

## ArevaEPRDCPEm Resource

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**From:** WILLIFORD Dennis (AREVA) [Dennis.Williford@areva.com]  
**Sent:** Wednesday, April 18, 2012 8:55 AM  
**To:** Tesfaye, Getachew  
**Cc:** BENNETT Kathy (AREVA); DELANO Karen (AREVA); ROMINE Judy (AREVA); RYAN Tom (AREVA)  
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 155, FSAR Ch 3, Supplement 17  
**Attachments:** RAI 155 Supplement 17 Response US EPR DC.PDF

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 5 of the 78 questions of RAI No. 155 on February 13, 2009. AREVA NP submitted Supplement 1 to the response on March 31, 2009 to address 20 of the remaining 73 questions. AREVA NP submitted Supplement 2 to the response on April 30, 2009, to address 9 of the remaining 53 questions. AREVA NP submitted Supplement 3 to the response on May 29, 2009, to address 20 of the remaining 44 questions. AREVA NP submitted Supplement 4 to the response on June 30, 2009, to address 8 of the remaining 24 questions. AREVA NP submitted Supplement 5 to the response on July 31, 2009, to address 11 of the remaining 16 questions. AREVA NP submitted Supplement 6 to the response on October 30, 2009, to provide new dates for 5 of the remaining 5 questions. AREVA NP submitted Supplement 7 to the response on January 28, 2010, to answer 1 of the remaining 5 questions and provide a new date for 1 of the remaining 5 questions. AREVA NP submitted Supplement 8 to the response on April 21, 2010, to answer 2 of the remaining 4 questions. AREVA NP submitted a revised schedule for Questions 03.08.01-24 and 03.08.04-06 in Supplements 9, 10 and 11 on June 24, 2010, February 11, 2011 and May 2, 2011, respectively. AREVA NP submitted a revised response for Question 03.08.01-06 in Supplement 12 on May 20, 2011. AREVA NP submitted Supplement 13 on July 8, 2011 to provide revised responses to seven questions. AREVA NP submitted Supplement 14 on December 14, 2011, Supplement 15 on January 25, 2012, and Supplement 16 on February 21, 2012 to provide a revised schedule for the response to the remaining two questions.

The response to one question (Question 03.08.01-20) has been revised. The attached file, "RAI 155 Supplement 17 Response US EPR DC.pdf" provides the revised response. Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 155 Question 03.08.01-20.

The following table indicates the respective pages in the response document, "RAI 155 Supplement 17 Response US EPR DC.pdf," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 155 — 03.08.01-20	2	12

The schedule for the final response to the remaining two questions is unchanged as indicated below.

Question #	Response Date
RAI 155 — 03.08.01-24	August 30, 2013
RAI 155 — 03.08.04-06	August 30, 2013

Sincerely,

**Dennis Williford, P.E.**  
**U.S. EPR Design Certification Licensing Manager**  
**AREVA NP Inc.**

7207 IBM Drive, Mail Code CLT 2B  
Charlotte, NC 28262  
Phone: 704-805-2223  
Email: [Dennis.Williford@areva.com](mailto:Dennis.Williford@areva.com)

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**From:** WILLIFORD Dennis (RS/NB)  
**Sent:** Tuesday, February 21, 2012 9:24 PM  
**To:** [Getachew.Tesfaye@nrc.gov](mailto:Getachew.Tesfaye@nrc.gov)  
**Cc:** 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. 155, FSAR Ch 3, Supplement 16

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 5 of the 78 questions of RAI No. 155 on February 13, 2009. AREVA NP submitted Supplement 1 to the response on March 31, 2009 to address 20 of the remaining 73 questions. AREVA NP submitted Supplement 2 to the response on April 30, 2009, to address 9 of the remaining 53 questions. AREVA NP submitted Supplement 3 to the response on May 29, 2009, to address 20 of the remaining 44 questions. AREVA NP submitted Supplement 4 to the response on June 30, 2009, to address 8 of the remaining 24 questions. AREVA NP submitted Supplement 5 to the response on July 31, 2009, to address 11 of the remaining 16 questions. AREVA NP submitted Supplement 6 to the response on October 30, 2009, to provide new dates for 5 of the remaining 5 questions. AREVA NP submitted Supplement 7 to the response on January 28, 2010, to answer 1 of the remaining 5 questions and provide a new date for 1 of the remaining 5 questions. AREVA NP submitted Supplement 8 to the response on April 21, 2010, to answer 2 of the remaining 4 questions. AREVA NP submitted a revised schedule for Questions 03.08.01-24 and 03.08.04-06 in Supplements 9, 10 and 11 on June 24, 2010, February 11, 2011 and May 2, 2011, respectively. AREVA NP submitted a revised response for Question 03.08.01-06 in Supplement 12 on May 20, 2011. AREVA NP submitted Supplement 13 on July 8, 2011 to provide revised responses to seven questions. AREVA NP submitted Supplement 14 on December 14, 2011 to provide a revised schedule for the response to the remaining two questions. AREVA NP submitted Supplement 15 on January 25, 2012 to provide a revised schedule for the response to the remaining two questions.

The schedule for the final response to the remaining two questions has been changed as indicated below. This schedule was transmitted to the NRC in AREVA NP letter 12:008 dated February 21, 2012.

Question #	Response Date
RAI 155 — 03.08.01-24	August 30, 2013
RAI 155 — 03.08.04-06	August 30, 2013

Sincerely,

**Dennis Williford, P.E.**  
**U.S. EPR Design Certification Licensing Manager**  
**AREVA NP Inc.**

7207 IBM Drive, Mail Code CLT 2B  
Charlotte, NC 28262  
Phone: 704-805-2223  
Email: [Dennis.Williford@areva.com](mailto:Dennis.Williford@areva.com)

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**From:** WILLIFORD Dennis (RS/NB)  
**Sent:** Wednesday, January 25, 2012 9:55 AM  
**To:** [Getachew.Tesfaye@nrc.gov](mailto:Getachew.Tesfaye@nrc.gov)  
**Cc:** BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB);

[Michael.Miernicki@nrc.gov](mailto:Michael.Miernicki@nrc.gov)

**Subject:** Response to U.S. EPR Design Certification Application RAI No. 155, FSAR Ch 3, Supplement 15

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 5 of the 78 questions of RAI No. 155 on February 13, 2009. AREVA NP submitted Supplement 1 to the response on March 31, 2009 to address 20 of the remaining 73 questions. AREVA NP submitted Supplement 2 to the response on April 30, 2009, to address 9 of the remaining 53 questions. AREVA NP submitted Supplement 3 to the response on May 29, 2009, to address 20 of the remaining 44 questions. AREVA NP submitted Supplement 4 to the response on June 30, 2009, to address 8 of the remaining 24 questions. AREVA NP submitted Supplement 5 to the response on July 31, 2009, to address 11 of the remaining 16 questions. AREVA NP submitted Supplement 6 to the response on October 30, 2009, to provide new dates for 5 of the remaining 5 questions. AREVA NP submitted Supplement 7 to the response on January 28, 2010, to answer 1 of the remaining 5 questions and provide a new date for 1 of the remaining 5 questions. AREVA NP submitted Supplement 8 to the response on April 21, 2010, to answer 2 of the remaining 4 questions. AREVA NP submitted a revised schedule for Questions 03.08.01-24 and 03.08.04-06 in Supplements 9, 10 and 11 on June 24, 2010, February 11, 2011 and May 2, 2011, respectively. AREVA NP submitted a revised response for Question 03.08.01-06 in Supplement 12 on May 20, 2011. AREVA NP submitted Supplement 13 on July 8, 2011 to provide revised responses to seven questions. AREVA NP submitted Supplement 14 on December 14, 2011 to provide a revised schedule for the response to the remaining two questions.

A preliminary revised schedule for technically correct and complete responses to the remaining two questions is provided below. This schedule is being reevaluated and a new supplement with a revised schedule will be transmitted by February 21, 2012.

Question #	Response Date
RAI 155 — 03.08.01-24	February 21, 2012
RAI 155 — 03.08.04-06	February 21, 2012

Sincerely,

**Dennis Williford, P.E.**  
**U.S. EPR Design Certification Licensing Manager**  
**AREVA NP Inc.**

7207 IBM Drive, Mail Code CLT 2B  
Charlotte, NC 28262  
Phone: 704-805-2223  
Email: [Dennis.Williford@areva.com](mailto:Dennis.Williford@areva.com)

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**From:** WILLIFORD Dennis (RS/NB)  
**Sent:** Wednesday, December 14, 2011 10:32 AM  
**To:** [Getachew.Tesfaye@nrc.gov](mailto:Getachew.Tesfaye@nrc.gov)  
**Cc:** 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. 155, FSAR Ch 3, Supplement 14

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 5 of the 78 questions of RAI No. 155 on February 13, 2009. AREVA NP submitted Supplement 1 to the response on March 31, 2009 to address 20 of the remaining 73 questions. AREVA NP submitted Supplement 2 to the response on April 30, 2009, to address 9 of the remaining 53 questions. AREVA NP submitted Supplement 3 to the response on May 29, 2009, to address 20 of the remaining 44 questions. AREVA NP submitted Supplement 4 to the response on June 30, 2009, to address 8 of the remaining 24 questions. AREVA NP submitted Supplement 5 to the response on July 31,

2009, to address 11 of the remaining 16 questions. AREVA NP submitted Supplement 6 to the response on October 30, 2009, to provide new dates for 5 of the remaining 5 questions. AREVA NP submitted Supplement 7 to the response on January 28, 2010, to answer 1 of the remaining 5 questions and provide a new date for 1 of the remaining 5 questions. AREVA NP submitted Supplement 8 to the response on April 21, 2010, to answer 2 of the remaining 4 questions. AREVA NP submitted a revised schedule for Questions 03.08.01-24 and 03.08.04-06 in Supplements 9, 10 and 11 on June 24, 2010, February 11, 2011 and May 2, 2011, respectively. AREVA NP submitted a revised response for Question 03.08.01-06 in Supplement 12 on May 20, 2011. AREVA NP submitted Supplement 13 on July 8, 2011 to provide revised responses to seven questions.

A preliminary revised schedule for technically correct and complete responses to the remaining two questions is provided below. This schedule is being reevaluated and a new supplement with a revised schedule will be transmitted by January 25, 2012.

Question #	Response Date
RAI 155 — 03.08.01-24	January 25, 2012
RAI 155 — 03.08.04-06	January 25, 2012

Sincerely,

**Dennis Williford, P.E.**  
**U.S. EPR Design Certification Licensing Manager**  
**AREVA NP Inc.**  
 7207 IBM Drive, Mail Code CLT 2B  
 Charlotte, NC 28262  
 Phone: 704-805-2223  
 Email: [Dennis.Williford@areva.com](mailto:Dennis.Williford@areva.com)

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**From:** WILLIFORD Dennis (RS/NB)  
**Sent:** Friday, July 08, 2011 9:22 AM  
**To:** Tesfaye, Getachew  
**Cc:** 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. 155, FSAR Ch 3, Supplement 13

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 5 of the 78 questions of RAI No. 155 on February 13, 2009. AREVA NP submitted Supplement 1 to the response on March 31, 2009 to address 20 of the remaining 73 questions. AREVA NP submitted Supplement 2 to the response on April 30, 2009, to address 9 of the remaining 53 questions. AREVA NP submitted Supplement 3 to the response on May 29, 2009, to address 20 of the remaining 44 questions. AREVA NP submitted Supplement 4 to the response on June 30, 2009, to address 8 of the remaining 24 questions. AREVA NP submitted Supplement 5 to the response on July 31, 2009, to address 11 of the remaining 16 questions. AREVA NP submitted Supplement 6 to the response on October 30, 2009, to provide new dates for 5 of the remaining 5 questions. AREVA NP submitted Supplement 7 to the response on January 28, 2010, to answer 1 of the remaining 5 questions and provide a new date for 1 of the remaining 5 questions. AREVA NP submitted Supplement 8 to the response on April 21, 2010, to answer 2 of the remaining 4 questions. AREVA NP submitted a revised schedule for Questions 03.08.01-24 and 03.08.04-06 in Supplements 9, 10 and 11 on June 24, 2010, February 11, 2011 and May 2, 2011, respectively. AREVA NP submitted a revised response for Question 03.08.01-06 in Supplement 12 on May 20, 2011.

The responses to 7 questions (Questions 03.08.01-13, 03.08.01-20, 03.08.03-10, 03.08.05-4, 03.08.05-8, 03.08.05-9, and 03.08.05-10) are superseded by the response to RAI 320 Question 03.07.02-63. The attached file, "RAI 155 Supplement 13 Response US EPR DC.pdf" provides the revised responses.

The following table indicates the respective pages in the response document, "RAI 155 Supplement 13 Response US EPR DC.pdf," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 155 — 03.08.01-13	2	5
RAI 155 — 03.08.01-20	6	15
RAI 155 — 03.08.03-10	16	16
RAI 155 — 03.08.05-04	17	18
RAI 155 — 03.08.05-08	19	21
RAI 155 — 03.08.05-09	22	22
RAI 155 — 03.08.05-10	23	23

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

Question #	Response Date
RAI 155 — 03.08.01-24	December 28, 2011
RAI 155 — 03.08.04-06	December 28, 2011

Sincerely,

***Dennis Williford, P.E.***  
***U.S. EPR Design Certification Licensing Manager***  
***AREVA NP Inc.***

7207 IBM Drive, Mail Code CLT 2B  
 Charlotte, NC 28262  
 Phone: 704-805-2223  
 Email: [Dennis.Williford@areva.com](mailto:Dennis.Williford@areva.com)

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**From:** WILLIFORD Dennis (RS/NB)  
**Sent:** Friday, May 20, 2011 11:28 AM  
**To:** Tesfaye, Getachew  
**Cc:** BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); CORNELL Veronica (External RS/NB); WELLS Russell (RS/NB)  
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 155, FSAR Ch 3, Supplement 12

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 5 of the 78 questions of RAI No. 155 on February 13, 2009. AREVA NP submitted Supplement 1 to the response on March 31, 2009 to address 20 of the remaining 73 questions. AREVA NP submitted Supplement 2 to the response on April 30, 2009, to address 9 of the remaining 53 questions. AREVA NP submitted Supplement 3 to the response on May 29, 2009, to address 20 of the remaining 44 questions. AREVA NP submitted Supplement 4 to the response on June 30, 2009, to address 8 of the remaining 24 questions. AREVA NP submitted Supplement 5 to the response on July 31, 2009, to address 11 of the remaining 16 questions. AREVA NP submitted Supplement 6 to the response on October 30, 2009, to provide new dates for 5 of the remaining 5 questions. AREVA NP submitted Supplement 7 to the response on January 28, 2010, to answer 1 of the remaining 5 questions and provide a new date for 1 of the

remaining 5 questions. AREVA NP submitted Supplement 8 to the response on April 21, 2010, to answer 2 of the remaining 4 questions. AREVA NP submitted a revised schedule for Questions 03.08.01-24 and 03.08.04-06 in Supplements 9, 10 and 11 on June 24, 2010, February 11, 2011 and May 2, 2011, respectively.

A final response to Question 03.08.01-06 was submitted in RAI 155 Supplement 8, April 21, 2010. To address NRC comments received during the U.S. EPR FSAR Section 3.8 audit held February 14 – 17, 2011, the response to Question 03.08.01-06 has been revised.

The attached file, "RAI 155 Supplement 12 Response US EPR DC.pdf" provides a technically correct, complete and revised FINAL response to Question 03.08.01-06, as committed.

The following table indicates the respective pages in the response document, "RAI 155 Supplement 12 Response US EPR DC.pdf," that contains AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 155 — 03.08.01-06	2	3

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

Question #	Response Date
RAI 155 — 03.08.01-24	December 28, 2011
RAI 155 — 03.08.04-06	December 28, 2011

Sincerely,

**Dennis Williford, P.E.**  
**U.S. EPR Design Certification Licensing Manager**  
**AREVA NP Inc.**  
7207 IBM Drive, Mail Code CLT 2B  
Charlotte, NC 28262  
Phone: 704-805-2223  
Email: [Dennis.Williford@areva.com](mailto:Dennis.Williford@areva.com)

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**From:** WELLS Russell (RS/NB)  
**Sent:** Monday, May 02, 2011 7:26 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. 155, FSAR Ch 3, Supplement 11

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 5 of the 78 questions of RAI No. 155 on February 13, 2009. AREVA NP submitted Supplement 1 to the response on March 31, 2009 to address 20 of the remaining 73 questions. AREVA NP submitted Supplement 2 to the response on April 30, 2009, to address 9 of the

remaining 53 questions. AREVA NP submitted Supplement 3 to the response on May 29, 2009, to address 20 of the remaining 44 questions. AREVA NP submitted Supplement 4 to the response on June 30, 2009, to address 8 of the remaining 24 questions. AREVA NP submitted Supplement 5 to the response on July 31, 2009, to address 11 of the remaining 16 questions. AREVA NP submitted Supplement 6 to the response on October 30, 2009, to provide new dates for 5 of the remaining 5 questions. AREVA NP submitted Supplement 7 to the response on January 28, 2010, to answer 1 of the remaining 5 questions and provide a new date for 1 of the remaining 5 questions. AREVA NP submitted Supplement 8 to the response on April 21, 2010, to answer 2 of the remaining 4 questions. AREVA NP submitted a revised schedule for Questions 03.08.01-24 and 03.08.04-06 in Supplements 9 and 10 on June 24, 2010 and February 11, 2011, respectively.

Due to changes in the schedule for FSAR Sections 3.7 and 3.8 as discussed with NRC, the schedule for Questions 03.08.01-24 and 03.08.04-06 is being revised.

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

Question #	Response Date
RAI 155 — 03.08.01-24	December 28, 2011
RAI 155 — 03.08.04-06	December 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](mailto:Russell.Wells@Areva.com)*

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**From:** BRYAN Martin (External RS/NB)

**Sent:** Friday, February 11, 2011 2:32 PM

**To:** 'Tesyfaye, 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. 155, FSAR Ch 3, Supplement 10

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 5 of the 78 questions of RAI No. 155 on February 13, 2009. AREVA NP submitted Supplement 1 to the response on March 31, 2009 to address 20 of the remaining 73 questions. AREVA NP submitted Supplement 2 to the response on April 30, 2009, to address 9 of the remaining 53 questions. AREVA NP submitted Supplement 3 to the response on May 29, 2009, to address 20 of the remaining 44 questions. AREVA NP submitted Supplement 4 to the response on June 30, 2009, to address 8 of the remaining 24 questions. AREVA NP submitted Supplement 5 to the response on July 31, 2009, to address 11 of the remaining 16 questions. AREVA NP submitted Supplement 6 to the response on October 30, 2009, to provide new dates for 5 of the remaining 5 questions. AREVA NP submitted Supplement 7 to the response on January 28, 2010, to answer 1 of the remaining 5 questions and provide a new date for 1 of the

remaining 5 questions. AREVA NP submitted Supplement 8 to the response on April 21, 2010, to answer 2 of the remaining 4 questions. On June 24, 2010, AREVA NP submitted Supplement 9 to provide a revised schedule for Questions 03.08.01-24 and 03.08.04-06.

The schedule for Questions 03.08.01-24 and 03.08.04-06 has been changed.

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

Question #	Response Date
RAI 155 — 03.08.01-24	July 22, 2011
RAI 155 — 03.08.04-06	July 22, 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](mailto:Martin.Bryan.ext@areva.com)

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**From:** BRYAN Martin (EXT)  
**Sent:** Thursday, June 24, 2010 1:02 PM  
**To:** 'Tefaye, Getachew'  
**Cc:** DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); VAN NOY Mark (EXT); CORNELL Veronica (External RS/NB); RYAN Tom (RS/NB); GARDNER Darrell (RS/NB)  
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 155, FSAR Ch 3, Supplement 9

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 5 of the 78 questions of RAI No. 155 on February 13, 2009. AREVA NP submitted Supplement 1 to the response on March 31, 2009 to address 20 of the remaining 73 questions. AREVA NP submitted Supplement 2 to the response on April 30, 2009, to address 9 of the remaining 53 questions. AREVA NP submitted Supplement 3 to the response on May 29, 2009, to address 20 of the remaining 44 questions. AREVA NP submitted Supplement 4 to the response on June 30, 2009, to address 8 of the remaining 24 questions. AREVA NP submitted Supplement 5 to the response on July 31, 2009, to address 11 of the remaining 16 questions. AREVA NP submitted Supplement 6 to the response on October 30, 2009, to provide new dates for 5 of the remaining 5 questions. AREVA NP submitted Supplement 7 to the response on January 28, 2010, to answer 1 of the remaining 5 questions and provide a new date for 1 of the remaining 5 questions. AREVA NP submitted Supplement 8 to the response on April 21, 2010, to answer 2 of the remaining 4 questions.

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 for the remaining two questions has been changed.

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



Question #	Response Date
RAI 155 — 03.08.01-24	May 25, 2011
RAI 155 — 03.08.04-06	May 25, 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](mailto:Martin.Bryan.ext@areva.com)

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**From:** BRYAN Martin (EXT)  
**Sent:** Wednesday, April 21, 2010 12:56 PM  
**To:** 'Tefsaye, Getachew'  
**Cc:** DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); VAN NOY Mark (EXT)  
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 155, FSAR Ch 3, Supplement 8

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 5 of the 78 questions of RAI No. 155 on February 13, 2009. AREVA NP submitted Supplement 1 to the response on March 31, 2009 to address 20 of the remaining 73 questions. AREVA NP submitted Supplement 2 to the response on April 30, 2009, to address 9 of the remaining 53 questions. AREVA NP submitted Supplement 3 to the response on May 29, 2009, to address 20 of the remaining 44 questions. AREVA NP submitted Supplement 4 to the response on June 30, 2009, to address 8 of the remaining 24 questions. AREVA NP submitted Supplement 5 to the response on July 31, 2009, to address 11 of the remaining 16 questions. AREVA NP submitted Supplement 6 to the response on October 30, 2009, to provide new dates for 5 of the remaining 5 questions. AREVA NP submitted Supplement 7 to the response on January 28, 2010, to answer 1 of the remaining 5 questions and provide a new date for 1 of the remaining 5 questions. The attached file, "RAI 155 Supplement 8 Response US EPR DC.pdf" provides a technically correct and complete response to 2 of the remaining 4 questions, as committed

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 155 Questions 03.08.01-3 and 03.08.01-6.

The following table indicates the respective pages in the response document, "RAI 155 Supplement 8 Response US EPR DC.pdf" that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 155 — 03.08.01-3	2	3
RAI 155 — 03.08.01-6	4	5

The schedule for technically correct and complete responses to the remaining 2 questions is unchanged and provided below:

Question #	Response Date
RAI 155 — 03.08.01-24	August 3, 2010
RAI 155 — 03.08.04-06	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](mailto:Martin.Bryan.ext@areva.com)

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**From:** DUNCAN Leslie E (AREVA NP INC)  
**Sent:** Thursday, January 28, 2010 7:40 PM  
**To:** 'Tesfaye, Getachew'  
**Cc:** DELANO Karen V (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); VAN NOY Mark (EXT)  
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 155, FSAR Ch 3, Supplement 7

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 5 of the 78 questions of RAI No. 155 on February 13, 2009. AREVA NP submitted Supplement 1 to the response on March 31, 2009 to address 20 of the remaining 73 questions. AREVA NP submitted Supplement 2 to the response on April 30, 2009, to address 9 of the remaining 53 questions. AREVA NP submitted Supplement 3 to the response on May 29, 2009, to address 20 of the remaining 44 questions. AREVA NP submitted Supplement 4 to the response on June 30, 2009, to address 8 of the remaining 24 questions. AREVA NP submitted Supplement 5 to the response on July 31, 2009, to address 11 of the remaining 16 questions. AREVA NP submitted Supplement 6 to the response on October 30, 2009, to provide new dates for 5 of the remaining 5 questions. The attached file, "RAI 155 Supplement 7 Response US EPR DC.pdf" provides a technically correct and complete response to 1 of the remaining 5 questions, as committed.

The response for 1 of the 2 questions committed for in Supplement 7 has been deferred for submittal in conjunction with Supplement 8 because of its dependency on work that is not yet complete.

The following table indicates the respective pages in the response document, "RAI 155 Supplement 7 Response US EPR DC.pdf" that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 155 — 03.08.01-20	2	11

The schedule for technically correct and complete responses to the remaining 4 questions is changed and provided below:

Question #	Response Date
RAI 155 – 03.08.01-3	April 21, 2010
RAI 155 – 03.08.01-6	April 21, 2010
RAI 155 – 03.08.01-24	August 3, 2010
RAI 155 – 03.08.04-6	August 3, 2010

Sincerely,

Les Duncan  
Licensing Engineer  
AREVA NP Inc.

An AREVA and Siemens Company  
Tel: (434) 832-2849  
[Leslie.Duncan@areva.com](mailto:Leslie.Duncan@areva.com)

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**From:** WELLS Russell D (AREVA NP INC)  
**Sent:** Friday, October 30, 2009 12:57 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. 155, FSAR Ch 3, Supplement 6

Getachew,

AREVA NP Inc. (AREVA NP) is unable to provide a response for RAI 155 Supplement 6 at this time. As discussed with the NRC staff, new seismic analyses using an embedded Finite Element – SASSI model are being finalized, which yields a new in-structure-seismic-response-spectra that will provide a more accurate assessment of sliding and overturning and improve high frequency response analysis.

The revised schedule for technically correct and complete responses to the remaining 5 questions is provided below:

Question #	Response Date
RAI 155 — 03.08.01-3	January 28, 2010
RAI 155 — 03.08.01-6	April 21, 2010
RAI 155 — 03.08.01-20	January 28, 2010
RAI 155 — 03.08.01-24	August 3, 2010
RAI 155 — 03.08.04-6	August 3, 2010

Sincerely,

(Russ Wells on behalf of)

*Ronda Pederson*

[ronda.pederson@areva.com](mailto:ronda.pederson@areva.com)

Licensing Manager, U.S. EPR Design Certification

New Plants Deployment

**AREVA NP, Inc.**  
An AREVA and Siemens company

3315 Old Forest Road

Lynchburg, VA 24506-0935

Phone: 434-832-3694

Cell: 434-841-8788

---

**From:** Pederson Ronda M (AREVA NP INC)  
**Sent:** Friday, July 31, 2009 4:15 PM  
**To:** 'Tefaye, Getachew'  
**Cc:** BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); VAN NOY Mark (EXT)  
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 155, FSAR Ch 3, Supplement 5

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 5 of the 78 questions of RAI No. 155 on February 13, 2009. AREVA NP submitted Supplement 1 to the response on March 31, 2009 to address 20 of the remaining questions. AREVA NP submitted Supplement 2 to the response on April 30, 2009, to address 9 of the remaining questions. AREVA NP submitted Supplement 3 to the response on May 29, 2009, to address 20 of the remaining questions. AREVA NP submitted Supplement 4 to the response on June 30, 2009, to address 8 of the remaining questions. The attached file, "RAI 155 Supplement 5 Response US EPR DC.pdf" provides technically correct and complete responses to 11 of the remaining 16 questions, as committed.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 155 Supplement 5 Questions 03.08.02-2, 03.08.02-7, 03.08.03-4, 03.08.03-17, 03.08.05-1, 03.08.05-8, and 03.08.05-12.

The following table indicates the respective pages in the response document, "RAI 155 Supplement 5 Response US EPR DC.pdf" that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 155 — 03.08.02-02	2	2
RAI 155 — 03.08.02-07	3	3
RAI 155 — 03.08.02-08	4	4
RAI 155 — 03.08.03-04	5	5
RAI 155 — 03.08.03-16	6	7
RAI 155 — 03.08.03-17	8	9
RAI 155 — 03.08.05-01	10	10
RAI 155 — 03.08.05-08	11	16
RAI 155 — 03.08.05-10	17	18
RAI 155 — 03.08.05-12	19	19
RAI 155 — 03.08.05-18	20	20

The schedule for technically correct and complete responses to the remaining 5 questions is unchanged and provided below:

Question RAI 155 #	Response Date
RAI 155 — 03.08.01-03	October 30, 2009

RAI 155 — 03.08.01-06	October 30, 2009
RAI 155 — 03.08.01-20	October 30, 2009
RAI 155 — 03.08.01-24	October 30, 2009
RAI 155 — 03.08.04-06	October 30, 2009

Sincerely,

*Ronda Pederson*

[ronda.pederson@areva.com](mailto: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:** Tuesday, June 30, 2009 8:34 PM

**To:** 'Getachew Tesfaye'; Miernicki, Michael

**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. 155, FSAR Ch 3, Supplement 4

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 5 of the 78 questions of RAI No. 155 on February 13, 2009. AREVA NP submitted Supplement 1 to the response on March 31, 2009 to address 20 of the remaining 73 questions. AREVA NP submitted Supplement 2 to the response on April 30, 2009, to address 9 of the remaining 53 questions. AREVA NP submitted Supplement 3 to the response on May 29, 2009, to address 20 of the remaining 44 questions. The attached file, "RAI 155 Supplement 4 Response US EPR DC.pdf" provides technically correct and complete responses to 8 of the remaining 24 questions, as committed.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 155 Questions 03.08.05-14 and 03.08.02-1.

The following table indicates the respective pages in the response document, "RAI 155 Supplement 4 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 155 — 03.08.01-11	2	2
RAI 155 — 03.08.02-1	3	3
RAI 155 — 03.08.02-4	4	4
RAI 155 — 03.08.05-7	5	8
RAI 155 — 03.08.05-13	9	10
RAI 155 — 03.08.05-14	11	13
RAI 155 — 03.08.05-15	14	14
RAI 155 — 03.08.05-16	15	15
RAI 155 — 03.08.05-18	16	16

The schedule for technically correct and complete responses to the remaining 16 questions is unchanged, with the exception of question 03.08.05-18, and is provided below. The schedule for the response to question 03.08.05-18 has been changed to July 31, 2009.

<b>Question RAI 155 #</b>	<b>Response Date</b>
RAI 155 — 03.08.01-03	October 30, 2009
RAI 155 — 03.08.01-06	October 30, 2009
RAI 155 — 03.08.01-20	October 30, 2009
RAI 155 — 03.08.01-24	October 30, 2009
RAI 155 — 03.08.02-02	July 31, 2009
RAI 155 — 03.08.02-07	July 31, 2009
RAI 155 — 03.08.02-08	July 31, 2009
RAI 155 — 03.08.03-04	July 31, 2009
RAI 155 — 03.08.03-16	July 31, 2009
RAI 155 — 03.08.03-17	July 31, 2009
RAI 155 — 03.08.04-06	October 30, 2009
RAI 155 — 03.08.05-01	July 31, 2009
RAI 155 — 03.08.05-08	July 31, 2009
RAI 155 — 03.08.05-10	July 31, 2009
RAI 155 — 03.08.05-12	July 31, 2009
RAI 155 — 03.08.05-18	July 31, 2009

Sincerely,

(Russ Wells on behalf of)

*Ronda Pederson*

[ronda.pederson@areva.com](mailto:ronda.pederson@areva.com)

Licensing Manager, U.S. EPR Design Certification

New Plants Deployment

**AREVA NP, Inc.**

An AREVA and Siemens company

3315 Old Forest Road

Lynchburg, VA 24506-0935

Phone: 434-832-3694

Cell: 434-841-8788

**From:** Pederson Ronda M (AREVA NP INC)

**Sent:** Friday, May 29, 2009 9:49 PM

**To:** Getachew Tesfaye

**Cc:** BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); VAN NOY Mark (EXT)

**Subject:** Response to U.S. EPR Design Certification Application RAI No. 155, Supplement 3

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 5 of the 78 questions of RAI No. 155 on February 13, 2009. AREVA NP submitted Supplement 1 to the response on March 31, 2009, to address 20 of the remaining questions. AREVA NP submitted Supplement 2 to the response on April 30, 2009, to address 9 of the remaining questions. The attached file, "RAI 155 Supplement 3 Response US EPR DC.pdf" provides technically correct and complete responses to 20 of the remaining 44 questions, as committed.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 155 Questions 03.08.01-8, 03.08.01-10, 03.08.01-12, 03.08.03-3, 03.08.03-6, 03.08.03-10, 03.08.04-3, and 03.08.05-6.

The following table indicates the respective pages in the response document, "RAI 155 Supplement 3 Response US EPR DC.pdf" that contain AREVA NP's response to the subject questions.

<b>Question #</b>	<b>Start Page</b>	<b>End Page</b>
RAI 155 — 03.08.01-8	2	9
RAI 155 — 03.08.01-9	10	10
RAI 155 — 03.08.01-10	11	17
RAI 155 — 03.08.01-12	18	19
RAI 155 — 03.08.01-16	20	21
RAI 155 — 03.08.01-22	22	24
RAI 155 — 03.08.01-27	25	26
RAI 155 — 03.08.02-5	27	27
RAI 155 — 03.08.02-6	28	31
RAI 155 — 03.08.02-10	32	32
RAI 155 — 03.08.03-3	33	35
RAI 155 — 03.08.03-6	36	37
RAI 155 — 03.08.03-10	38	38
RAI 155 — 03.08.03-11	39	40
RAI 155 — 03.08.03-12	41	41
RAI 155 — 03.08.04-3	42	45
RAI 155 — 03.08.04-4	46	47
RAI 155 — 03.08.04-5	48	48
RAI 155 — 03.08.05-2	49	50
RAI 155 — 03.08.05-6	51	52

The schedule for technically correct and complete responses to the remaining 24 questions is unchanged and provided below:

<b>Question RAI 155 #</b>	<b>Response Date</b>
RAI 155 — 03.08.01-03	October 30, 2009
RAI 155 — 03.08.01-06	October 30, 2009

RAI 155 — 03.08.01-11	June 30, 2009
RAI 155 — 03.08.01-20	October 30, 2009
RAI 155 — 03.08.01-24	October 30, 2009
RAI 155 — 03.08.02-01	June 30, 2009
RAI 155 — 03.08.02-02	July 31, 2009
RAI 155 — 03.08.02-04	June 30, 2009
RAI 155 — 03.08.02-07	July 31, 2009
RAI 155 — 03.08.02-08	July 31, 2009
RAI 155 — 03.08.03-04	July 31, 2009
RAI 155 — 03.08.03-16	July 31, 2009
RAI 155 — 03.08.03-17	July 31, 2009
RAI 155 — 03.08.04-06	October 30, 2009
RAI 155 — 03.08.05-01	July 31, 2009
RAI 155 — 03.08.05-07	June 30, 2009
RAI 155 — 03.08.05-08	July 31, 2009
RAI 155 — 03.08.05-10	July 31, 2009
RAI 155 — 03.08.05-12	July 31, 2009
RAI 155 — 03.08.05-13	June 30, 2009
RAI 155 — 03.08.05-14	June 30, 2009
RAI 155 — 03.08.05-15	June 30, 2009
RAI 155 — 03.08.05-16	June 30, 2009
RAI 155 — 03.08.05-18	June 30, 2009

Sincerely,

*Ronda Pederson*

[ronda.pederson@areva.com](mailto:ronda.pederson@areva.com)

Licensing Manager, U.S. EPR Design Certification

**AREVA NP Inc.**

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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, April 30, 2009 9:16 PM

**To:** Getachew Tesfaye ([gxt2@nrc.gov](mailto:gxt2@nrc.gov))

**Cc:** BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); VAN NOY Mark (EXT)

**Subject:** Response to U.S. EPR Design Certification Application RAI No. 155, Supplement 2 (part 4 of 4)

Getachew,



Response file, "RAI 155 Supplement 2 Response US EPR DC (Part 4 of 4).pdf" is attached.

Sincerely,

*Ronda Pederson*

[ronda.pederson@areva.com](mailto:ronda.pederson@areva.com)

Licensing Manager, U.S. EPR Design Certification

**AREVA NP Inc.**

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3315 Old Forest Road

Lynchburg, VA 24506-0935

Phone: 434-832-3694

Cell: 434-841-8788

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**From:** Pederson Ronda M (AREVA NP INC)

**Sent:** Thursday, April 30, 2009 9:12 PM

**To:** Getachew Tesfaye ([gxt2@nrc.gov](mailto:gxt2@nrc.gov))

**Cc:** BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); VAN NOY Mark (EXT)

**Subject:** Response to U.S. EPR Design Certification Application RAI No. 155, Supplement 2 (part 3 of 4)

[Getachew,](#)

[Response file, "RAI 155 Supplement 2 Response US EPR DC \(Part 3 of 4\).pdf" is attached.](#)

Sincerely,

*Ronda Pederson*

[ronda.pederson@areva.com](mailto: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

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**From:** Pederson Ronda M (AREVA NP INC)

**Sent:** Thursday, April 30, 2009 9:11 PM

**To:** Getachew Tesfaye ([gxt2@nrc.gov](mailto:gxt2@nrc.gov))

**Cc:** BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); VAN NOY Mark (EXT)

**Subject:** Response to U.S. EPR Design Certification Application RAI No. 155, Supplement 2 (part 2 of 4)

[Getachew,](#)

[Response file, "RAI 155 Supplement 2 Response US EPR DC \(Part 2 of 4\).pdf" is attached.](#)

Sincerely,

*Ronda Pederson*

[ronda.pederson@areva.com](mailto: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, April 30, 2009 9:09 PM

**To:** Getachew Tesfaye ([gxt2@nrc.gov](mailto:gxt2@nrc.gov))

**Cc:** BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); VAN NOY Mark (EXT)

**Subject:** Response to U.S. EPR Design Certification Application RAI No. 155, Supplement 2 (part 1 of 4)

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 5 of the 78 questions of RAI No. 155 on February 13, 2009. AREVA NP submitted Supplement 1 to the response on March 31, 2009 to address 20 of the remaining questions. The response document, "RAI 155 Supplement 2 Response U.S. EPR DC" provides technically correct and complete responses to 9 of the remaining 53 questions, as committed.

Due to transmittal size limitations, the response file has been separated to e-mail the response in four parts. Attached is "RAI 155 Supplement 2 Response U.S. EPR DC (Part 1 of 4).pdf."

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 155 Questions 03.08.01-07, 03.08.02-03, 03.08.03-05, 03.08.03-14 and 03.08.03-15.

The following table indicates the respective pages in the response document, "RAI 155 Supplement 2 Response U.S. EPR DC," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 155 — 03.08.01-07	2	5
RAI 155 — 03.08.01-17	6	6
RAI 155 — 03.08.02-03	7	7
RAI 155 — 03.08.03-05	8	15
RAI 155 — 03.08.03-14	16	16
RAI 155 — 03.08.03-15	17	37
RAI 155 — 03.08.04-02	38	38
RAI 155 — 03.08.05-05	39	42
RAI 155 — 03.08.05-11	43	43
RAI 155 — 03.08.05-12	44	44

AREVA NP's response to RAI 155 Question 03.08.05-12 has been deferred to July 31, 2009 to be provided concurrently with the response to a similar question regarding the Nuclear Island common structure. With this

exception, the schedule for technically correct and complete responses to the remaining 44 questions is unchanged and is provided below:

<b>Question RAI 155 #</b>	<b>Response Date</b>
RAI 155 — 03.08.01-03	October 30, 2009
RAI 155 — 03.08.01-06	October 30, 2009
RAI 155 — 03.08.01-08	May 29, 2009
RAI 155 — 03.08.01-09	May 29, 2009
RAI 155 — 03.08.01-10	May 29, 2009
RAI 155 — 03.08.01-11	June 30, 2009
RAI 155 — 03.08.01-12	May 29, 2009
RAI 155 — 03.08.01-16	May 29, 2009
RAI 155 — 03.08.01-20	October 30, 2009
RAI 155 — 03.08.01-22	May 29, 2009
RAI 155 — 03.08.01-24	October 30, 2009
RAI 155 — 03.08.01-27	May 29, 2009
RAI 155 — 03.08.02-01	June 30, 2009
RAI 155 — 03.08.02-02	July 31, 2009
RAI 155 — 03.08.02-04	June 30, 2009
RAI 155 — 03.08.02-05	May 29, 2009
RAI 155 — 03.08.02-06	May 29, 2009
RAI 155 — 03.08.02-07	July 31, 2009
RAI 155 — 03.08.02-08	July 31, 2009
RAI 155 — 03.08.02-10	May 29, 2009
RAI 155 — 03.08.03-03	May 29, 2009
RAI 155 — 03.08.03-04	July 31, 2009
RAI 155 — 03.08.03-06	May 29, 2009
RAI 155 — 03.08.03-10	May 29, 2009
RAI 155 — 03.08.03-11	May 29, 2009
RAI 155 — 03.08.03-12	May 29, 2009
RAI 155 — 03.08.03-16	July 31, 2009
RAI 155 — 03.08.03-17	July 31, 2009
RAI 155 — 03.08.04-03	May 29, 2009
RAI 155 — 03.08.04-04	May 29, 2009
RAI 155 — 03.08.04-05	May 29, 2009
RAI 155 — 03.08.04-06	October 30, 2009
RAI 155 — 03.08.05-01	July 31, 2009
RAI 155 — 03.08.05-02	May 29, 2009
RAI 155 — 03.08.05-06	May 29, 2009
RAI 155 — 03.08.05-07	June 30, 2009
RAI 155 — 03.08.05-08	July 31, 2009
RAI 155 — 03.08.05-10	July 31, 2009
RAI 155 — 03.08.05-12	July 31, 2009
RAI 155 — 03.08.05-13	June 30, 2009

RAI 155 — 03.08.05-14	June 30, 2009
RAI 155 — 03.08.05-15	June 30, 2009
RAI 155 — 03.08.05-16	June 30, 2009
RAI 155 — 03.08.05-18	June 30, 2009

Sincerely,

*Ronda Pederson*

[ronda.pederson@areva.com](mailto: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:** Tuesday, March 31, 2009 8:16 PM

**To:** Getachew Tesfaye

**Cc:** BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); VAN NOY Mark (EXT); HEDRICK Gary E (AFS)

**Subject:** Response to U.S. EPR Design Certification Application RAI No. 155, Supplement 1

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 5 of the 78 questions of RAI No. 155 on February 13, 2009. The attached file, "RAI 155 Supplement 1 Response U.S. EPR DC" provides technically correct and complete responses to 20 of the remaining 73 questions, as committed.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 155 Supplement 1 Questions 03.08.01-04, 03.08.01-05, 03.08.01-21, 03.08.02-09, 03.08.03-02, 03.08.03-09, 03.08.05-03, and 03.08.05-04.

The following table indicates the respective page(s) in the response document, "RAI 155 Supplement 1 Response U.S. EPR DC," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 155 — 03.08.01-01	2	2
RAI 155 — 03.08.01-02	3	9
RAI 155 — 03.08.01-04	10	12
RAI 155 — 03.08.01-05	13	16
RAI 155 — 03.08.01-13	17	19
RAI 155 — 03.08.01-21	20	20
RAI 155 — 03.08.01-23	21	21
RAI 155 — 03.08.01-25	22	22

RAI 155 — 03.08.02-09	23	23
RAI 155 — 03.08.03-01	24	31
RAI 155 — 03.08.03-02	32	33
RAI 155 — 03.08.03-07	34	34
RAI 155 — 03.08.03-08	35	36
RAI 155 — 03.08.03-09	37	37
RAI 155 — 03.08.03-13	38	38
RAI 155 — 03.08.04-01	39	40
RAI 155 — 03.08.05-03	41	41
RAI 155 — 03.08.05-04	42	46
RAI 155 — 03.08.05-09	47	48
RAI 155 — 03.08.05-17	49	53

The schedule for technically correct and complete responses to the remaining 53 questions is unchanged and provided below:

<b>Question RAI 155 #</b>	<b>Response Date</b>
RAI 155 — 03.08.01-03	October 30, 2009
RAI 155 — 03.08.01-06	October 30, 2009
RAI 155 — 03.08.01-07	April 30, 2009
RAI 155 — 03.08.01-08	May 29, 2009
RAI 155 — 03.08.01-09	May 29, 2009
RAI 155 — 03.08.01-10	May 29, 2009
RAI 155 — 03.08.01-11	June 30, 2009
RAI 155 — 03.08.01-12	May 29, 2009
RAI 155 — 03.08.01-16	May 29, 2009
RAI 155 — 03.08.01-17	April 30, 2009
RAI 155 — 03.08.01-20	October 30, 2009
RAI 155 — 03.08.01-22	May 29, 2009
RAI 155 — 03.08.01-24	October 30, 2009
RAI 155 — 03.08.01-27	May 29, 2009
RAI 155 — 03.08.02-01	June 30, 2009
RAI 155 — 03.08.02-02	July 31, 2009
RAI 155 — 03.08.02-03	April 30, 2009
RAI 155 — 03.08.02-04	June 30, 2009
RAI 155 — 03.08.02-05	May 29, 2009
RAI 155 — 03.08.02-06	May 29, 2009
RAI 155 — 03.08.02-07	July 31, 2009
RAI 155 — 03.08.02-08	July 31, 2009
RAI 155 — 03.08.02-10	May 29, 2009
RAI 155 — 03.08.03-03	May 29, 2009
RAI 155 — 03.08.03-04	July 31, 2009
RAI 155 — 03.08.03-05	April 30, 2009
RAI 155 — 03.08.03-06	May 29, 2009
RAI 155 — 03.08.03-10	May 29, 2009

RAI 155 — 03.08.03-11	May 29, 2009
RAI 155 — 03.08.03-12	May 29, 2009
RAI 155 — 03.08.03-14	April 30, 2009
RAI 155 — 03.08.03-15	April 30, 2009
RAI 155 — 03.08.03-16	July 31, 2009
RAI 155 — 03.08.03-17	July 31, 2009
RAI 155 — 03.08.04-02	April 30, 2009
RAI 155 — 03.08.04-03	May 29, 2009
RAI 155 — 03.08.04-04	May 29, 2009
RAI 155 — 03.08.04-05	May 29, 2009
RAI 155 — 03.08.04-06	October 30, 2009
RAI 155 — 03.08.05-01	July 31, 2009
RAI 155 — 03.08.05-02	May 29, 2009
RAI 155 — 03.08.05-05	April 30, 2009
RAI 155 — 03.08.05-06	May 29, 2009
RAI 155 — 03.08.05-07	June 30, 2009
RAI 155 — 03.08.05-08	July 31, 2009
RAI 155 — 03.08.05-10	July 31, 2009
RAI 155 — 03.08.05-11	April 30, 2009
RAI 155 — 03.08.05-12	April 30, 2009
RAI 155 — 03.08.05-13	June 30, 2009
RAI 155 — 03.08.05-14	June 30, 2009
RAI 155 — 03.08.05-15	June 30, 2009
RAI 155 — 03.08.05-16	June 30, 2009
RAI 155 — 03.08.05-18	June 30, 2009

Sincerely,

*Ronda Pederson*

[ronda.pederson@areva.com](mailto: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:** Friday, February 13, 2009 7:18 PM

**To:** 'Getachew Tesfaye'

**Cc:** BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); VAN NOY Mark (EXT); HARRIS Carolyn A (AREVA NP INC)

**Subject:** Response to U.S. EPR Design Certification Application RAI No. 155, FSAR Ch. 3

Getachew,

Attached please find AREVA NP Inc.’s (AREVA NP) response to the subject request for additional information (RAI). The attached file, “RAI 155 Response US EPR DC.pdf” provides technically correct and complete responses to 5 of the 78 questions.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the responses to RAI 155 Questions 03.08.01-15, 03.08.01-18, 03.08.01-19, and 03.08.01-26.

The following table indicates the respective pages in the response document, “RAI 155 Response US EPR DC.pdf,” that contain AREVA NP’s response to the subject questions.

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A complete answer is not provided for 73 of the 78 questions. The schedule for a technically correct and complete response to these questions is provided below.

<b>Question #</b>	<b>Response Date</b>
RAI 155 — 03.08.01-01	March 31, 2009
RAI 155 — 03.08.01-02	March 31, 2009
RAI 155 — 03.08.01-03	October 30, 2009
RAI 155 — 03.08.01-04	March 31, 2009
RAI 155 — 03.08.01-05	March 31, 2009
RAI 155 — 03.08.01-06	October 30, 2009
RAI 155 — 03.08.01-07	April 30, 2009
RAI 155 — 03.08.01-08	May 29, 2009
RAI 155 — 03.08.01-09	May 29, 2009
RAI 155 — 03.08.01-10	May 29, 2009
RAI 155 — 03.08.01-11	June 30, 2009
RAI 155 — 03.08.01-12	May 29, 2009
RAI 155 — 03.08.01-13	March 31, 2009
RAI 155 — 03.08.01-16	May 29, 2009
RAI 155 — 03.08.01-17	April 30, 2009
RAI 155 — 03.08.01-20	October 30, 2009
RAI 155 — 03.08.01-21	March 31, 2009
RAI 155 — 03.08.01-22	May 29, 2009
RAI 155 — 03.08.01-23	March 31, 2009
RAI 155 — 03.08.01-24	October 30, 2009
RAI 155 — 03.08.01-25	March 31, 2009
RAI 155 — 03.08.01-27	May 29, 2009
RAI 155 — 03.08.02-01	June 30, 2009
RAI 155 — 03.08.02-02	July 31, 2009
RAI 155 — 03.08.02-03	April 30, 2009
RAI 155 — 03.08.02-04	June 30, 2009
RAI 155 — 03.08.02-05	May 29, 2009
RAI 155 — 03.08.02-06	May 29, 2009
RAI 155 — 03.08.02-07	July 31, 2009
RAI 155 — 03.08.02-08	July 31, 2009
RAI 155 — 03.08.02-09	March 31, 2009
RAI 155 — 03.08.02-10	May 29, 2009
RAI 155 — 03.08.03-01	March 31, 2009
RAI 155 — 03.08.03-02	March 31, 2009
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RAI 155 — 03.08.03-04	July 31, 2009
RAI 155 — 03.08.03-05	April 30, 2009
RAI 155 — 03.08.03-06	May 29, 2009
RAI 155 — 03.08.03-07	March 31, 2009
RAI 155 — 03.08.03-08	March 31, 2009
RAI 155 — 03.08.03-09	March 31, 2009
RAI 155 — 03.08.03-10	May 29, 2009
RAI 155 — 03.08.03-11	May 29, 2009
RAI 155 — 03.08.03-12	May 29, 2009
RAI 155 — 03.08.03-13	March 31, 2009
RAI 155 — 03.08.03-14	April 30, 2009
RAI 155 — 03.08.03-15	April 30, 2009
RAI 155 — 03.08.03-16	July 31, 2009
RAI 155 — 03.08.03-17	July 31, 2009
RAI 155 — 03.08.04-01	March 31, 2009
RAI 155 — 03.08.04-02	April 30, 2009
RAI 155 — 03.08.04-03	May 29, 2009
RAI 155 — 03.08.04-04	May 29, 2009
RAI 155 — 03.08.04-05	May 29, 2009
RAI 155 — 03.08.04-06	October 30, 2009
RAI 155 — 03.08.05-01	July 31, 2009
RAI 155 — 03.08.05-02	May 29, 2009
RAI 155 — 03.08.05-03	March 31, 2009
RAI 155 — 03.08.05-04	March 31, 2009
RAI 155 — 03.08.05-05	April 30, 2009
RAI 155 — 03.08.05-06	May 29, 2009
RAI 155 — 03.08.05-07	June 30, 2009
RAI 155 — 03.08.05-08	July 31, 2009
RAI 155 — 03.08.05-09	March 31, 2009
RAI 155 — 03.08.05-10	July 31, 2009
RAI 155 — 03.08.05-11	April 30, 2009
RAI 155 — 03.08.05-12	April 30, 2009
RAI 155 — 03.08.05-13	June 30, 2009
RAI 155 — 03.08.05-14	June 30, 2009
RAI 155 — 03.08.05-15	June 30, 2009
RAI 155 — 03.08.05-16	June 30, 2009
RAI 155 — 03.08.05-17	March 31, 2009
RAI 155 — 03.08.05-18	June 30, 2009

Sincerely,

*Ronda Pederson*

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Licensing Manager, U.S. EPR Design Certification

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**From:** Getachew Tesfaye [<mailto:Getachew.Tesfaye@nrc.gov>]  
**Sent:** Wednesday, January 14, 2009 9:33 AM  
**To:** ZZ-DL-A-USEPR-DL  
**Cc:** Jim Xu; Samir Chakrabarti; Sujit Samaddar; Michael Miernicki; Joseph Colaccino; ArevaEPRDCPEm Resource  
**Subject:** U.S. EPR Design Certification Application RAI No. 155 (1671, 1831,1672, 1834, 1833, 1836), FSAR Ch. 3

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on December 12, 2008, and discussed with your staff on January 13, 2009. No changes were made to the Draft RAI Questions 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:** 3880

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Supplement 17  
**Sent Date:** 4/18/2012 8:55:02 AM  
**Received Date:** 4/18/2012 8:55:11 AM  
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**Request for Additional Information No. 155, Supplement 17**

**01/14/2009**

**U.S. EPR Standard Design Certification**

**AREVA NP Inc.**

**Docket No. 52-020**

**SRP Section: 03.08.01 - Concrete Containment**

**SRP Section: 03.08.02 - Steel Containment**

**SRP Section: 03.08.03 - Concrete and Steel Internal Structures of Steel or  
Concrete Containments**

**SRP Section: 03.08.04 - Other Seismic Category I Structures**

**SRP Section: 03.08.05 - Foundations**

**Application Section: FSAR Section 3.8**

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

**Question 03.08.01-20:**

FSAR Section 3E.1 describes the three critical sections relating to the RCB which are the wall to foundation connection, equipment hatch area, and typical cylinder wall and buttress. AREVA is requested to include the dome, ring girder (thickened section of concrete at the top perimeter of the cylindrical containment wall where it transitions into the spherical dome), and the temporary construction opening as critical sections. Unless there is sufficient technical basis for excluding these locations, they should be included as critical sections for analysis and design.

**Response to Question 03.08.01-20:**

This response supersedes the prior response to RAI 155, Question 03.08.01-20 in its entirety.

A three-tier critical section selection methodology has been developed and implemented for selection of U.S. EPR Seismic Category I structure critical sections, as discussed with the NRC staff in a series of audits and meetings during 2009.

This critical section selection methodology was used to produce a set of critical sections, which are listed in Table 03.08.01-20-1. Critical sections selected by application of this methodology include the dome and dome ring girder areas but not the temporary construction opening. Critical sections featuring major Reactor Containment Building (RCB) penetrations (i.e., equipment hatch opening, typical airlock, main steam, and feedwater penetrations) are included and provide bounding representation of the behavior of RCB penetrations that are not identified as critical sections, including the temporary construction opening.

A revised U.S. EPR FSAR Tier 2, Appendix 3E with results of critical section design and with descriptions of applicable loadings, analysis, modeling techniques, and design methods will be provided with the Response to RAI 155 Question 03.08.04-6.

***Critical Sections for Safety-Related Structures***

This section describes critical section selection criteria for U.S. EPR Seismic Category I structures and presents design criteria and analysis results for determining adequate safety of the U.S. EPR design.

This section discusses the Nuclear Island (NI) Common Basemat Structures, Emergency Power Generating Buildings (EPGB), and Essential Service Water Buildings (ESWB).

For these safety-related structures, this description provides:

- Critical section selection criteria.
- Critical section listing.
- Critical section description.
- Critical section design criteria.
- Critical section analysis and results.

U.S. EPR critical sections are listed in Table 03.08.01-20-1. Table 03.08.01-20-1 has been updated to reflect the results of the embedded 3-D FEM soil-structure interaction (SSI) analysis

performed in 2011; In addition to increasing the number of quantitatively selected critical sections described below, the scope of critical sections NI 10, NI 12, NI 13, NI 15, NI 16, and NI 17 was increased.

According to the qualitative methodology, the tendon gallery has been included as part of Critical Section NI 7. According to the supplementary methodology, the vent stack has been added to the table as Critical Section NI 27.

Three additional critical sections were selected according to the quantitative methodology:

- Fuel Building (FB) hardened shell—typical roof slab areas for material lock room and support walls (NI 21 in Table 03.08.01-20-1).
- FB internal structures—typical floor slab above spent fuel pool area and support walls (NI 22 in Table 03.08.01-20-1).
- Reactor Shield Building (RSB)—lower portion typical wall areas (NI 23 in Table 03.08.01-20-1).

Three critical sections were removed from the list of critical sections selected according to the supplementary methodology:

- Safeguard Buildings (SB) 2/3 internal structures—typical floor slab at elevation -16 feet, 4 13/16 inches; this was included as part of SB 2/3 internal structures—typical floor slab at elevation -16 feet, 5 inches and 0 feet, 0 inches (NI 13 in Table 03.08.01-20-1).
- FB internal structures—typical floor slab at elevation -20 feet, 4 1/16 inches; this was removed because another floor slab was selected in the Fuel Building according to quantitative methodology (NI 22 in Table 03.08.01-20-1).
- SB 2/3 internal structures—typical 0 feet, 11 13/16 inches thick shear wall next to RSB; this one-foot thick shear wall was removed because the scope of critical sections selected quantitatively was increased.

### ***Critical Section Selection Criteria***

Critical sections are those portions of individual Seismic Category I structures (i.e., shear walls, floor slabs and roofs, structure-to-structure connections) that are particularly important for prevention or mitigation of consequences of postulated design basis accidents, are expected to experience the largest structural demands during design basis conditions, or are needed for safety evaluation of an essentially complete design.

Some selected critical sections may also be typical of other portions of the structure, where the portions they typify are not identified as critical sections due to their strong similarities with the selected critical sections. Once design of critical sections is complete, the design for that structure is essentially complete for safety evaluation purposes. Critical sections are analytically representative of an essentially complete U.S. EPR design, and their structural design adequacy provides reasonable assurance of overall U.S. EPR structural design adequacy.

U.S. EPR critical section selection is characterized by a three-tier process that includes qualitative, quantitative, and supplementary methodologies to reasonably assure completeness and consistency across each structure. A description of each methodology is discussed in this response and included in U.S. EPR FSAR Tier 2, Section 3E.

## Qualitative Methodology

The qualitative methodology is applied to portions of the U.S. EPR NI Common Basemat Structures that are credited in the risk mitigation of the nuclear power plant under design basis loading conditions to provide protection of public safety through the physical plant boundaries. Due to a safety-critical role, some of the U.S. EPR NI Common Basemat Structures are required to achieve major performance requirements for functions whose failures could degrade system or equipment performance of the U.S. EPR design or pose a safety hazard to plant personnel or to the general public. In this regard, they are considered critical structures or critical sections. Unique engineered features in each of the structures can be further broken into portions (e.g., cylindrical walls, liner plates, dome, and dome ring areas of the RCB) that are defined as critical sections.

## Quantitative Methodology

ANSYS, V 11.0 SP1, is used to create a finite element analysis model of the U.S. EPR NI Common Basemat Structures. This model incorporates numerous finite element types to represent the NI geometry.

The quantitative methodology identifies critical sections by analysis of force and moment results extracted from portions of the global static model not already defined as critical sections by the qualitative methodology. Element forces and moments are extracted from the finite element model (FEM) and sorted for each force or moment type using a series of ANSYS macros to identify elements that have maximum and minimum force demand (minimum being the largest negative forces and moments). The quantitative selection methodology identifies critical sections as follows:

- Specific NI Common Basemat Structures to be reviewed are identified.
- Applicable load combinations are identified.
- Element forces and moments per unit length (i.e.,  $T_X$ ,  $T_Y$ ,  $T_{XY}$ ,  $M_X$ ,  $M_Y$ ,  $M_{XY}$ ,  $N_X$ , and  $N_Y$ ), along with element centroids in the global Cartesian coordinate system, are obtained from the specified load combinations for all elements in the applicable buildings.
- The elements for walls and slabs are sorted in ascending order by force and moment type.
- For each load combination, elements with the maximum and minimum force demands are identified for walls and slabs. This process is repeated for the selected load combinations and results are combined to produce a subset of potential critical elements.
- The subset of potential critical elements is further refined by eliminating duplicate elements for each element type. The final subset contains only unique controlling critical elements.
- Critical element locations are plotted at their respective elevations for each building. XY scatter plots of controlling critical elements are produced for each elevation containing critical elements and are generated at 10 percent intervals from 100 percent of unique critical elements down to 10 percent. As the percentage of the critical elements with highest forces and moments plotted is decreased, limiting critical elements become apparent. Final identification of critical sections is performed based on the maximum value of load type and frequency.



## **Supplementary Methodology**

In addition to the critical sections identified by the qualitative and quantitative methodologies, there are other portions or sections of the plant that may be safety-related but are not explicitly modeled and considered in the U.S. EPR static finite element model. Seismic Category I structures that perform safety-related functions are reviewed to determine which structural sections are not otherwise selected by either the quantitative or qualitative method. Once these sections are determined, engineering judgment is applied to assess whether they should be identified as critical sections. Critical sections selected using this method are supplementary critical sections.

Supplementary critical sections also include sections that constitute significant portions of the Seismic Category I structures in terms of their physical dimensions (i.e., wall and slab areas). Although these sections are not subject to the limiting structural demands of quantitatively-defined critical sections and can be considered less critical, they are necessary to represent an essentially complete design of each structure and provide reasonable assurance of U.S. EPR design adequacy. This is a significant consideration because quantitatively-determined critical sections represent only those portions of a structure that experience high loads or stress and may not identify intervening structural elements that are not subject to high stress or loading but are needed for evaluating structural functionality.

Because potential supplementary critical sections exist throughout the U.S. EPR design, spatial distribution and significant structural discontinuities are also important factors in supplementary critical sections selection.

### ***NI Structures***

#### **Description of NI Structures**

Critical sections presented in this section are structures supported on the NI Common Basemat. This includes the RCB containing the Reactor Building Internal Structures (RBIS); Fuel Building; Safeguard Buildings 1, 2, 3, and 4; and the Reactor Shield Building.

The RCB is located inside the reinforced concrete RSB and is separated by an annular space to protect against interaction of the two structures during postulated design basis loading conditions.

The RBIS consists of concrete walls and floors, steel framing members, and other concrete and steel structural elements that are located inside of the RCB.

The RSB completely encloses the RCB and is connected to the external walls of SB 2 and SB 3 and the FB.

There are four SBs located around and immediately adjacent to the RSB. SB 2 and SB 3 are located inside a single shield building that protects them against beyond design basis accidents.

The FB is located on the side of the RSB opposite SB 2 and SB 3. The FB is protected against external events such as aircraft hazard by thickened exterior walls and roof.

U.S. EPR FSAR Tier 2, Section 3.8.5.1.1 describes the NI Common Basemat. The NI basemat is a cruciform-shaped, heavily-reinforced concrete slab that supports the NI Common Basemat Structures.

### **Description of NI Critical Sections**

Critical sections within the NI Common Basemat Structures are chosen using the three-tier methodology.

Critical sections identified by the qualitative methodology are:

- RCB—typical liner plate.
- RCB—typical cylinder wall and buttress.
- RCB—typical dome and dome ring areas.
- RCB—typical connection of containment wall to NI basemat.
- RCB—equipment hatch area.
- RBIS—typical primary shield wall/reactor vessel support area.
- NI basemat, including tendon gallery, and RBIS baseslab.
- FB internal structures—typical spent fuel pool walls and floor slab.
- RCB—typical airlock and main steam and feedwater (MS/FW) penetrations.
- FB Internal Structures—fuel transfer tube.

Critical sections identified by the quantitative methodology are:

- RBIS—typical operating floor slab area.
- RBIS—typical elevation +4 feet, 11 1/16 inches heavy slab and support walls.
- RBIS—typical steam generator (SG) cubicle area walls and slabs.
- SB 2/3 hardened shell—typical walls from top of NI basemat to grade.
- SB 2/3 internal structures—typical exterior walls from top of NI basemat to elevation +15 feet, 5 inches.
- SB 2/3 internal structures—typical floor slab at elevation -16 feet, 5 inches and 0 feet, 0 inches.
- SBs 1 and 4—typical main steam and feedwater valve room walls and slabs.
- SBs 1 and 4—typical exterior walls from top of NI basemat to elevation +15 feet, 5 inches.
- FB hardened shell—typical walls from top of NI basemat to elevation +12 feet, 0 inches.
- FB internal structures—typical major walls from top of NI basemat to bottom of spent fuel pool slab.
- FB internal structures—typical spent fuel pool walls and floor slab.
- RSB—typical wall areas and connection between RSB wall and SB/FB roof slabs.

- RSB—typical dome-to-wall transition areas.
- FB hardened shell—typical roof slab areas for material lock room and support walls.
- FB internal structures—typical floor slab above spent fuel pool area and support walls.
- RSB—lower portion typical wall areas.

Note that spent fuel pool walls and slab were identified as critical sections by both the qualitative and quantitative methodologies.

Critical sections identified by the supplementary methodology are:

- NI—typical columns and beams.
- NI—Vent Stack.

This information will be added to U.S. EPR FSAR Tier 2, Section 3E and as U.S. EPR FSAR Tier 2, Table 3E.1-41.

### **Design Criteria for NI Critical Sections**

U.S. EPR FSAR Tier 2, Sections 3.8.1.2, 3.8.2.2, 3.8.3.2, 3.8.4.2, and 3.8.5.2 describe codes, standards, and specifications for use in the design of the RCB (concrete), RCB (steel), RBIS, Seismic Category I structures other than the RCB, RBIS, and NI basemat, respectively.

### **Analysis for NI Critical Sections**

To determine forces and moments throughout these structures, a global ANSYS FEM (U.S. EPR FSAR Tier 2, Sections 3.8.1.4.1, 3.8.3.4.1, 3.8.4.4.2, and 3.8.5.4.2) was developed and solved using independent loads and load combinations as prescribed by applicable codes and standards. U.S. EPR FSAR Tier 2, Sections 3.8.1.3, 3.8.2.3, 3.8.3.3, 3.8.4.3, and 3.8.5.3 describe independent loads and load combinations for use in the design of the NI Common Basemat Structures.

Independent loads considered in the ANSYS FEM are shown in U.S. EPR FSAR Tier 2, Table 3E.1-1. These loads are applied to the global ANSYS FEM to analyze and evaluate the overall structural response of the NI Common Basemat Structures. These analyses are described in U.S. EPR FSAR Tier 2, Sections 3.8.1.4, 3.8.2.4, 3.8.3.4, 3.8.4.4, and 3.8.5.4. Additional independent loads that are not considered in the global ANSYS FEM are shown in U.S. EPR FSAR Tier 2, Table 3E.1-2 and described in U.S. EPR FSAR Tier 2, Sections 3.8.1.3, 3.8.2.3, 3.8.3.3, 3.8.4.3, and 3.8.5.3. These loads will be independently considered and added during the design process.

Global ANSYS analysis results provide element forces and moments in accordance with U.S. EPR FSAR Tier 2, Figure 3E.1-1—ANSYS Analysis Results for Nuclear Island Elements. Forces and moments shown in U.S. EPR FSAR Tier 2, Figure 3E.1-1 are:

$T_x$  = axial or membrane load in x-direction (kips/foot).

$T_y$  = axial or membrane load in y-direction (kips/foot).

$T_{xy}$  = in-plane shear load (kips/foot).

$N_x$  = out-of-plane shear load along y-axis of element (kips/foot).

$N_y$  = out-of-plane shear load along x-axis of element (kips/foot).

$M_x$  = bending moment about y-axis through element (kip-feet/foot).

$M_y$  = bending moment about x-axis through element (kip-feet/foot).

$M_{xy}$  = twisting moment (kip-feet/foot).

## **EPGB**

### **Description of EPGB**

The U.S. EPR design provides two EPGB adjacent to the NI Common Basemat Structures and the ESWB.

U.S. EPR FSAR Tier 2, Section 3.8.4.1.4 provides EPGB general descriptions, including descriptions of functional equipment at each floor level.

EPGB lateral load resisting elements are primarily exterior and interior reinforced concrete shear walls and a reinforced concrete mat foundation situated at grade. The basemat, elevated concrete slabs, and steel framed platforms consist of the structural elements described in U.S. EPR FSAR Tier 2, Sections 3.8.4.1.4 and 3.8.5.1.2.

### **Description of EPGB Critical Sections**

EPGB critical sections are selected using the supplementary selection methodology. This methodology requires that the structural components of the major lateral load path and the gravity load path for the EPGB are sufficiently represented by selected critical sections to verify that they act together to represent an essentially complete design. EPGB critical sections are those portions of the structures selected by engineering judgment that are typical of the remaining portions of the EPGB and serve as lateral and gravity loading resisting elements. This approach is acceptable because the EPGB has a predominantly symmetrical, minimally complex geometry with evenly distributed loading as compared to the NI Common Basemat Structures.

EPGB critical sections are:

- EPGB—basemat foundation at elevation 0 feet, 0 inches.
- EPGB—shear wall on column line 11.
- EPGB—reinforced concrete slab and composite beams at elevation 51 feet, 6 inches.
- EPGB—shear wall on column line C.
- EPGB—shear wall on column line E.

This information will be added to U.S. EPR FSAR Tier 2, Section 3E and as U.S. EPR FSAR Tier 2, Table 3E.2-9.

## **Design Criteria for EPGB Critical Sections**

U.S. EPR FSAR Tier 2, Sections 3.8.4.2 and 3.8.5.2 describe applicable codes, standards, and specifications for use in the design of EPGB reinforced concrete and structural steel components (including composite beams).

## **Analysis for EPGB Critical Sections**

For the EPGB and other buildings outside the NI Common Basemat, GT STRUDL is used to develop individual FEM.

SSI analysis is used to determine enveloping structural response accelerations for development of equivalent static safe shutdown earthquake (SSE) loads for the GT STRUDL FEM.

U.S. EPR FSAR Tier 2, Sections 3.8.4.4.3 and 3.8.5.4.3 describe the use of GT STRUDL in EPGB critical section design. Design forces and moments are extracted from GT STRUDL analyses for use in the design of EPGB basemat and superstructure components.

U.S. EPR FSAR Tier 2, Figure 3E.2-1—Finite Element Planar Reference Frame Systems provides the planar reference system for the GT STRUDL finite element analysis output. U.S. EPR FSAR Tier 2, Figure 3E.2-1, “Plate Bending” shows the positive direction of the finite element bending moments  $M_{xx}$ ,  $M_{yy}$  and  $M_{xy}$  and out-of-plane shear forces  $V_{xx}$  and  $V_{yy}$ . U.S. EPR FSAR Tier 2, Figure 3E.2-1, “Plane Stress/Strain” shows that the positive direction of the finite element in-plane forces  $N_{xx}$ ,  $N_{yy}$  and  $N_{xy}$  are the same as the positive orientation of the plane stresses  $S_{xx}$ ,  $S_{yy}$  and  $S_{xy}$ .

U.S. EPR FSAR Tier 2, Sections 3.8.4.3.1 and 3.8.5.3 describe applicable independent loads for use in the EPGB critical section design. U.S. EPR FSAR Tier 2, Sections 3.8.4.3.2 and 3.8.5.3 describe applicable load combinations for use in the EPGB critical section design, and U.S. EPR FSAR Tier 2, Table 3.7.1-6 lists applicable soil cases.

## **ESWB**

### **Description of ESWB**

The U.S. EPR design includes four ESWB adjacent to the NI Common Basemat Structures and the EPGB.

U.S. EPR FSAR Tier 2, Section 3.8.4.1.5 provides ESWB general descriptions, including descriptions of functional equipment at each floor level.

ESWB lateral load resisting elements are interior and exterior reinforced concrete shear walls and a concrete basemat foundation situated at 22 ft – 0 in below grade. The structural elements pertaining to the ESWB are described in U.S. EPR FSAR Tier 2, Sections 3.8.4.1.5 and 3.8.5.1.3.

### **Description of ESWB Critical Sections**

ESWB critical sections are selected using the supplementary selection methodology. This methodology requires that the structural components of the major lateral load path and the

gravity load path for the ESWB are sufficiently represented by the selected critical sections to verify that they act together to represent an essentially complete design. Accordingly, ESWB critical sections are those portions of the structures selected by engineering judgment that are typical of the remaining portions of the ESWB and deemed to serve as major lateral and gravity loading resisting elements. This approach is acceptable because the ESWB has a predominantly symmetrical, minimally complex geometry with evenly distributed loading as compared to the NI Common Basemat Structures.

ESWB critical sections are:

- ESWB—basemat foundation at elevation -16 feet, 0 inches.
- ESWB—shear wall at column line 4.
- ESWB—fan deck slab at elevation 63 feet, 0 inches.
- ESWB—shear wall on column line D.

This information will be added to U.S. EPR FSAR Tier 2, Section 3E and as U.S. EPR FSAR Tier 2, Table 3E.3-10.

### **Design Criteria for ESWB Critical Sections**

U.S. EPR FSAR Tier 2, Sections 3.8.4.2 and 3.8.5.2 describe applicable codes, standards, and specifications for use in the ESWB critical section design.

### **Analysis for ESWB Critical Sections**

For the ESWB and other buildings outside the NI Common Basemat, GT STRUDL is used to develop individual FEM.

SSI analysis is used to determine enveloping structural response accelerations for development of equivalent static SSE loads for the GT STRUDL FEM.

U.S. EPR FSAR Tier 2, Sections 3.8.4.4.4 and 3.8.5.4.4 describe the use of GT STRUDL in ESWB critical section design. Design forces and moments are extracted from GT STRUDL analyses for use in the design of basemat foundation and superstructure components.

U.S. EPR FSAR Tier 2, Figure 3E.3-1 provides the planar reference system for the GT STRUDL finite element analysis output. U.S. EPR FSAR Tier 2, Figure 3E.3-1, "Plate Bending" shows the positive direction of the finite element bending moments  $M_{xx}$ ,  $M_{yy}$  and  $M_{xy}$  and out-of-plane shear forces  $V_{xx}$  and  $V_{yy}$ . U.S. EPR FSAR Tier 2, Figure 3E.3-1, "Plane Stress/Strain" shows that the positive direction of the finite element in-plane forces  $N_{xx}$ ,  $N_{yy}$  and  $N_{xy}$  are the same as the positive orientation of the plane stresses  $S_{xx}$ ,  $S_{yy}$  and  $S_{xy}$ .

U.S. EPR FSAR Tier 2, Sections 3.8.4.3.1 and 3.8.5.3 describe applicable independent loads for use in the ESWB critical section design. U.S. EPR FSAR Tier 2, Sections 3.8.4.3.2 and 3.8.5.3 describe applicable load combinations for use in the ESWB design, and U.S. EPR FSAR Tier 2, Table 3.7.1-6 lists applicable soil cases.

**FSAR Impact:**

U.S. EPR FSAR, Tier 2, Section 3E will be revised as described in the response and indicated in the enclosed markup.

U.S. EPR FSAR, Tier 2, Table 3E.1-41, Table 3E.2-9, and Table 3E.3-10 will be added as described in the response and indicated in the enclosed markup.

**Table 03.08.01-20-1—U.S. EPR Critical Sections**

<b>Section</b>	<b>Description of Critical Section</b>
NI 1	Reactor Containment Building—Typical Liner Plate
NI 2	Reactor Containment Building—Typical Cylinder Wall and Buttress
NI 3	Reactor Containment Building—Typical Dome and Dome Ring Areas
NI 4	Reactor Containment Building—Typical Connection of Containment Wall to Nuclear Island Basemat
NI 5	Reactor Containment Building—Equipment Hatch Area
NI 6	Reactor Building Internal Structures—Typical Primary Shield Wall / Reactor Vessel Support Area
NI 7	Nuclear Island Basemat, including tendon gallery, & Reactor Building Internal Structures Baseslab
NI 8	Reactor Building Internal Structures—Typical Operating Floor Slab Area
NI 9	Reactor Building Internal Structures—Typical Elevation 4'-11" Heavy Slab & Support Walls
NI 10	Reactor Building Internal Structures—Typical SG Cubicle Area Walls & Slabs
NI 11	Safeguard Building 2/3 Hardened Shell—Typical Walls from Top of Nuclear Island Basemat to Grade
NI 12	Safeguard Building 2/3 Internal Structures—Typical Exterior Walls from Top of Nuclear Island Basemat to Elevation 15'-5"
NI 13	Safeguard Building 2/3 Internal Structures—Typical Floor Slab at Elevation -16'-5" & 0'-0"
NI 14	Safeguard Buildings 1 & 4—Typical Main Steam and Feedwater Valve Room Walls and Slabs
NI 15	Safeguard Buildings 1 & 4—Typical Exterior Walls from Top of Nuclear Island Basemat to Elevation 15'-5"
NI 16	Fuel Building Hardened Shell—Typical Walls from Top of Nuclear Island Basemat to Elevation 12'-0"
NI 17	Fuel Building Internal Structures—Typical Major Walls from Top of Nuclear Island Basemat to Bottom of Spent Fuel Pool Slab
NI 18	Fuel Building Internal Structures—Typical Spent Fuel Pool Walls and Floor Slab
NI 19	Reactor Shield Building Typical Wall Areas & Connection Between Reactor Shield Building Wall and Safeguard / Fuel Building Roof Slabs
NI 20	Reactor Shield Building—Typical Dome to Wall Transition Areas
NI 21	Fuel Building Hardened Shell—Typical Roof Slab Areas for Material Lock Room & Support Walls
NI 22	Fuel Building Internal Structures—Typical Floor Slab Above Spent Fuel Pool Area & Support Walls
NI 23	Reactor Shield Building—Lower Portion Typical Wall Areas
NI 24	Nuclear Island Typical Columns and Beams
NI 25	Reactor Containment Building—Typical Airlock and MS/FW Penetrations
NI 26	Fuel Building Internal Structures—Fuel Transfer Tube
NI 27	Vent Stack
EPGB 1	Emergency Power Generating Building—Basemat Foundation at Elevation 0'-0"
EPGB 2	Emergency Power Generating Building—Shear Wall on Column Line 11
EPGB 3	Emergency Power Generating Building—Reinforced Concrete Slab and Composite Beams at Elevation 51'-6"
EPGB 4	Emergency Power Generating Building—Shear Wall on Column Line C
EPGB 5	Emergency Power Generating Building—Shear Wall on Column Line E
ESWB 1	Essential Service Water Building—Basemat Foundation at Elevation -16'-0"
ESWB 2	Essential Service Water Building—Shear Wall on Column Line 4
ESWB 3	Essential Service Water Building—Fan Deck Slab at Elevation 63'-0"
ESWB 4	Essential Service Water Building—Shear Wall on Column Line D



# U.S. EPR Final Safety Analysis Report Markups

## Design Details and Critical Sections for Safety-Related Category I Structures

This appendix provides details of structural design and analysis for the critical sections relevant to Seismic Category I structures.

03.08.01-20

### Critical Section Selection Criteria

Critical sections are those portions of individual Seismic Category I structures (i.e., shear walls, floor slabs and roofs, structure-to-structure connections), which are particularly important for prevention or mitigation of consequences of postulated design basis accidents, are expected to experience the largest structural demands during design basis conditions, or are needed for safety evaluation of an essentially complete design.

Some selected critical sections may also be typical of other portions of the structure, where the portions they typify are not identified as critical sections due to their strong similarities with the selected critical sections. Critical sections are analytically representative of an essentially complete U.S. EPR design, and their structural design adequacy provides reasonable assurance of overall U.S. EPR structural design adequacy.

U.S. EPR critical section selection is characterized by a three-tier process that includes qualitative, quantitative, and supplementary methodologies to reasonably assure completeness and consistency across each structure. The critical sections for the Seismic Category I structures, are shown in the following tables:

- Table 3E.1-41—Nuclear Island Critical Sections.
- Table 3E.2-9—Emergency Power Generating Building Critical Sections.
- Table 3E.3-10—Essential Service Water Building Critical Sections.

### Qualitative Methodology

The qualitative methodology is applied to portions of the U.S. EPR nuclear island (NI) Common Basemat Structures that are credited in the risk mitigation of the nuclear power plant under design basis loading conditions to provide protection of public safety through the physical plant boundaries. Due to a safety-critical role, some of the U.S. EPR NI Common Basemat Structures are required to achieve major performance requirements for functions whose failures could degrade system or equipment performance of the U.S. EPR design or pose a safety hazard to plant personnel or to the general public. In this regard, they are considered critical structures or critical sections. Unique engineered features in each of the structures can be further broken into portions (e.g., cylindrical walls, liner plates, dome, and dome ring areas of the Reactor Containment Building (RCB)) that are defined as critical sections.

Critical sections identified by the qualitative methodology are:

- RCB—typical liner plate.
- RCB—typical cylinder wall and buttress.
- RCB—typical dome and dome ring areas.
- RCB—typical connection of containment wall to NI basemat.
- RCB—equipment hatch area.
- RBIS—typical primary shield wall/reactor vessel support area.
- NI basemat, including tendon gallery, and RBIS baseslab.
- Fuel Building (FB) internal structures—typical spent fuel pool walls and floor slab.
- RCB—typical airlock and main steam and feedwater (MS/FW) penetrations.
- FB Internal Structures—fuel transfer tube.

Quantitative Methodology

ANSYS, V 11.0 SP1 is used to create a finite element analysis model of the U.S. EPR NI Common Basemat Structures. This model incorporates numerous finite element types to represent the NI geometry.

The quantitative methodology identifies critical sections by analysis of force and moment results extracted from portions of the global static model not already defined as critical sections by the qualitative methodology. Element forces and moments are extracted from the finite element model (FEM) and sorted for each force or moment type using a series of ANSYS macros to identify elements that have maximum and minimum force demand (minimum being the largest negative forces and moments).  
The quantitative selection methodology identifies critical sections as follows:

- Specific NI Common Basemat Structures to be reviewed are identified.
- Applicable load combinations are identified.
- Element forces and moments per unit length (i.e.,  $T_x$ ,  $T_y$ ,  $T_{xy}$ ,  $M_x$ ,  $M_y$ ,  $M_{xy}$ ,  $N_x$ ,  $N_y$ ), along with element centroids in the global Cartesian coordinate system, are obtained from the specified load combinations for all elements in the applicable buildings.
- The elements for walls and slabs are sorted in ascending order by force and moment type.

- For each load combination, elements with the maximum and minimum force demands are identified for walls and slabs. This process is repeated for the selected load combinations and results are combined to produce a subset of potential critical elements.
- The subset of potential critical elements is further refined by eliminating duplicate elements for each element type. The final subset contains only unique controlling critical elements.
- Critical element locations are plotted at their respective elevations for each building. XY scatter plots of controlling critical elements are produced for each elevation containing critical elements and are generated at 10 percent intervals from 100 percent of unique critical elements down to 10 percent. As the percentage of the critical elements with highest forces and moments plotted is decreased, limiting critical elements become apparent. Final identification of critical sections is performed based on the maximum value of load type and frequency.

Critical sections identified by the quantitative methodology are:

- Reactor Building Internal Structure (RBIS)—typical operating floor slab area.
- RBIS—typical elevation +4 feet, 11 1/16 inches heavy slab and support walls.
- RBIS—typical steam generator (SG) cubicle area walls and slabs.
- Safeguard Building (SB) 2/3 hardened shell—typical walls from top of NI basemat to grade.
- SB 2/3 internal structures—typical exterior walls from top of NI basemat to elevation +15 feet, 5 inches.
- SB 2/3 internal structures—typical floor slab at elevation -16 feet, 5 inches and 0 feet, 0 inches.
- SBs 1 and 4—typical main steam and feedwater valve room walls and slabs.
- SBs 1 and 4—typical exterior walls from top of NI basemat to elevation +15 feet, 5 inches.
- FB hardened shell—typical walls from top of NI basemat to elevation +12 feet, 0 inches.
- FB internal structures—typical major walls from top of NI basemat to bottom of spent fuel pool slab.
- FB internal structures—typical spent fuel pool walls and floor slab.
- Reactor Shield Building (RSB)—typical wall areas and connection between RSB wall and SB/FB roof slabs.

- RSB—typical dome-to-wall transition areas.
- FB hardened shell—typical roof slab areas for material lock room & support walls.
- FB internal structures—typical floor slab above spent fuel pool area & support walls.
- RSB—lower portion typical wall areas.

Note that spent fuel pool walls and slab were identified as critical sections by both the qualitative and quantitative methodologies.

#### Supplementary Methodology

In addition to the critical sections identified by the qualitative and quantitative methodologies, there are other portions or sections of the plant that may be safety-related but are not explicitly modeled and considered in the U.S. EPR static finite element model. Seismic Category I structures that perform safety-related functions are reviewed to determine which structural sections are not otherwise selected by either the quantitative or qualitative method. Once these sections are determined, engineering judgment is applied to assess whether they should be identified as critical sections. Critical sections selected using this method are supplementary critical sections.

Supplementary critical sections also include sections that constitute significant portions of the Seismic Category I structures in terms of their physical dimensions (i.e., wall and slab areas). Although these sections are not subject to the limiting structural demands of quantitatively-defined critical sections and can be considered less critical, they are necessary to represent an essentially complete design of each structure and provide reasonable assurance of U.S. EPR design adequacy. This is a significant consideration because quantitatively-determined critical sections represent only those portions of a structure that experience high loads or stress and may not identify intervening structural elements that are not subject to high stress or loading but are needed for evaluating structural functionality.

Because potential supplementary critical sections exist throughout the U.S. EPR design, spatial distribution and significant structural discontinuities are also important factors in supplementary critical sections selection.

Critical sections identified by the supplementary methodology are:

- NI—typical columns and beams.
- NI—Vent Stack.
- Emergency Power Generating Buildings (EPGB)—basemat foundation at elevation 0 feet, 0 inches.

- EPGB—shear wall on column line 11.
- EPGB—reinforced concrete slab and composite beams at elevation 51 feet, 6 inches.
- EPGB—shear wall on column line C.
- EPGB—shear wall on column line E.
- Essential Service Water Buildings (ESWB)—basemat foundation at elevation -16 feet, 0 inches.
- ESWB—shear wall at column line 4.
- ESWB—fan deck slab at elevation 63 feet, 0 inches.
- ESWB—shear wall on column line D.

Information is presented for the ~~Nuclear Island (NI)~~ Common Basemat Structures (3E.1), ~~Emergency Power Generating Buildings (EPGB)~~ (3E.2), and ~~Essential Service Water Buildings (ESWB)~~ (3E.3).

The following information is provided:

- Description of the critical section.
- Applicable loadings and design method.
- Results of structural analysis.

A COL applicant that references the U.S. EPR design certification will address critical sections relevant to site-specific Seismic Category I structures.

### 3E.1

#### **Nuclear Island Structures**

##### **Description of Critical Sections in Nuclear Island Structures**

The critical sections presented in this section are structures supported on the NI Common Basemat. This includes the Reactor Containment Building (~~RCB~~) containing the Reactor Building (~~RB~~) Internal Structure, the Fuel Building (~~FB~~), Safeguard Building (~~SB~~)-1, 2, 3, and 4 and the Reactor Shield Building (~~RSB~~).

The RCB is located inside of the reinforced concrete RSB, and is separated by an annular space to protect against interaction of the two structures when subjected to postulated design basis loading conditions. Figure 3.8-2, Figure 3.8-3, and Figure 3.8-4 show arrangements of the RCB. Figure 3.8.1.1 provides a description of the RCB.

**Table 3E.1-41—Nuclear Island Critical Sections  
Sheet 1 of 2**

<b>Section</b>	<b>Description of Critical Section</b>
<u>NI 1</u>	<u>Reactor Containment Building—Typical Liner Plate</u>
<u>NI 2</u>	<u>Reactor Containment Building—Typical Cylinder Wall and Buttress</u>
<u>NI 3</u>	<u>Reactor Containment Building—Typical Dome and Dome Ring Areas</u>
<u>NI 4</u>	<u>Reactor Containment Building—Typical Connection of Containment Wall to Nuclear Island Basemat</u>
<u>NI 5</u>	<u>Reactor Containment Building—Equipment Hatch Area</u>
<u>NI 6</u>	<u>Reactor Building Internal Structures—Typical Primary Shield Wall / Reactor Vessel Support Area</u>
<u>NI 7</u>	<u>Nuclear Island Basemat, including tendon gallery, &amp; Reactor Building Internal Structures Baseslab</u>
<u>NI 8</u>	<u>Reactor Building Internal Structures— Typical Operating Floor Slab Area</u>
<u>NI 9</u>	<u>Reactor Building Internal Structures—Typical Elevation 4'-11" Heavy Slab &amp; Support Walls</u>
<u>NI 10</u>	<u>Reactor Building Internal Structures—Typical SG Cubicle Area Walls &amp; Slabs</u>
<u>NI 11</u>	<u>Safeguard Building 2/3 Hardened Shell—Typical Walls from Top of Nuclear Island Basemat to Grade</u>
<u>NI 12</u>	<u>Safeguard Building 2/3 Internal Structures—Typical Exterior Walls from Top of Nuclear Island Basemat to Elevation 15'-5"</u>
<u>NI 13</u>	<u>Safeguard Building 2/3 Internal Structures—Typical Floor Slab at Elevation -16'-5" &amp; 0'-0"</u>
<u>NI 14</u>	<u>Safeguard Buildings 1 and 4—Typical Main Steam and Feedwater Valve Room Walls and Slabs</u>
<u>NI 15</u>	<u>Safeguard Buildings 1 and 4—Typical Exterior Walls from Top of Nuclear Island Basemat to Elevation 15'-5"</u>
<u>NI 16</u>	<u>Fuel Building Hardened Shell—Typical Walls from Top of Nuclear Island Basemat to Elevation 12'-0"</u>
<u>NI 17</u>	<u>Fuel Building Internal Structures—Typical Major Walls from Top of Nuclear Island Basemat to Bottom of Spent Fuel Pool Slab</u>
<u>NI 18</u>	<u>Fuel Building Internal Structures—Typical Spent Fuel Pool Walls and Floor Slab</u>
<u>NI 19</u>	<u>Reactor Shield Building —Typical Wall Areas &amp; Connection Between Reactor Shield Building Wall and Safeguard / Fuel Building Roof Slabs</u>
<u>NI 20</u>	<u>Reactor Shield Building—Typical Dome to Wall Transition Areas</u>
<u>NI 21</u>	<u>Fuel Building Hardened Shell—Typical Roof Slab Areas for Material Lock Room &amp; Support Walls</u>
<u>NI 22</u>	<u>Fuel Building Internal Structures—Typical Floor Slab Above Spent Fuel Pool Area &amp; Support Walls</u>
<u>NI 23</u>	<u>Reactor Shield Building—Lower Portion Typical Wall Areas</u>

**Table 3E.1-41—Nuclear Island Critical Sections  
Sheet 2 of 2**

<u>Section</u>	<u>Description of Critical Section</u>
<u>NI 24</u>	<u>Nuclear Island—Typical Columns and Beams</u>
<u>NI 25</u>	<u>Reactor Containment Building—Typical Airlock and MS/FW Penetrations</u>
<u>NI 26</u>	<u>Fuel Building Internal Structures—Fuel Transfer Tube</u>
<u>NI 27</u>	<u>Vent Stack</u>



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**Table 3E.2-9—Emergency Power Generating Building Critical Sections**

<u>Section</u>	<u>Description of Critical Section</u>
EPGB 1	Emergency Power Generating Building—Basemat Foundation at Elevation 0'-0"
EPGB 2	Emergency Power Generating Building—Shear Wall on Column Line 11
EPGB 3	Emergency Power Generating Building—Reinforced Concrete Slab and Composite Beams at Elevation 51'-6"
EPGB 4	Emergency Power Generating Building—Shear Wall on Column Line C
EPGB 5	Emergency Power Generating Building—Shear Wall on Column Line E

**Table 3E.3-8—Governing Design Data for ESWB Fan Deck Slab at Elevation 63 ft – 0 in (Tension)**

Direction	Tension (k/ft)
X-axis	30
Z-axis	40

**Table 3E.3-9—Governing Design Data for ESWB Fan Deck Slab at Elevation 63 ft – 0 in (In-Plane Shear)**

Critical LC	Long Cut	Cut Length	Results for In-Plane Shear Check					
			FX (k)	FY (k)	FZ (k)	MX (k-ft)	MY (k-ft)	MZ (k-ft)
D + F + L + H + 0.4EX - 0.4EY - EZ (7122)	FANDECK_IN - PLANE SHEAR	63 ft – 0 in	413	127	2628	979	6499	-257

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**Table 3E.3-10—Essential Service Water Building Critical Sections**

<u>Section</u>	<u>Description of Critical Section</u>
<u>ESWB 1</u>	<u>Essential Service Water Building—Basemat Foundation at Elevation -16'-0"</u>
<u>ESWB 2</u>	<u>Essential Service Water Building—Shear Wall on Column Line 4</u>
<u>ESWB 3</u>	<u>Essential Service Water Building—Fan Deck Slab at Elevation 63'-0"</u>
<u>ESWB 4</u>	<u>Essential Service Water Building—Shear Wall on Column Line D</u>