28		1.74	0.50	H
VP07-22					18.19	2.24	2.30	11.74				H
VP07-3					30.89	2.70	2.73	39.55				H
VP07-4					5.92	2.78	2.78	32.95		1.74	0.50	H
VP11-15					13.89	2.74	2.72	28.90				H
VP11-19					28.63	2.68	2.63	29.93		3.48	0.75	H
VP11-22					19.91	2.70	2.58	28.83		3.48	0.75	H
VP11-23					20.77	2.66	2.63	23.54		3.48	0.50	H
VP11-24					21.35	2.44	2.25	14.64				H
VP11-25					13.89	2.55	2.60	16.18				H
VP11-41					55.68	2.59	2.58	10.42				V
VP11-44					18.94	2.72	2.69	12.76				V
VP23-10					242.02	1.06	1.31	23.53				H
VP23-2					242.02	1.31	1.06	23.53				H
VP23-32					196.28	0.81	0.81	17.72				V
VP23-33					202.11	0.80	0.80	17.72				V
VP23-36					202.11	0.80	0.80	17.72				V
VP23-37					196.28	0.81	0.81	17.72				V
VP23-4					516.02	0.42	0.42	26.13				H
VP23-5					280.52	0.99	1.18	24.23				H

Table 06.02.01.02-3-2—Vent Paths Associated with Critical Rooms (2 Sheets)

	From		To		Vent Path							
Vent Path No.	El. (ft)	Room Name	El. (ft)	Room Name	Area (ft^2)	Forward Loss Coeff.	Reverse Loss Coeff.	Inertia Length (ft)	Type	Burst Pres. (psi) (1)	Opening Time (s) (1)	Orient. (2)
VP23-8					280.52	1.20	1.02	24.42				H
VP23-9					516.02	0.42	0.42	26.13				H
VP29-1					280.25	1.19	1.19	24.95				H
VP29-17					21.64	2.65	2.70	28.59				H
VP29-2					21.31	2.47	2.61	19.99				H
VP29-20					168.77	0.85	0.84	16.90				V
VP29-21					169.17	0.86	0.84	16.90				V
VP29-24					169.17	0.86	0.84	16.90				V
VP29-25					168.77	0.85	0.84	16.90				V
VP29-35					42.68	2.48	2.48	14.91				V
VP29-4					21.31	2.61	2.48	20.19				H
VP29-6					280.25	1.19	1.19	24.95				H
VP34-19					23.06	2.57	2.44	19.09				H
VP34-20					168.77	0.84	0.84	19.52				V
VP34-21					169.17	0.84	0.84	19.52				V
VP34-24					169.17	0.84	0.84	19.52				V
VP34-25					168.77	0.84	0.84	19.52				V
VP34-35					55.46	2.39	2.39	11.15				V

Notes:

1. Burst pressures and opening times are listed only for the doors credited in the subcompartment pressurization analysis. These doors open in the from-to direction shown.
2. Orientation of the flow through the vent. "H" stands for horizontal flow and "V" for vertical flow.

Question 06.02.01.02-4

This question relates to conservativeness of subcompartment differential pressure calculations in FSAR Section 6.2.1.2. In RAI #82 06.02.01.02-1b.2 the staff requested that for each subcompartment for which the pressure response to a high energy pipe break was calculated, that AREVA provide a comparison of the calculated subcompartment pressure with the maximum pressure allowed by the subcompartment design and justify that sufficient margin is available. In response, AREVA provided a table of calculated subcompartment differential pressures with the maximum differential pressure allowed for some of the subcompartments in FSAR Table 6.2.1-10 but not all of the subcompartments. Provide this information for all the subcompartments described in FSAR Table 6.2.1-10 as well as the additional subcompartments for which the staff has requested analyses under RAI # 82 6.02.01.02-1 a.3 to close this issue.

The above questions are follow-up questions to previously issued RAIs and the containment audit held in Lynchburg on July 14 and 15, 2009.

Response to Question 06.02.01.02-4:

This response supersedes the original Response to RAI 266, Supplement 8, Question 06.02.01.02-4, which was submitted on August 25, 2010.

The Response to Question 06.02.01.02-3, Table 06.02.01.02-3-1 provides the bounding subcompartment pressures resulting from postulated high energy line breaks (HELBs). The maximum differential pressure allowable is provided for the steam generator (SG) rooms, reactor coolant pump (RCP) rooms, and the pressurizer cavity in the Response to RAI 82, Supplement 1, Question 06.02.01.02-1b.2. U.S. EPR FSAR Tier 2, Section 3.8.1.4 provides additional information on the ultimate internal pressure load capability of the containment.

The design criteria for Reactor Building (RB) subcompartments uses limits for allowable stresses, strains, deformations, and other design criteria for Seismic Category I concrete structures in accordance with ACI 349. Because this process involves different categories of loads and load combinations, a design margin for differential pressure alone can not be defined.

FSAR Impact:

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