

ArevaEPRDCPEm Resource

From: WILLIFORD Dennis (AREVA) [Dennis.Williford@areva.com]
Sent: Tuesday, April 17, 2012 12:05 PM
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. 505 (5902,5735,5869,5754,5803,5950,5744), FSAR Ch. 7, Supplement 15
Attachments: RAI 505 Supplement 15 Response US EPR DC.pdf

Getachew,

On September 29, 2011, AREVA NP Inc. provided a schedule for technically correct and complete responses to the 34 questions in RAI 505. In Supplement 1 sent on October 27, 2011, and Supplement 2 sent on November 17, 2011, AREVA NP provided a revised schedule for technically correct and complete responses to 33 questions and a preliminary revised schedule for Question 07.01-33. AREVA NP provided Supplement 3 on November 22, 2011 to provide a final response to 4 questions. On December 9, 2011, AREVA NP provided Supplement 4 to revise the schedule for 7 questions. On December 14, 2011, AREVA NP provided Supplement 5 to revise the schedule for 5 questions. On December 15, 2011, AREVA NP provided Supplement 6 to provide a complete and final response to 6 questions. On January 10, 2012, AREVA NP provided Supplement 7 to provide a complete and final response to 2 questions. On January 19, 2012, AREVA NP provided Supplement 8 to provide a complete and final response to one question and a revised preliminary schedule for the response to Question 07.01-33. On February 9, 2012, AREVA NP provided Supplement 9 to revise the schedule for 11 questions. On February 17, 2012, AREVA NP provided Supplement 10 to revise the schedule for 20 questions. On February 21, 2012, AREVA NP provided Supplement 11 to revise the schedule for Question 07.01-33. On March 16, 2012, AREVA NP provided Supplement 12 to provide a complete and final response to 2 of the remaining questions (07.01-41 and 07.05-10), and a revised response to 2 questions (07.08-46 and 07.09-72). On April 3, 2012, AREVA NP provided Supplement 13 to provide a complete and final response to one of the remaining questions (07.08-47). On April 11, 2012, AREVA NP provided Supplement 14 to provide a complete and final response to one of the remaining questions (07.01-38).

The attached file, "RAI 505 Supplement 15 Response - US EPR DC.pdf" provides a technically correct and complete final response to 2 of the remaining 17 questions (07.01-37 and 07.03-38). 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 Questions 07.01-37 and Question 07.03-38.

The following table indicates the respective pages in the response document, "RAI 505 Supplement 15 Response - US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 505 — 07.01-37	2	2
RAI 505 — 07.03-38	3	35

The schedule for a technically correct and complete final response to the remaining 15 questions remains unchanged as provided below.

Question #	Response Date
RAI 505 — 07.01-33	August 30, 2013
RAI 505 — 07.01-34	May 9, 2012
RAI 505 — 07.01-35	May 30, 2012
RAI 505 — 07.01-36	May 1, 2012
RAI 505 — 07.01-39	May 22, 2012
RAI 505 — 07.01-40	May 22, 2012
RAI 505 — 07.01-44	May 9, 2012
RAI 505 — 07.01-45	May 1, 2012
RAI 505 — 07.01-46	May 1, 2012
RAI 505 — 07.01-47	May 22, 2012
RAI 505 — 07.01-48	May 9, 2012
RAI 505 — 07.01-49	May 30, 2012
RAI 505 — 07.01-50	May 30, 2012
RAI 505 — 07.01-51	May 22, 2012
RAI 505 — 07.09-71	May 9, 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

From: WILLIFORD Dennis (RS/NB)
Sent: Wednesday, April 11, 2012 11:00 AM
To: 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. 505 (5902,5735,5869,5754,5803,5950,5744), FSAR Ch. 7, Supplement 14

Getachew,

On September 29, 2011, AREVA NP Inc. provided a schedule for technically correct and complete responses to the 34 questions in RAI 505. In Supplement 1 sent on October 27, 2011, and Supplement 2 sent on November 17, 2011, AREVA NP provided a revised schedule for technically correct and complete responses to 33 questions and a preliminary revised schedule for Question 07.01-33. AREVA NP provided Supplement 3 on November 22, 2011 to provide a final response to 4 questions. On December 9, 2011, AREVA NP provided Supplement 4 to revise the schedule for 7 questions. On December 14, 2011, AREVA NP provided Supplement 5 to revise the schedule for 5 questions. On December 15, 2011, AREVA NP provided Supplement 6 to provide a complete and final response to 6 questions. On January 10, 2012, AREVA NP provided Supplement 7 to provide a complete and final response to 2 questions. On January 19, 2012, AREVA NP provided Supplement 8 to provide a complete and final response to one question and a revised preliminary schedule for the response to Question 07.01-33. On February 9, 2012, AREVA NP provided Supplement 9 to revise the schedule for 11 questions. On February 17, 2012, AREVA NP provided

Supplement 10 to revise the schedule for 20 questions. On February 21, 2012, AREVA NP provided Supplement 11 to revise the schedule for Question 07.01-33. On March 16, 2012, AREVA NP provided Supplement 12 to provide a complete and final response to 2 of the remaining questions (07.01-41 and 07.05-10), and a revised response to 2 questions (07.08-46 and 07.09-72). On April 3, 2012, AREVA NP provided Supplement 13 to provide a complete and final response to one of the remaining questions (07.08-47).

The attached file, "RAI 505 Supplement 14 Response - US EPR DC.pdf" provides a technically correct and complete response to 1 of the remaining 18 questions (07.01-38). 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 Question 07.01-38.

The following table indicates the respective pages in the response document, "RAI 505 Supplement 14 Response - US EPR DC.pdf," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 505 — 07.01-38	2	3

The schedule for a technically correct and complete response to the remaining 17 questions remains unchanged as provided below.

Question #	Response Date
RAI 505 — 07.01-33	August 30, 2013
RAI 505 — 07.01-34	May 9, 2012
RAI 505 — 07.01-35	May 30, 2012
RAI 505 — 07.01-36	May 1, 2012
RAI 505 — 07.01-37	April 17, 2012
RAI 505 — 07.01-39	May 22, 2012
RAI 505 — 07.01-40	May 22, 2012
RAI 505 — 07.01-44	May 9, 2012
RAI 505 — 07.01-45	May 1, 2012
RAI 505 — 07.01-46	May 1, 2012
RAI 505 — 07.01-47	May 22, 2012
RAI 505 — 07.01-48	May 9, 2012
RAI 505 — 07.01-49	May 30, 2012
RAI 505 — 07.01-50	May 30, 2012
RAI 505 — 07.01-51	May 22, 2012
RAI 505 — 07.03-38	April 17, 2012
RAI 505 — 07.09-71	May 9, 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

From: WILLIFORD Dennis (RS/NB)

Sent: Tuesday, April 03, 2012 3:27 PM

To: 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. 505 (5902,5735,5869,5754,5803,5950,5744), FSAR Ch. 7, Supplement 13

Getachew,

On September 29, 2011, AREVA NP Inc. provided a schedule for technically correct and complete responses to the 34 questions in RAI 505. In Supplement 1 sent on October 27, 2011, and Supplement 2 sent on November 17, 2011, AREVA NP provided a revised schedule for technically correct and complete responses to 33 questions and a preliminary revised schedule for Question 07.01-33. AREVA NP provided Supplement 3 on November 22, 2011 to provide a final response to 4 questions. On December 9, 2011, AREVA NP provided Supplement 4 to revise the schedule for 7 questions. On December 14, 2011, AREVA NP provided Supplement 5 to revise the schedule for 5 questions. On December 15, 2011, AREVA NP provided Supplement 6 to provide a complete and final response to 6 questions. On January 10, 2012, AREVA NP provided Supplement 7 to provide a complete and final response to 2 questions. On January 19, 2012, AREVA NP provided Supplement 8 to provide a complete and final response to one question and a revised preliminary schedule for the response to Question 07.01-33. On February 9, 2012, AREVA NP provided Supplement 9 to revise the schedule for 11 questions. On February 17, 2012, AREVA NP provided Supplement 10 to revise the schedule for 20 questions. On February 21, 2012, AREVA NP provided Supplement 11 to revise the schedule for Question 07.01-33. On March 16, 2012, AREVA NP provided Supplement 12 to provide a complete and final response to 2 of the remaining questions (07.01-41 and 07.05-10), and a revised response to 2 questions (07.08-46 and 07.09-72).

The attached file, "RAI 505 Supplement 13 Response - US EPR DC.pdf" provides a technically correct and complete response to 1 of the remaining 19 questions (07.08-47). 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 Question 07.08-47. Also appended to this file are affected pages of Technical Report ANP-10315P. The revision to this technical report will be submitted by separate letter after completion of all responses to RAI 505.

The following table indicates the respective pages in the response document, "RAI 505 Supplement 13 Response - US EPR DC.pdf," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 505 — 07.08-47	2	7

The schedule for a technically correct and complete response to the remaining 18 questions remains unchanged as provided below.

Question #	Response Date
RAI 505 — 07.01-33	August 30, 2013
RAI 505 — 07.01-34	May 9, 2012
RAI 505 — 07.01-35	May 30, 2012

RAI 505 — 07.01-36	May 1, 2012
RAI 505 — 07.01-37	April 17, 2012
RAI 505 — 07.01-38	May 1, 2012
RAI 505 — 07.01-39	May 22, 2012
RAI 505 — 07.01-40	May 22, 2012
RAI 505 — 07.01-44	May 9, 2012
RAI 505 — 07.01-45	May 1, 2012
RAI 505 — 07.01-46	May 1, 2012
RAI 505 — 07.01-47	May 22, 2012
RAI 505 — 07.01-48	May 9, 2012
RAI 505 — 07.01-49	May 30, 2012
RAI 505 — 07.01-50	May 30, 2012
RAI 505 — 07.01-51	May 22, 2012
RAI 505 — 07.03-38	April 17, 2012
RAI 505 — 07.09-71	May 9, 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

From: WILLIFORD Dennis (RS/NB)
Sent: Friday, March 16, 2012 12:59 PM
To: 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. 505 (5902,5735,5869,5754,5803,5950,5744), FSAR Ch. 7, Supplement 12

Getachew,

On September 29, 2011, AREVA NP Inc. provided a schedule for technically correct and complete responses to the 34 questions in RAI 505. In Supplement 1 sent on October 27, 2011, and Supplement 2 sent on November 17, 2011, AREVA NP provided a revised schedule for technically correct and complete responses to 33 questions and a preliminary revised schedule for Question 07.01-33. AREVA NP provided Supplement 3 on November 22, 2011 to provide a final response to 4 questions. On December 9, 2011, AREVA NP provided Supplement 4 to revise the schedule for 7 questions. On December 14, 2011, AREVA NP provided Supplement 5 to revise the schedule for 5 questions. On December 15, 2011, AREVA NP provided Supplement 6 to provide a complete and final response to 6 questions. On January 10, 2012, AREVA NP provided Supplement 7 to provide a complete and final response to 2 questions. On January 19, 2012, AREVA NP provided Supplement 8 to provide a complete and final response to one question and a revised preliminary schedule for the response to Question 07.01-33. On February 9, 2012, AREVA NP provided Supplement 9 to revise the schedule for 11 questions. On February 17, 2012, AREVA NP provided

Supplement 10 to revise the schedule for 20 questions. On February 21, 2012, AREVA NP provided Supplement 11 to revise the schedule for Question 07.01-33.

The attached file, "RAI 505 Supplement 12 Response - US EPR DC.pdf" provides technically correct and complete responses to 2 of the remaining 21 questions (07.01-41 and 07.05-10), and a revised response to 2 questions (07.08-46 and 07.09-72). 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 Question 07.01-41, 07.05-10, 07.08-46, and 07.09-72. Also appended to this file are affected pages of Technical Reports ANP-10304, ANP-10309P and ANP-10315P. Revisions to these Technical Reports will be submitted by separate letter after completion of all responses to RAI 505.

The following table indicates the respective pages in the response document, "RAI 505 Supplement 12 Response - US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 505 — 07.01-41	2	5
RAI 505 — 07.05-10	6	9
RAI 505 — 07.08-46	10	10
RAI 505 — 07.09-72	11	12

The schedule for a technically correct and complete response to the remaining 19 questions remains unchanged as provided below.

Question #	Response Date
RAI 505 — 07.01-33	August 30, 2013
RAI 505 — 07.01-34	May 9, 2012
RAI 505 — 07.01-35	May 30, 2012
RAI 505 — 07.01-36	May 1, 2012
RAI 505 — 07.01-37	April 17, 2012
RAI 505 — 07.01-38	May 1, 2012
RAI 505 — 07.01-39	May 22, 2012
RAI 505 — 07.01-40	May 22, 2012
RAI 505 — 07.01-44	May 9, 2012
RAI 505 — 07.01-45	May 1, 2012
RAI 505 — 07.01-46	May 1, 2012
RAI 505 — 07.01-47	May 22, 2012
RAI 505 — 07.01-48	May 9, 2012
RAI 505 — 07.01-49	May 30, 2012
RAI 505 — 07.01-50	May 30, 2012
RAI 505 — 07.01-51	May 22, 2012
RAI 505 — 07.03-38	April 17, 2012
RAI 505 — 07.08-47	May 30, 2012
RAI 505 — 07.09-71	May 9, 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
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From: WILLIFORD Dennis (RS/NB)
Sent: Tuesday, February 21, 2012 9:31 PM
To: 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. 505 (5902,5735,5869,5754,5803,5950,5744), FSAR Ch. 7, Supplement 11

Getachew,

On September 29, 2011, AREVA NP Inc. provided a schedule for technically correct and complete responses to the 34 questions in RAI 505. In Supplement 1 sent on October 27, 2011, and Supplement 2 sent on November 17, 2011, AREVA NP provided a revised schedule for technically correct and complete responses to 33 questions and a preliminary revised schedule for Question 07.01-33. AREVA NP provided Supplement 3 on November 22, 2011 to provide a final response to 4 questions. On December 9, 2011, AREVA NP provided Supplement 4 to revise the schedule for 7 questions. On December 14, 2011, AREVA NP provided Supplement 5 to revise the schedule for 5 questions. On December 15, 2011, AREVA NP provided Supplement 6 to provide a complete and final response to 6 questions. On January 10, 2012, AREVA NP provided Supplement 7 to provide a complete and final response to 2 questions. On January 19, 2012, AREVA NP provided Supplement 8 to provide a complete and final response to one question and a revised preliminary schedule for the response to Question 07.01-33. On February 9, 2012, AREVA NP provided Supplement 9 to revise the schedule for 11 questions. On February 17, 2012, AREVA NP provided Supplement 10 to revise the schedule for 20 questions.

The schedule for a technically correct and complete response to question 07.01-33 has been changed as provided below. The response schedule for the other questions remains unchanged. This schedule was transmitted to the NRC in AREVA NP letter 12:008 dated February 21, 2012.

Question #	Response Date
RAI 505 — 07.01-33	August 30, 2013
RAI 505 — 07.01-34	May 9, 2012
RAI 505 — 07.01-35	May 30, 2012
RAI 505 — 07.01-36	May 1, 2012
RAI 505 — 07.01-37	April 17, 2012
RAI 505 — 07.01-38	May 1, 2012
RAI 505 — 07.01-39	May 22, 2012
RAI 505 — 07.01-40	May 22, 2012
RAI 505 — 07.01-41	April 17, 2012
RAI 505 — 07.01-44	May 9, 2012
RAI 505 — 07.01-45	May 1, 2012

RAI 505 — 07.01-46	May 1, 2012
RAI 505 — 07.01-47	May 22, 2012
RAI 505 — 07.01-48	May 9, 2012
RAI 505 — 07.01-49	May 30, 2012
RAI 505 — 07.01-50	May 30, 2012
RAI 505 — 07.01-51	May 22, 2012
RAI 505 — 07.03-38	April 17, 2012
RAI 505 — 07.05-10	April 17, 2012
RAI 505 — 07.08-47	May 30, 2012
RAI 505 — 07.09-71	May 9, 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

From: WILLIFORD Dennis (RS/NB)
Sent: Friday, February 17, 2012 4:09 PM
To: 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. 505 (5902,5735,5869,5754,5803,5950,5744), FSAR Ch. 7, Supplement 10

Getachew,

On September 29, 2011, AREVA NP Inc. provided a schedule for technically correct and complete responses to the 34 questions in RAI 505. In Supplement 1 sent on October 27, 2011, and Supplement 2 sent on November 17, 2011, AREVA NP provided a revised schedule for technically correct and complete responses to 33 questions and a preliminary revised schedule for Question 07.01-33. AREVA NP provided Supplement 3 on November 22, 2011 to provide a final response to 4 questions. On December 9, 2011, AREVA NP provided Supplement 4 to revise the schedule for 7 questions. On December 14, 2011, AREVA NP provided Supplement 5 to revise the schedule for 5 questions. On December 15, 2011, AREVA NP provided Supplement 6 to provide a complete and final response to 6 questions. On January 10, 2012, AREVA NP provided Supplement 7 to provide a complete and final response to 2 questions. On January 19, 2012, AREVA NP provided Supplement 8 to provide a complete and final response to one question and a revised preliminary schedule for the response to Question 07.01-33. On February 9, 2012, AREVA NP provided Supplement 9 to revise the schedule for 11 questions.

The schedule for a technically correct and complete response to 20 of the remaining 21 questions has been changed as provided below. The response schedule to the other question remains unchanged.

Question #	Response Date
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RAI 505 — 07.01-33	February 21, 2012
RAI 505 — 07.01-34	May 9, 2012
RAI 505 — 07.01-35	May 30, 2012
RAI 505 — 07.01-36	May 1, 2012
RAI 505 — 07.01-37	April 17, 2012
RAI 505 — 07.01-38	May 1, 2012
RAI 505 — 07.01-39	May 22, 2012
RAI 505 — 07.01-40	May 22, 2012
RAI 505 — 07.01-41	April 17, 2012
RAI 505 — 07.01-44	May 9, 2012
RAI 505 — 07.01-45	May 1, 2012
RAI 505 — 07.01-46	May 1, 2012
RAI 505 — 07.01-47	May 22, 2012
RAI 505 — 07.01-48	May 9, 2012
RAI 505 — 07.01-49	May 30, 2012
RAI 505 — 07.01-50	May 30, 2012
RAI 505 — 07.01-51	May 22, 2012
RAI 505 — 07.03-38	April 17, 2012
RAI 505 — 07.05-10	April 17, 2012
RAI 505 — 07.08-47	May 30, 2012
RAI 505 — 07.09-71	May 9, 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

From: WILLIFORD Dennis (RS/NB)
Sent: Thursday, February 09, 2012 8:15 AM
To: 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. 505 (5902,5735,5869,5754,5803,5950,5744), FSAR Ch. 7, Supplement 9

Getachew,

On September 29, 2011, AREVA NP Inc. provided a schedule for technically correct and complete responses to the 34 questions in RAI 505. In Supplement 1 sent on October 27, 2011, and Supplement 2 sent on November 17, 2011, AREVA NP provided a revised schedule for technically correct and complete responses to 33 questions and a preliminary revised schedule for Question 07.01-33. AREVA NP provided Supplement 3 on November 22, 2011 to provide a final response to 4 questions. On December 9, 2011, AREVA NP provided Supplement 4 to revise the schedule for 7 questions. On December 14, 2011, AREVA NP provided Supplement 5 to revise the schedule for 5 questions. On December 15, 2011, AREVA NP provided

Supplement 6 to provide a complete and final response to 6 questions. On January 10, 2012, AREVA NP provided Supplement 7 to provide a complete and final response to 2 questions. On January 19, 2012, AREVA NP provided Supplement 8 to provide a complete and final response to one question and a revised preliminary schedule for the response to Question 07.01-33.

The schedule for a technically correct and complete response to 11 of the remaining 21 questions has been changed as provided below. The response schedule to the other 10 questions remains unchanged.

Question #	Response Date
RAI 505 — 07.01-33	February 21, 2012
RAI 505 — 07.01-34	April 5, 2012
RAI 505 — 07.01-35	April 26, 2012
RAI 505 — 07.01-36	April 5, 2012
RAI 505 — 07.01-37	March 8, 2012
RAI 505 — 07.01-38	April 5, 2012
RAI 505 — 07.01-39	April 26, 2012
RAI 505 — 07.01-40	April 26, 2012
RAI 505 — 07.01-41	March 8, 2012
RAI 505 — 07.01-44	April 5, 2012
RAI 505 — 07.01-45	April 26, 2012
RAI 505 — 07.01-46	April 26, 2012
RAI 505 — 07.01-47	April 5, 2012
RAI 505 — 07.01-48	April 5, 2012
RAI 505 — 07.01-49	April 26, 2012
RAI 505 — 07.01-50	April 26, 2012
RAI 505 — 07.01-51	April 26, 2012
RAI 505 — 07.03-38	March 8, 2012
RAI 505 — 07.05-10	March 8, 2012
RAI 505 — 07.08-47	April 26, 2012
RAI 505 — 07.09-71	April 5, 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

From: WILLIFORD Dennis (RS/NB)
Sent: Thursday, January 19, 2012 11:19 AM
To: 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. 505 (5902,5735,5869,5754,5803,5950,5744), FSAR Ch. 7, Supplement 8

Getachew,

On September 29, 2011, AREVA NP Inc. provided a schedule for technically correct and complete responses to the 34 questions in RAI 505. In Supplement 1 sent on October 27, 2011, and Supplement 2 sent on November 17, 2011, AREVA NP provided a revised schedule for technically correct and complete responses to 33 questions and a preliminary revised schedule for Question 07.01-33. AREVA NP provided Supplement 3 on November 22, 2011 to provide a final response to 4 questions. On December 9, 2011, AREVA NP provided Supplement 4 to revise the schedule for 7 questions. On December 14, 2011, AREVA NP provided Supplement 5 to revise the schedule for 5 questions. On December 15, 2011, AREVA NP provided Supplement 6 to provide a complete and final response to 6 questions. On January 10, 2012, AREVA NP provided Supplement 7 to provide a complete and final response to 2 questions.

The attached file, "RAI 505 Supplement 8 Response US EPR DC.pdf" provides a technically correct and complete final response to 1 of the remaining 22 questions.

The following table indicates the respective pages in the response document, "RAI 505 Supplement 8 Response US EPR DC.pdf," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 505 — 07.01-42	2	2

The schedule for a technically correct and complete response to the remaining 21 questions is provided below. The preliminary schedule for the response to Question 07.01-33 has been revised and is being reevaluated and a new supplement with a revised schedule will be transmitted by February 21, 2012.

Question #	Response Date
RAI 505 — 07.01-33	February 21, 2012
RAI 505 — 07.01-34	April 5, 2012
RAI 505 — 07.01-35	April 26, 2012
RAI 505 — 07.01-36	February 9, 2012
RAI 505 — 07.01-37	March 8, 2012
RAI 505 — 07.01-38	February 9, 2012
RAI 505 — 07.01-39	February 9, 2012
RAI 505 — 07.01-40	February 9, 2012
RAI 505 — 07.01-41	February 9, 2012
RAI 505 — 07.01-44	February 9, 2012
RAI 505 — 07.01-45	April 26, 2012
RAI 505 — 07.01-46	April 26, 2012
RAI 505 — 07.01-47	February 9, 2012
RAI 505 — 07.01-48	February 9, 2012
RAI 505 — 07.01-49	February 9, 2012
RAI 505 — 07.01-50	April 26, 2012

RAI 505 — 07.01-51	February 9, 2012
RAI 505 — 07.03-38	April 26, 2012
RAI 505 — 07.05-10	March 8, 2012
RAI 505 — 07.08-47	April 26, 2012
RAI 505 — 07.09-71	April 5, 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

From: WILLIFORD Dennis (CORP/QP)

Sent: Tuesday, January 10, 2012 5:21 PM

To: 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. 505 (5902,5735,5869,5754,5803,5950,5744), FSAR Ch. 7, Supplement 7

Getachew,

On September 29, 2011, AREVA NP Inc. provided a schedule for technically correct and complete responses to the 34 questions in RAI 505. In Supplement 1 sent on October 27, 2011, and Supplement 2 sent on November 17, 2011, AREVA NP provided a revised schedule for technically correct and complete responses to 33 questions and a preliminary revised schedule for Question 07.01-33. AREVA NP provided Supplement 3 on November 22, 2011 to provide a final response to 4 questions. On December 9, 2011, AREVA NP provided Supplement 4 to revise the schedule for 7 questions. On December 14, 2011, AREVA NP provided Supplement 5 to revise the schedule for 5 questions. On December 15, 2011, AREVA NP provided Supplement 6 to provide a complete and final response to 6 questions.

The attached file, "RAI 505 Supplement 7 Response US EPR DC.pdf" provides technically correct and complete final responses to 2 of the remaining 24 questions. Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 505 Question 07.08-48.

The following table indicates the respective pages in the response document, "RAI 505 Supplement 7 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 505 — 07.08-44	2	3
RAI 505 — 07.08-48	4	5

The schedule for a technically correct and complete response to the remaining 22 questions has changed as provided below. The preliminary schedule for the response to Question 07.01-33 is being reevaluated and a new supplement with a revised schedule will be transmitted by January 25, 2012.

Question #	Response Date
RAI 505 — 07.01-33	January 25, 2012
RAI 505 — 07.01-34	April 5, 2012
RAI 505 — 07.01-35	April 26, 2012
RAI 505 — 07.01-36	February 9, 2012
RAI 505 — 07.01-37	March 8, 2012
RAI 505 — 07.01-38	February 9, 2012
RAI 505 — 07.01-39	February 9, 2012
RAI 505 — 07.01-40	February 9, 2012
RAI 505 — 07.01-41	February 9, 2012
RAI 505 — 07.01-42	February 9, 2012
RAI 505 — 07.01-44	February 9, 2012
RAI 505 — 07.01-45	April 26, 2012
RAI 505 — 07.01-46	April 26, 2012
RAI 505 — 07.01-47	February 9, 2012
RAI 505 — 07.01-48	February 9, 2012
RAI 505 — 07.01-49	February 9, 2012
RAI 505 — 07.01-50	April 26, 2012
RAI 505 — 07.01-51	February 9, 2012
RAI 505 — 07.03-38	April 26, 2012
RAI 505 — 07.05-10	March 8, 2012
RAI 505 — 07.08-47	April 26, 2012
RAI 505 — 07.09-71	April 5, 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

From: WILLIFORD Dennis (RS/NB)
Sent: Thursday, December 15, 2011 1:49 PM
To: 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. 505 (5902,5735,5869,5754,5803,5950,5744), FSAR Ch. 7, Supplement 6

Getachew,

On September 29, 2011, AREVA NP Inc. provided a schedule for technically correct and complete responses to the 34 questions in RAI 505. In Supplement 1 sent on October 27, 2011, and Supplement 2 sent on November 17, 2011, AREVA NP provided a revised schedule for technically correct and complete responses

to 33 questions and a preliminary revised schedule for Question 07.01-33. AREVA NP provided Supplement 3 on November 22, 2011 to provide a final response to 4 questions. On December 9, 2011, AREVA NP provided Supplement 4 to revise the schedule for 7 questions. On December 14, 2011, AREVA NP provided Supplement 5 to revise the schedule for 5 questions.

The attached file, "RAI 505 Supplement 6 Response US EPR DC.pdf" provides technically correct and complete responses to 6 of the remaining 30 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. Also appended to this file are affected pages of Technical Reports ANP-10304 and ANP-10309P. Revisions to these Technical Reports will be submitted by separate letter after completion of all responses to RAI 505.

The following table indicates the respective pages in the response document, "RAI 505 Supplement 6 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 505 — 07.03-37	2	3
RAI 505 — 07.04-15	4	5
RAI 505 — 07.05-11	6	6
RAI 505 — 07.08-43	7	8
RAI 505 — 07.08-45	9	10
RAI 505 — 07.08-49	11	12

The schedule for a technically correct and complete response to the remaining 24 questions remains unchanged. The preliminary schedule for the response to Question 07.01-33 is being reevaluated and a new supplement with a revised schedule will be transmitted by January 25, 2012.

Question #	Response Date
RAI 505 — 07.01-33	January 25, 2012
RAI 505 — 07.01-34	January 10, 2012
RAI 505 — 07.01-35	February 9, 2012
RAI 505 — 07.01-36	January 10, 2012
RAI 505 — 07.01-37	January 19, 2012
RAI 505 — 07.01-38	January 10, 2012
RAI 505 — 07.01-39	January 10, 2012
RAI 505 — 07.01-40	January 10, 2012
RAI 505 — 07.01-41	January 10, 2012
RAI 505 — 07.01-42	January 10, 2012
RAI 505 — 07.01-44	January 10, 2012
RAI 505 — 07.01-45	February 9, 2012
RAI 505 — 07.01-46	February 9, 2012
RAI 505 — 07.01-47	January 10, 2012
RAI 505 — 07.01-48	January 10, 2012
RAI 505 — 07.01-49	January 10, 2012
RAI 505 — 07.01-50	January 10, 2012
RAI 505 — 07.01-51	January 10, 2012
RAI 505 — 07.03-38	February 9, 2012

RAI 505 — 07.05-10	January 19, 2012
RAI 505 — 07.08-44	January 10, 2012
RAI 505 — 07.08-47	January 10, 2012
RAI 505 — 07.08-48	January 10, 2012
RAI 505 — 07.09-71	January 10, 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

From: WILLIFORD Dennis (RS/NB)
Sent: Wednesday, December 14, 2011 11:30 AM
To: 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. 505 (5902,5735,5869,5754,5803,5950,5744), FSAR Ch. 7, Supplement 5

Getachew,

On September 29, 2011, AREVA NP Inc. provided a schedule for technically correct and complete responses to the 34 questions in RAI 505. In Supplement 1 sent on October 27, 2011, and Supplement 2 sent on November 17, 2011, AREVA NP provided a revised schedule for technically correct and complete responses to 33 questions and a preliminary revised schedule for Question 07.01-33. AREVA NP provided Supplement 3 on November 22, 2011 to provide a final response to 4 questions. On December 9, 2011, AREVA NP provided a revised schedule for 7 questions.

The schedule for the response to four questions (Questions 7.1-35, 7.1-45, 7.1-46, and 7.3-38) is being changed, as indicated in bold below. In addition, the preliminary schedule for the response to Question 07.01-33 has been revised as indicated. This schedule is being reevaluated and a new supplement with a revised schedule will be transmitted by January 25, 2012. The schedule for a technically correct and complete response to the remaining 25 questions remains unchanged.

Question #	Response Date
RAI 505 — 07.01-33	January 25, 2012
RAI 505 — 07.01-34	January 10, 2012
RAI 505 — 07.01-35	February 9, 2012
RAI 505 — 07.01-36	January 10, 2012
RAI 505 — 07.01-37	January 19, 2012
RAI 505 — 07.01-38	January 10, 2012
RAI 505 — 07.01-39	January 10, 2012
RAI 505 — 07.01-40	January 10, 2012

RAI 505 — 07.01-41	January 10, 2012
RAI 505 — 07.01-42	January 10, 2012
RAI 505 — 07.01-44	January 10, 2012
RAI 505 — 07.01-45	February 9, 2012
RAI 505 — 07.01-46	February 9, 2012
RAI 505 — 07.01-47	January 10, 2012
RAI 505 — 07.01-48	January 10, 2012
RAI 505 — 07.01-49	January 10, 2012
RAI 505 — 07.01-50	January 10, 2012
RAI 505 — 07.01-51	January 10, 2012
RAI 505 — 07.03-37	January 19, 2012
RAI 505 — 07.03-38	February 9, 2012
RAI 505 — 07.04-15	January 19, 2012
RAI 505 — 07.05-10	January 19, 2012
RAI 505 — 07.05-11	January 19, 2012
RAI 505 — 07.08-43	January 19, 2012
RAI 505 — 07.08-44	January 10, 2012
RAI 505 — 07.08-45	January 10, 2012
RAI 505 — 07.08-47	January 10, 2012
RAI 505 — 07.08-48	January 10, 2012
RAI 505 — 07.08-49	January 19, 2012
RAI 505 — 07.09-71	January 10, 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

From: RYAN Tom (RS/NB)
Sent: Friday, December 09, 2011 8:35 AM
To: Getachew.Tesfaye@nrc.gov
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); WILLIFORD Dennis (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 505 (5902,5735,5869,5754,5803,5950,5744), FSAR Ch. 7, Supplement 4

Getachew,

On September 29, 2011, AREVA NP Inc. provided a schedule for technically correct and complete responses to the 34 questions in RAI 505. On October 27, 2011, and November 17, 2011, AREVA NP provided a revised schedule for technically correct and complete responses to 33 questions and a preliminary revised schedule for Question 07.01-33. On November 22, 2011, AREVA NP provided a final response to four questions.

The schedule for the response to the questions 7.1-37, 7.3-37, 7.4-15, 7.5-10, 7.5-11, 7.8-43, and 7.8-49 is being changed and indicated in bold below, the remaining 23 questions remains unchanged, as indicated below. In addition, the preliminary schedule for a response to Question 07.01-33 remains unchanged. The schedule for Question 07.01-33 is being reevaluated and a new supplement with a revised schedule will be transmitted by December 14, 2011.

Question #	Response Date
RAI 505 — 07.01-33	December 14, 2011
RAI 505 — 07.01-34	January 10, 2012
RAI 505 — 07.01-35	January 10, 2012
RAI 505 — 07.01-36	January 10, 2012
RAI 505 — 07.01-37	January 19, 2012
RAI 505 — 07.01-38	January 10, 2012
RAI 505 — 07.01-39	January 10, 2012
RAI 505 — 07.01-40	January 10, 2012
RAI 505 — 07.01-41	January 10, 2012
RAI 505 — 07.01-42	January 10, 2012
RAI 505 — 07.01-44	January 10, 2012
RAI 505 — 07.01-45	January 10, 2012
RAI 505 — 07.01-46	January 10, 2012
RAI 505 — 07.01-47	January 10, 2012
RAI 505 — 07.01-48	January 10, 2012
RAI 505 — 07.01-49	January 10, 2012
RAI 505 — 07.01-50	January 10, 2012
RAI 505 — 07.01-51	January 10, 2012
RAI 505 — 07.03-37	January 19, 2012
RAI 505 — 07.03-38	January 10, 2012
RAI 505 — 07.04-15	January 19, 2012
RAI 505 — 07.05-10	January 19, 2012
RAI 505 — 07.05-11	January 19, 2012
RAI 505 — 07.08-43	January 19, 2012
RAI 505 — 07.08-44	January 10, 2012
RAI 505 — 07.08-45	January 10, 2012
RAI 505 — 07.08-47	January 10, 2012
RAI 505 — 07.08-48	January 10, 2012
RAI 505 — 07.08-49	January 19, 2012
RAI 505 — 07.09-71	January 10, 2012

Sincerely,

**Tom Ryan for
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

From: WILLIFORD Dennis (RS/NB)
Sent: Tuesday, November 22, 2011 2:51 PM
To: 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. 505 (5902,5735,5869,5754,5803,5950,5744), FSAR Ch. 7, Supplement 3

Getachew,

On September 29, 2011, AREVA NP Inc. provided a schedule for technically correct and complete responses to the 34 questions in RAI 505. On October 27, 2011, and November 17, 2011, AREVA NP provided a revised schedule for technically correct and complete responses to 33 questions and a preliminary revised schedule for Question 07.01-33.

After discussions with NRC staff, the attached file, "RAI 505 Supplement 3 Response US EPR DC.pdf" provides technically correct and complete responses to 4 of the 34 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 505 Question 07.07-23, Question 07.08 -46 and Question 07.09.02-72.

The following table indicates the respective pages in the response document, "RAI 505 Supplement 3 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 505 — 07.01-43	2	3
RAI 505 — 07.07-23	4	4
RAI 505 — 07.08-46	5	5
RAI 505 — 07.09-72	6	7

The schedule for the response to the remaining 30 questions remains unchanged, as indicated below. In addition, the preliminary revised schedule for a response to Question 07.01-33 remains unchanged. The schedule for Question 07.01-33 is being reevaluated and a new supplement with a revised schedule will be transmitted by December 14, 2011.

Question #	Response Date
RAI 505 — 07.01-33	December 14, 2011
RAI 505 — 07.01-34	January 10, 2012
RAI 505 — 07.01-35	January 10, 2012
RAI 505 — 07.01-36	January 10, 2012
RAI 505 — 07.01-37	December 11, 2011
RAI 505 — 07.01-38	January 10, 2012
RAI 505 — 07.01-39	January 10, 2012
RAI 505 — 07.01-40	January 10, 2012

RAI 505 — 07.01-41	January 10, 2012
RAI 505 — 07.01-42	January 10, 2012
RAI 505 — 07.01-44	January 10, 2012
RAI 505 — 07.01-45	January 10, 2012
RAI 505 — 07.01-46	January 10, 2012
RAI 505 — 07.01-47	January 10, 2012
RAI 505 — 07.01-48	January 10, 2012
RAI 505 — 07.01-49	January 10, 2012
RAI 505 — 07.01-50	January 10, 2012
RAI 505 — 07.01-51	January 10, 2012
RAI 505 — 07.03-37	December 11, 2011
RAI 505 — 07.03-38	January 10, 2012
RAI 505 — 07.04-15	December 11, 2011
RAI 505 — 07.05-10	December 11, 2011
RAI 505 — 07.05-11	December 11, 2011
RAI 505 — 07.08-43	December 11, 2011
RAI 505 — 07.08-44	January 10, 2012
RAI 505 — 07.08-45	January 10, 2012
RAI 505 — 07.08-47	January 10, 2012
RAI 505 — 07.08-48	January 10, 2012
RAI 505 — 07.08-49	December 11, 2011
RAI 505 — 07.09-71	January 10, 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

From: WILLIFORD Dennis (RS/NB)
Sent: Thursday, November 17, 2011 5:44 PM
To: 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. 505 (5902,5735,5869,5754,5803,5950,5744), FSAR Ch. 7, Supplement 2

Getachew,

On September 29, 2011, AREVA NP Inc. provided a schedule for technically correct and complete responses to the 34 questions in RAI 505. On October 27, 2011, AREVA NP provided a revised schedule for technically correct and complete responses to 13 questions and a preliminary revised schedule for Question 07.01-33.

The schedule for the final responses has been revised, as indicated in bold below. In addition, the preliminary revised schedule for a response to Question 07.01-33 has been revised. The schedule for Question 07.01-33 is being reevaluated and a new supplement with a revised schedule will be transmitted by December 14, 2011.

Question #	Response Date
RAI 505 — 07.01-33	December 14, 2011
RAI 505 — 07.01-34	January 10, 2012
RAI 505 — 07.01-35	January 10, 2012
RAI 505 — 07.01-36	January 10, 2012
RAI 505 — 07.01-37	December 11, 2011
RAI 505 — 07.01-38	January 10, 2012
RAI 505 — 07.01-39	January 10, 2012
RAI 505 — 07.01-40	January 10, 2012
RAI 505 — 07.01-41	January 10, 2012
RAI 505 — 07.01-42	January 10, 2012
RAI 505 — 07.01-43	December 11, 2011
RAI 505 — 07.01-44	January 10, 2012
RAI 505 — 07.01-45	January 10, 2012
RAI 505 — 07.01-46	January 10, 2012
RAI 505 — 07.01-47	January 10, 2012
RAI 505 — 07.01-48	January 10, 2012
RAI 505 — 07.01-49	January 10, 2012
RAI 505 — 07.01-50	January 10, 2012
RAI 505 — 07.01-51	January 10, 2012
RAI 505 — 07.03-37	December 11, 2011
RAI 505 — 07.03-38	January 10, 2012
RAI 505 — 07.04-15	December 11, 2011
RAI 505 — 07.05-10	December 11, 2011
RAI 505 — 07.05-11	December 11, 2011
RAI 505 — 07.07-23	December 11, 2011
RAI 505 — 07.08-43	December 11, 2011
RAI 505 — 07.08-44	January 10, 2012
RAI 505 — 07.08-45	January 10, 2012
RAI 505 — 07.08-46	December 11, 2011
RAI 505 — 07.08-47	January 10, 2012
RAI 505 — 07.08-48	January 10, 2012
RAI 505 — 07.08-49	December 11, 2011
RAI 505 — 07.09-71	January 10, 2012
RAI 505 — 07.09-72	January 10, 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**From:** WILLIFORD Dennis (RS/NB)**Sent:** Thursday, October 27, 2011 11:22 AM**To:** 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. 505 (5902,5735,5869,5754,5803,5950,5744), FSAR Ch. 7, Supplement 1

Getachew,

On September 29, 2011, AREVA NP Inc. provided a schedule for a technically correct and complete response to the 34 questions in RAI 505.

The schedule for the final response to Questions 07.01-38, 07.01-44, 07.01-45, 07.01-46, 07.01-47, 07.01-48, 07.01-49, 07.01-50, 07.01-51, 07.03-38, 07.08-43, 07.08-47, 07.08-48 has been revised, as indicated in bold below. In addition, a preliminary revised schedule for a technically correct and complete response to Question 07.01-33 is provided below. The schedule for Question 07.01-33 is being reevaluated and a new supplement with a revised schedule will be transmitted by November 17, 2011.

Question #	Response Date
RAI 505 — 07.01-33	November 17, 2011
RAI 505 — 07.01-34	December 8, 2011
RAI 505 — 07.01-35	November 17, 2011
RAI 505 — 07.01-36	December 8, 2011
RAI 505 — 07.01-37	December 8, 2011
RAI 505 — 07.01-38	January 10, 2012
RAI 505 — 07.01-39	December 8, 2011
RAI 505 — 07.01-40	December 8, 2011
RAI 505 — 07.01-41	November 17, 2011
RAI 505 — 07.01-42	December 20, 2011
RAI 505 — 07.01-43	November 17, 2011
RAI 505 — 07.01-44	January 10, 2012
RAI 505 — 07.01-45	January 10, 2012
RAI 505 — 07.01-46	January 10, 2012
RAI 505 — 07.01-47	January 10, 2012
RAI 505 — 07.01-48	January 10, 2012
RAI 505 — 07.01-49	January 10, 2012
RAI 505 — 07.01-50	January 10, 2012
RAI 505 — 07.01-51	January 10, 2012
RAI 505 — 07.03-37	November 17, 2011
RAI 505 — 07.03-38	January 10, 2012
RAI 505 — 07.04-15	November 17, 2011

RAI 505 — 07.05-10	November 17, 2011
RAI 505 — 07.05-11	November 17, 2011
RAI 505 — 07.07-23	November 17, 2011
RAI 505 — 07.08-43	January 10, 2012
RAI 505 — 07.08-44	December 8, 2011
RAI 505 — 07.08-45	December 8, 2011
RAI 505 — 07.08-46	December 8, 2011
RAI 505 — 07.08-47	January 10, 2012
RAI 505 — 07.08-48	January 10, 2012
RAI 505 — 07.08-49	November 17, 2011
RAI 505 — 07.09-71	December 8, 2011
RAI 505 — 07.09-72	December 8, 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

From: WILLIFORD Dennis (RS/NB)
Sent: Thursday, September 29, 2011 11:04 AM
To: 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. 505 (5902,5735,5869,5754,5803,5950,5744), FSAR Ch. 7

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 505 Response US EPR DC.pdf," provides a schedule since a technically correct and complete response to the 34 questions cannot be provided at this time.

The following table indicates the respective pages in the response document, "RAI 505 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 505 — 07.01-33	2	2
RAI 505 — 07.01-34	3	3
RAI 505 — 07.01-35	4	4
RAI 505 — 07.01-36	5	5
RAI 505 — 07.01-37	6	6
RAI 505 — 07.01-38	7	7
RAI 505 — 07.01-39	8	8
RAI 505 — 07.01-40	9	9

RAI 505 — 07.01-41	10	10
RAI 505 — 07.01-42	11	11
RAI 505 — 07.01-43	12	12
RAI 505 — 07.01-44	13	13
RAI 505 — 07.01-45	14	14
RAI 505 — 07.01-46	15	15
RAI 505 — 07.01-47	16	16
RAI 505 — 07.01-48	17	18
RAI 505 — 07.01-49	19	19
RAI 505 — 07.01-50	20	20
RAI 505 — 07.01-51	21	22
RAI 505 — 07.03-37	23	23
RAI 505 — 07.03-38	24	24
RAI 505 — 07.04-15	25	25
RAI 505 — 07.05-10	26	26
RAI 505 — 07.05-11	27	27
RAI 505 — 07.07-23	28	28
RAI 505 — 07.08-43	29	29
RAI 505 — 07.08-44	30	30
RAI 505 — 07.08-45	31	31
RAI 505 — 07.08-46	32	32
RAI 505 — 07.08-47	33	33
RAI 505 — 07.08-48	34	34
RAI 505 — 07.08-49	35	35
RAI 505 — 07.09-71	36	36
RAI 505 — 07.09-72	37	37

A complete answer is not provided for the 34 questions. The schedule for a technically correct and complete response to these questions is provided below.

Please note that the date for the response to Question 07.01-33 is a commitment date to provide a final schedule for the response in a follow-up letter.

Question #	Response Date
RAI 505 — 07.01-33	October 27, 2011
RAI 505 — 07.01-34	December 8, 2011
RAI 505 — 07.01-35	November 17, 2011
RAI 505 — 07.01-36	December 8, 2011
RAI 505 — 07.01-37	December 8, 2011
RAI 505 — 07.01-38	December 20, 2011
RAI 505 — 07.01-39	December 8, 2011
RAI 505 — 07.01-40	December 8, 2011
RAI 505 — 07.01-41	November 17, 2011
RAI 505 — 07.01-42	December 20, 2011
RAI 505 — 07.01-43	November 17, 2011

RAI 505 — 07.01-44	December 20, 2011
RAI 505 — 07.01-45	December 20, 2011
RAI 505 — 07.01-46	December 20, 2011
RAI 505 — 07.01-47	December 8, 2011
RAI 505 — 07.01-48	December 20, 2011
RAI 505 — 07.01-49	December 20, 2011
RAI 505 — 07.01-50	December 20, 2011
RAI 505 — 07.01-51	December 20, 2011
RAI 505 — 07.03-37	November 17, 2011
RAI 505 — 07.03-38	December 20, 2011
RAI 505 — 07.04-15	November 17, 2011
RAI 505 — 07.05-10	November 17, 2011
RAI 505 — 07.05-11	November 17, 2011
RAI 505 — 07.07-23	November 17, 2011
RAI 505 — 07.08-43	December 20, 2011
RAI 505 — 07.08-44	December 8, 2011
RAI 505 — 07.08-45	December 8, 2011
RAI 505 — 07.08-46	December 8, 2011
RAI 505 — 07.08-47	December 20, 2011
RAI 505 — 07.08-48	December 20, 2011
RAI 505 — 07.08-49	November 17, 2011
RAI 505 — 07.09-71	December 8, 2011
RAI 505 — 07.09-72	December 8, 2011

Sincerely,

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To: ZZ-DL-A-USEPR-DL
Cc: Zhang, Deanna; Morton, Wendell; Spaulding, Deirdre; Mott, Kenneth; Truong, Tung; Zhao, Jack; Mills, Daniel; Jackson, Terry; Canova, Michael; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 505 (5902,5735,5869,5754,5803,5950,5744), FSAR Ch. 7

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on August 12, 2011, and discussed with your staff on August 22 and 25, 2011. No change is made to the draft RAI as a result of those discussions. 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
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Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 3877

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**Request for Additional Information No. 505 (5902,5735,5869,5754,5803,5950,5744),
Revision 0, Supplement 15**

8/30/2011

U. S. EPR Standard Design Certification

AREVA NP Inc.

Docket No. 52-020

SRP Section: 07.01 - Instrumentation and Controls - Introduction

SRP Section: 07.03 - Engineered Safety Features Systems

SRP Section: 07.04 - Safe Shutdown Systems

SRP Section: 07.05 - Information Systems Important to Safety

SRP Section: 07.07 - Control Systems

SRP Section: 07.08 - Diverse Instrumentation and Control Systems

SRP Section: 07.09 - Data Communication Systems

Application Section: FSAR Chapter 7

**QUESTIONS for Instrumentation, Controls and Electrical Engineering 1
(AP1000/EPR Projects) (ICE1)**

Question 07.01-37:**OPEN ITEM**

Provide an ITAAC Item in U.S. EPR FSAR Tier 1, Section 2.4.4, that ties together satisfactory completion of the SAS ITAAC to completion of referenced ITAAC provided by the applicant in response to RAI 78, Questions 14.03.05-3&4 (Supplement 2).

IEEE Std. 603-1998, Clause 5.2, requires, in part, that the safety system design provide features to ensure that system-level actions go to completion. 10 CFR 52.47(b)(1) requires, in part, that ITAAC are necessary and sufficient to provide reasonable assurance that if the ITAAC are performed and the acceptance criteria met, a facility that incorporates the design certification has been constructed and will be operated in conformity with the design certification, the provisions of the Act, and the Commission's rules and regulations. For the staff's review of compliance for SAS, the staff did not find an ITAAC item in Tier 1, Section 2.4.4, that verified SAS system design incorporates features that ensure completion of protective action. The SAS performs safety-related closed loop controls to help the plant achieve and maintain safe shutdown conditions as well as providing safety-related interlocks. In the applicant's response to RAI 78, Questions 14.03.05-3&4 (Supplement 2), the applicant states the following:

"Completion of protective action is verified by several ITAAC. ITAAC Item 4.2 in Section 2.4.1 verifies that an ESF actuation signal remains as long as conditions that represent the completion of the function do not exist and requires deliberate operator action to be returned to normal. ITAAC Item 4.4 in Section 2.4.5 verifies proper connections from the other I&C systems to the PACS. Various mechanical system PACS ITAAC is provided that verifies that the actuator responds to the state requested by the test signal sent to the PACS. Examples of this ITAAC can be found in Tier 1, Sections 2.2.1, 2.2.3, 2.2.4, 2.2.7, 2.6.1, 2.6.6, 2.7.1, 2.7.2, 2.7.11. All ITAAC items mentioned above provide verification that completion of protective action requirement is satisfied."

The staff understood the applicant's rationale in this excerpt. However, the staff requests the applicant provide an ITAAC Item in Tier 1, Section 2.4.4, that ties these commitments together into the SAS ITAAC to ensure that the ITAAC for SAS will not be completed until satisfactory completion of the above-mentioned sections are satisfactory.

Response to Question 07.01-37:

U.S. EPR FSAR Tier 1, Section 2.4.4 will be revised to include ITAAC for safety automation system (SAS) functions.

FSAR Impact:

U.S. EPR FSAR Tier 1, Section 2.4.4 will be revised as described in the response and indicated on the enclosed markup.

Question 07.03-38:**OPEN ITEM**

Provide information on how SAS and other TXS safety-related I&C systems comply with the requirements of IEEE Std. 603-1998, Clause 4, as shown on U.S. EPR FSAR, Tier 2, Table 7.1-2.

Section 4 of IEEE Std. 603-1991, requires, in part, the specific basis established for the design of each safety system. The staff reviewed the FSAR to determine how the applicant addressed design basis requirements of IEEE Std. 603-1998, Clause 4, and applicable general design criteria, for SAS and other safety-related systems. The staff was unable to determine that for SAS and other safety-related I&C systems, all design basis requirements have been incorporated. For example, in Tier 2, Section 7.1.2.6.10, Interim Revision 3 mark-ups, the applicant states that the U.S. EPR design does contain equipment protective features that may prevent a piece of safety-related equipment from performing its function and that a failure of this type would be bounded by the single failure analysis. The applicant goes on to state that failure modes and effects analysis (FMEA) have been performed for the safety-related process systems to demonstrate that no single failure can prevent performance of a safety function.

The staff accepted the applicant's rationale in its evaluation of the PS for compliance with Clause 4.k. However, the staff has not received an FMEA for SAS, or the other safety-related systems in the U.S. EPR design. The applicant has bounded compliance with Clause 4.k by the single failure criterion but without similar analysis for SAS and other safety-systems available to the staff for review, the staff cannot make a reasonable assurance finding. Table 7.1-2 matches individual requirements to the various TXS I&C systems. Table 7.1-2 does not demonstrate specifically how the requirements are met for each system that is applicable to IEEE Std. 603-1998, Clause 4.

The staff requests the applicant specifically address the requirements of Clause 4 for each TXS safety-related I&C system in U.S. EPR FSAR Tier 2, Section 7.1. If particular sub-clauses to IEEE Std. 603-1998, Clause 4 are not applicable to a TXS safety-related I&C system then the staff requests the applicant state this and provide a justification for the exclusion.

Response to Question 07.03-38:Safety Information and Control System

Information about the safety information and control system (SICS) is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.3.1. Specific information for the SICS for IEEE 603-1998, Clause 4 is as follows:

- a) The modes of operation of the U.S. EPR are provided in U.S. EPR FSAR Tier 2, Chapter 16, Table 3.3.1-1. The anticipated operational occurrence (AOOs) and postulated accident (PAs) that require protective action are analyzed in U.S. EPR FSAR Tier 2, Chapter 15. The initiating events analyzed are listed in U.S. EPR FSAR Tier 2, Table 15.0-1. The initial conditions analyzed for each event are presented in U.S. EPR FSAR Tier 2, Table 15.0-5. The human system interface (HSI) design concept in relation to the SICS is addressed in U.S. EPR FSAR Tier 2, Section 18.7.4 and in Tier 1, Table 3.4-1, Item 8.

- b) The SICS is designed so that safety-related functions required for an AOO or PA are performed in the presence of the following:
- Single detectable failures within the SICS.
 - Failures caused by the single failure.
 - Failures and spurious system actions that cause, or are caused by the AOO or PA that requires the safety function.

The SICS provides controls in the main control room (MCR) for the manual actuation of engineered safety features (ESF) functions listed in FSAR Tier 2, Table 7.3-5.

- c) Bypassed and inoperable status indication (BISI) of safety-related systems is provided by the PICS. BISI is also addressed in U.S. EPR FSAR Tier 2, Sections 7.1.3.1.4, 7.5.2.1.1, 7.5.2.2.4, and 7.5.2.2.5.
- d) The SICS does not provide variables that control protective actions to the protection system (PS).
- e) The SICS provides a manual actuation of reactor trip in the MCR and reactor shutdown system (RSS).

The SICS provides controls in the MCR for the manual actuation of ESF functions listed in U.S. EPR FSAR Tier 2, Table 7.3-5.

For the U.S. EPR, protective actions performed by the PS and the reactor trips are provided in U.S. EPR FSAR Tier 2, Table 7.2-1. Plant-specific Emergency Operating Procedures (EOPs) and Abnormal Operating Procedures (AOPs) for the U.S. EPR design need to be developed. The plant-specific EOPs will be developed from a Technical Bases Document (TBD) that will be based on hundreds of safety analyses, which are not yet completed. The emergency operating procedure development process is described in U.S. EPR FSAR Tier 2, Section 13.5.2.1.2, states that the EOPs for the U.S. EPR design will be based on the same symptom-based approach and mitigation strategies as the Babcock and Wilcox (B&W) Unit EOP TBD. This document, which represents the vendor Emergency Procedure Guidelines (EPG), provides the bases that were used to develop the plant-specific EOPs for currently operating plants that have the B&W nuclear steam supply system. The relevant NRC regulation requirements that will be used as acceptance criteria during the development of the EPGs and EOPs are provided in U.S. EPR FSAR Tier 2, Section 13.4.2.1.4. Since EPGs and EOPs have not been developed, the points in time and plant conditions for allowance of manual control are not known, the justification for permitting initiation or control subsequent to initiation solely by manual means is not known, and the expected range of environmental conditions imposed on the operator during normal, abnormal and accident conditions throughout manual operations is not known.

- f) The SICS does not have variables that have spatial dependence or sensors required for protective purposes.
- g) Information concerning transient and steady-state motive and control power and environmental conditions during normal, abnormal and accident conditions is for safety systems provided as follows:

- Electrical Information is provided in U.S. EPR FSAR Tier 2, Section 8.2.2.4, and Tables 8.3-1, Table 8.3-11 and 8.3-12.
 - Radiation Zone information is provided in U.S. EPR FSAR Tier 2, Figures 12.3-21 through 12.3-29, 12.3-64 through 12.3-66, 12.3-70, and 12.3-81.
 - Environmental conditions are provided in U.S. EPR FSAR Tier 2, Table 9.4.14-1.
 - Electromagnetic and radio-frequency interference qualification is provided in U.S. EPR FSAR Tier 2, Section 7.1.3.4.17.
 - Seismic and dynamic qualification of electrical and I&C equipment is provided in U.S. EPR FSAR Tier 2, Section 3.10.2.
 - Methodology for qualifying safety-related electrical equipment is provided in U.S. EPR FSAR Tier 2, Appendix 3D.
 - Seismic qualification techniques are provided in U.S. EPR FSAR Tier 2, Appendix 3E.
- h) Information about conditions that have the potential of degrading safety system performance is provided as follows:
- Fire, for which fire protection compliance information is provided in U.S. EPR FSAR Tier 2, Section 3.1.1.3.1.
 - Wind and tornado loading, for which information is provided in U.S. EPR FSAR Tier 2, Section 3.3.
 - Safeguards Building flooding, for which the analysis is provided in U.S. EPR FSAR Tier 2, Section 3.4.3.4.
 - Missile projection, for which protection information is provided in U.S. EPR FSAR Tier 2, Section 3.5.
 - Environmental qualification of electrical equipment, which includes fluid system separation, equipment separation and redundancy, is provided in U.S. EPR FSAR Tier 2, Section 3.11.
 - Loss of ventilation to electrical equipment, for which information is provided in U.S. EPR FSAR Tier 2, Section 3.11.4.
 - The SICS is contained within the Safeguards Building, which is a Seismic Category I structure. Information pertaining to pipe breaks is provided in U.S. EPR FSAR Tier 2, Section 3.4.3.1.
 - The MCR and RSS will be designed in a way that minimizes human error and incorporates human reliability evaluations to preclude operator error from the SICS. Additional information is provided in U.S. EPR FSAR Tier 2, Sections 18.7.2 and 18.7.4, and in Tier 1, Table 3.4-1.
 - Independence between safety-related I&C systems and non-safety related I&C systems is maintained to prevent failure in a non-safety system from affecting the SICS. Additional information is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.6.4.
- i) The SICS will be designed to meet the applicable requirements and guidance identified in U.S. EPR FSAR Tier 2, Section 7.1.1.2.1.

- j) The PS performs the protective actions for the U.S. EPR. Reactor trips are listed in U.S. FSAR Tier 2, Table 7.2-1 and reactor trip setpoints are provided in U.S. EPR FSAR Table 15.0-7.

The PS processes both automatic and manual ESF functions. U.S. EPR FSAR Tier 2, Table 7.3-1 provides the ESF functions and the range of each variable.

Critical points in time, or plant conditions that define the proper completion of a safety function are addressed in plant-specific plant specific EOPs and AOPs. The plant specific EOPs and AOPs for the U.S. EPR design are not yet written. The plant specific EOPs will be developed from a TBD that is based on hundreds of safety analyses, which are not yet completed. U.S. EPR FSAR Tier 2, Section 13.5.2.1.2, states that the EOPs for the U.S. EPR design will be based on the same symptom-based approach and mitigation strategies as the B&W Unit EOP TBD. This document, which represents the vendor EPG, provides the bases that were used to develop the plant-specific EOPs for currently operating plants that have the B&W nuclear steam supply system.

The relevant NRC regulation requirements that will be used as acceptance criteria during the development of the EPGs and EOPs are provided in U.S. EPR FSAR Tier 2, Section 13.4.2.1.4.

- k) For safety-related systems, independence is established so that a single failure does not result in the loss of the safety function of the process system. Information about safety-related equipment protective provisions is provided in U.S. EPR FSAR Tier 2, Section 7.1.3.6.10.
- l) The controls and indications that are required to be on the SICS are implemented with dedicated, hardwired I&C.

Protection System

Information about the PS is provided in U.S. EPR FSAR Tier 2, 7.1.1.4.1. Specific information for the PS for IEEE 603-1998, Clause 4 is as follows:

- a) The modes of operation of the U.S. EPR are provided in U.S. EPR FSAR Tier 2, Chapter 16, Table 3.3.1-1. The AOOs and PAs requiring protective action by the PS are analyzed in U.S. EPR FSAR Tier 2, Chapter 15. The initiating events analyzed are listed in U.S. EPR FSAR Tier 2, Table 15.0-1. The initial conditions analyzed for each event are presented in Table 15.0-5. The correlation between each event and specific ESF actuation functions performed by the PS is found in Table 15.0-10.
- b) The PS is designed so that safety-related functions required for an AOO or PA are performed in the presence of the following:
- Single detectable failures within the PS.
 - Failures caused by the single failure.
 - Failures and spurious system actions that cause or are caused by the AOO or PA that requires the safety function.

The PS is provided to sense conditions that require protective action, and to automatically initiate the safety systems required to mitigate the event.

The PS provides the following safety-related functions:

- Performs automatic initiation of reactor trip functions, listed in U.S. EPR FSAR Tier 2, Table 7.2-1.
 - Performs automatic initiation of ESF functions, listed in U.S. EPR FSAR Tier 2, Table 7.3-1.
 - Initiates reactor trip manual functions.
 - Provides actuation of ESF manual functions.
 - Generates permissive signals that authorize the activation or deactivation of certain protective actions according to current plant conditions.
 - Generates permissive signals that maintain safety-related interlocks.
- c) BISI of safety-related systems is provided by the PICS. BISI is also addressed in U.S. EPR FSAR Tier 2, Sections 7.1.3.1.4, 7.5.2.1.1, 7.5.2.2.4, and 7.5.2.2.5. Additional information is provided in U.S. EPR FSAR Tier 2, Section 7.3.2.1.2.
- d) The PS processes both automatic and manual reactor trip functions. The PS initiates an automatic reactor trip to mitigate the effects of AOOs and PAs.

The PS automatically initiates a reactor trip when selected variables, provided in U.S. EPR FSAR Tier 2, Table 7.2-1, exceed setpoints that are indicative of conditions that require protective action.

U.S. EPR FSAR Tier 2 Table 7.2-1 provides the protective function and the range of each variable.

The PS automatically initiates ESF functions. U.S. EPR FSAR Tier 2, Table 7.3-1 provides the ESF functions and the range of each variable.

The analytical limit for reactor trip setpoints is provided in U.S. EPR FSAR Tier 2, Table 15.0-7.

RAI 414, Question 7.3-30 provides time response information for each variable associated with protective functions of the PS.

U.S. EPR FSAR Tier 2, Section 18.7.4 provides information about the inventory of alarms, displays and controls.

Additional information is provided in U.S. EPR FSAR Tier 2, Section 7.3.2.1.3.

- e) The SICS provides a manual actuation of reactor trip in the MCR and RSS.

PS manually actuated functions are listed in U.S. EPR FSAR Tier 2, Table 7.3-5.

For the U.S. EPR, protective actions performed by the PS and the reactor trips are provided in U.S. EPR FSAR Tier 2, Table 7.2-1. Plant-specific EOPs and AOPs for the U.S. EPR design need to be developed. The plant-specific EOPs will be developed from a Technical Bases Document (TBD) that will be based on hundreds of safety analyses, which are not yet completed. U.S. EPR FSAR Tier 2, Chapter 13.5.2.1.2, states that the EOPs for the U.S. EPR design will be based on the same symptom-based approach and mitigation strategies as the B&W Unit EOP TBD. This document, which represents the vendor EPG, provides the bases that were used to develop the plant-specific EOPs for currently operating plants that have the B&W nuclear steam supply system. The relevant NRC regulation requirements that will be used as acceptance criteria during the development of the EPGs and EOPs are provided in U.S. EPR FSAR Tier 2, Chapter 13.4.2.1.4. Since EPGs and EOPs have not been developed, the points in time and plant conditions for allowance of manual control are not known, the justification for permitting initiation or control subsequent to initiation solely by manual means is not known, and the expected range of environmental conditions imposed on the operator during normal, abnormal and accident conditions throughout manual operations is not known.

- f) The U.S. EPR design does not use spatially dependent variables as inputs to ESF actuation. Additional information is provided in U.S. EPR FSAR Tier 2, Section 7.2.2.1.5.

The self-powered neutron detectors (SPNDs) have spatial dependence required for protective purposes. The minimum number of SPNDs required for protective purposes is provided in U.S. EPR FSAR Tier 2, Chapter 16, Table 3.3.1-1.

- g) Information concerning transient and steady-state motive and control power and environmental conditions during normal, abnormal and accident conditions is for safety systems provided as follows:
- Electrical Information is provided in U.S. EPR FSAR Tier 2, Section 8.2.2.4, Tables 8.3-1, 8.3-11 and 8.3-12.
 - Radiation Zone information is provided in U.S. EPR FSAR Tier 2, Figures 12.3-21 through 12.3-29, 12.3-64 through 12.3-66, 12.3-70 and 12.3-81.
 - Environmental conditions are provided in U.S. EPR FSAR Tier 2, Table 9.4.14-1.
 - Electromagnetic and radio-frequency interference qualification is provided in U.S. EPR FSAR Tier 2, Section 7.1.3.4.17.
 - Seismic and dynamic qualification of electrical and I&C equipment is provided in U.S. EPR FSAR Tier 2, Section 3.10.2.
 - Methodology for qualifying safety-related electrical equipment is provided in U.S. EPR FSAR Tier 2, Appendix 3D.
 - Seismic qualification techniques are provided in U.S. EPR FSAR Tier 2, Appendix 3E.
- h) Information about conditions that have the potential of degrading safety system performance is provided as follows:
- Fire, for which fire protection compliance information is provided in U.S. EPR FSAR Tier 2, Section 3.1.1.3.1.

- Wind and tornado loading, for which information is provided in U.S. EPR FSAR Tier 2, Section 3.3.
 - Safeguards Building flooding, for which the analysis is provided in U.S. EPR FSAR Tier 2, Section 3.4.3.4.
 - Missile projection, for which protection information is provided in U.S. EPR FSAR Tier 2, Section 3.5.
 - Environmental qualification of electrical equipment, which includes fluid system separation, equipment separation and redundancy, is provided in U.S. EPR FSAR Tier 2, Section 3.11.
 - Loss of ventilation to electrical equipment, for which information is provided in U.S. EPR FSAR Tier 2, Section 3.11.4.
 - The PS is contained within the Safeguards Building which is a Seismic Category I structure. Information pertaining to pipe breaks is provided in U.S. EPR FSAR Tier 2, Section 3.4.3.1.
 - The MCR and RSS will be designed to minimize human error and incorporate human reliability evaluations to preclude operator error. Additional information is provided in U.S. EPR FSAR Tier 2, Sections 7.1.1.6.5, 18.7.2, 18.7.4, and in Tier 1, Table 3.4-1.
 - Independence between safety-related I&C systems and non-safety related I&C systems is maintained to prevent failure in a non-safety system from affecting the PS. Additional information is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.6.4.
- i) The PS will be designed to meet the applicable requirements and guidance identified in U.S. EPR FSAR Tier 2, Sections 7.1.1.2.1 through 7.1.1.2.2.

Information about the Teleperm XS (TXS) platform design is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.2.1. System design principles are addressed in U.S. EPR FSAR Tier 2, Section 7.1.1.6.

- j) The PS performs the protective actions for the U.S. EPR. Reactor trips are listed in U.S. EPR FSAR Tier 2, Table 7.2-1 and each reactor trip set-point is provided in U.S. EPR FSAR Tier 2, Table 15.0-7.

The PS automatically initiates ESF functions. U.S. EPR FSAR Tier 2, Table 7.3-1 provides the ESF functions and the range of each variable.

Critical points in time or plant conditions that define the proper completion of a safety function are addressed in plant-specific EOPs and AOPs; however, the plant-specific EOPs and AOPs for the U.S. EPR design have not yet been written. The plant-specific EOPs will be developed from a Technical Bases Document (TBD) that will be based on hundreds of safety analyses, which are not yet completed. FSAR Section 13.5.2.1.2, Emergency Operating Procedure Development Process, states that the EOPs for the U.S. EPR design will be based on the same symptom-based approach and mitigation strategies as the B&W Unit EOP TBD. This document, which represents the vendor EPG, provides the bases that were used to develop the plant-specific EOPs for currently operating plants that have the B&W nuclear steam supply system.

The relevant NRC regulation requirements that will be used as acceptance criteria during the development of the EPGs and EOPs are provided in U.S. EPR FSAR Tier 2, Section 13.4.2.1.4, EOP Development Acceptance Criteria.

- k) For safety-related systems, independence is established so that a single failure does not result in the loss of the safety function of the process system. Information for safety-related equipment protective provisions is provided in U.S. EPR FSAR Tier 2, Section 7.1.3.6.10.
- l) DCS design principles are addressed in U.S. EPR FSAR Tier 2, Section 7.1.1.6. The other special design basis that is imposed on the I&C systems design is the defense-in-depth and diversity analysis based on a software common cause failure. The overall defense-in-depth and diversity is described in ANP-10304, Revision 4 (Reference 1).

Safety Automation System

Information about the safety automation system (SAS) is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.4.2. Specific information for the SAS for IEEE 603-1998, Clause 4 is as follows:

- a) The modes of operation of the U.S. EPR are provided in U.S. EPR FSAR Tier 2, Chapter 16, Table 3.3.1-1. The AOOs and postulated accident PAs that require protective action are analyzed in U.S. EPR FSAR Tier 2, Chapter 15. The initiating events analyzed are listed in U.S. EPR FSAR Tier 2, Table 15.0-1. The initial conditions analyzed for each event are presented in U.S. EPR FSAR Tier 2, Table 15.0-5.
- b) The SAS is designed so that safety-related functions required for an AOO or PA are performed in the presence of the following:
 - Single detectable failures within the SAS.
 - Failures caused by the single failure.
 - Failures and spurious system actions that cause or are caused by the AOO or PA requiring the safety function.

Automatic actuation of ESF systems and auxiliary supporting systems is performed by the PS. The SAS performs closed loop automatic controls of certain ESF systems following the actuation by the PS. These controls are described in U.S. EPR FSAR Tier 2, Section 7.3.1.2. The SAS does not perform automatic or manual protective actions. SAS automatic functions are addressed in U.S. EPR FSAR Tier 2, Table 7.1-5, and Sections 7.3 and 7.6.

- c) BISI of safety-related systems is provided by the PICS. BISI is also addressed in U.S. EPR FSAR Tier 2, Sections 7.1.3.1.4, 7.5.2.1.1, 7.5.2.2.4, and 7.5.2.2.5.
- d) The PS processes both automatic and manual reactor trip functions. The SAS does not perform automatic or manual protective actions and does not provide any input variables to the PS for control of any protective action.
- e) The SAS does not perform automatic or manual protective actions and does not provide any input variables to the PS for control of any protective action.

- f) The SAS does not have variables with spatial dependence, or sensors required for protective purposes.
- g) Information concerning transient and steady-state motive and control power and environmental conditions during normal, abnormal and accident conditions is for safety systems provided as follows:
- Electrical information is provided in U.S. EPR FSAR Tier 2, Section 8.2.2.4, Tables 8.3-1, 8.3-11 and 8.3-12.
 - Radiation zone information is provided in U.S. EPR FSAR Tier 2, Figures 12.3-21 through 12.3-29, 12.3-64 through 12.3-66, 12.3-70, and 12.3-81.
 - Environmental conditions are provided in U.S. EPR FSAR Tier 2, Table 9.4.14-1.
 - Electromagnetic and radio-frequency interference qualification is provided in U.S. EPR FSAR Tier 2, Section 7.1.3.4.17.
 - Seismic and dynamic qualification of electrical and I&C equipment is provided in U.S. EPR FSAR Tier 2, Section 3.10.2.
 - Methodology for qualifying safety-related electrical equipment is provided in U.S. EPR FSAR Tier 2, Appendix 3D.
 - Seismic qualification techniques are provided in U.S. EPR FSAR Tier 2, Appendix 3E
- h) Information about conditions that have the potential of degrading safety system performance is provided as follows:
- Fire, for which fire protection compliance information is provided in U.S. EPR FSAR Tier 2, Section 3.1.1.3.1.
 - Wind and tornado loading, for which information is provided in U.S. EPR FSAR Tier 2, Section 3.3.
 - Safeguards Building flooding, for which the analysis is provided in U.S. EPR FSAR Tier 2, Section 3.4.3.4.
 - Missile projection, for which protection information is provided in U.S. EPR FSAR Tier 2, Section 3.5.
 - Environmental qualification of electrical equipment, which includes fluid system separation, equipment separation and redundancy, is provided in U.S. EPR FSAR Tier 2, Section 3.11.
 - Loss of ventilation to electrical equipment, for which information is provided in U.S. EPR FSAR Tier 2, Section 3.11.4.
 - The SAS is contained within Seismic Category I structures. Information pertaining to pipe breaks is provided in U.S. EPR FSAR Tier 2, Section 3.4.3.1.
 - The MCR and RSS will be designed to minimize human error and incorporate human reliability evaluations to preclude operator error. Additional information is provided in U.S. EPR FSAR Tier 2, Sections 7.1.1.6.5, 18.7.2, 18.7.4, and in Tier 1, Table 3.4-1.

- Independence between safety-related I&C systems and non-safety related I&C systems is maintained to prevent failure in a non-safety system from affecting the SAS. Additional information is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.6.4.
- i) The SAS will be designed to meet the applicable requirements and guidance identified in U.S. EPR FSAR Tier 2, Sections 7.1.1.2.1.

Information about the TXS platform design is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.2.1. System design principles are addressed in U.S. EPR FSAR Tier 2, Section 7.1.1.6.

- j) The PS performs the protective actions for the U.S. EPR. Reactor trips are listed in U.S. EPR FSAR Tier 2, Table 7.2-1 and each reactor trip set-point is provided in U.S. EPR FSAR Tier 2, Table 15.0-7.

The PS processes both automatic and manual ESF functions. U.S. EPR FSAR Tier 2, Table 7.3-1 provides the ESF functions and the range of each variable.

Critical points in time or plant conditions that define the proper completion of a safety function are addressed in plant-specific Emergency Operating Procedures (EOPs) and Abnormal Operating Procedures (AOPs); however the plant specific EOPs and AOPs for the U.S. EPR design have not yet been written. The plant specific EOPs will be developed from a TBD that will be based on hundreds of safety analyses, which are not yet completed. U.S. EPR FSAR Tier 2, Section 13.5.2.1.2 states that the EOPs for the U.S. EPR design will be based on the same symptom-based approach and mitigation strategies as the B&W Unit EOP TBD. This document, which represents the vendor EPG, provides the bases that were used to develop the plant-specific EOPs for currently operating plants that have the B&W nuclear steam supply system.

The relevant NRC regulation requirements that will be used as acceptance criteria during the development of the EPGs and EOPs are provided in U.S. EPR FSAR Tier 2, Section 13.4.2.1.4.

- k) For safety-related systems, independence is established so that a single failure does not result in the loss of the safety function of the process system. Information for safety-related equipment protective provisions is provided in U.S. EPR FSAR Tier 2, Section 7.1.3.6.10.
- l) DCS design principles are addressed in U.S. EPR FSAR Tier 2, Section 7.1.1.6. The other special design basis that is imposed on the I&C systems design is the defense-in-depth and diversity analysis based on a software common cause failure. The overall defense-in-depth and diversity is described in Reference 1.

Priority and Actuator Control System

Information about the priority and actuator control system (PACS) is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.4.3. Specific information for the PACS for IEEE 603-1998, Clause 4 is as follows:

- a) The modes of operation of the U.S. EPR are provided in U.S. EPR FSAR Tier 2, Chapter 16, Table 3.3.1-1. The AOOs and PAs that require protective action are analyzed in U.S. EPR

FSAR Tier 2, Chapter 15. The initiating events analyzed are listed in U.S. EPR FSAR Tier 2, Table 15.0-1. The initial conditions analyzed for each event are presented in U.S. EPR FSAR Tier 2, Table 15.0-5.

- b) The PACS is designed so that safety-related functions required for an AOO or PA are performed in the presence of the following:
- Single detectable failures within the PACS.
 - Failures caused by the single failure.
 - Failures and spurious system actions that cause or are caused by the AOO or PA requiring the safety function.

Protection system (PS) signals received by each priority module override other signals received by the priority module.

The PS sends a signal to the PACS to automatically initiate each ESF function except the Turbine Trip. U.S. EPR FSAR Tier 2, Table 7.3-1 provides the ESF functions and the range of each variable. The PACS is not utilized for the performance of a Turbine Trip ESF function.

- c) BISI of safety-related systems is provided by the PICS. BISI is also addressed in U.S. EPR FSAR Tier 2, Sections 7.1.3.1.4, 7.5.2.1.1, 7.5.2.2.4, and 7.5.2.2.5.
- d) The PS processes both automatic and manual ESF functions. U.S. EPR FSAR Tier 2, Table 7.3-1 provides the ESF functions and the range of each variable. The PS sends a signal to the PACS to automatically initiate each ESF function except the Turbine Trip. The PACS is not utilized for the performance of a Turbine Trip ESF function.

RAI 414, Question 7.3-30 provides time response information for each variable associated with protective functions of the PS.

- e) Protection system manually actuated ESF functions are listed in U.S. EPR FSAR Tier 2, Table 7.3-5. The PACS is not utilized for the performance of a Turbine Trip ESF function.

For the U.S. EPR, protective actions are performed by the PS, and the reactor trips are provided in U.S. EPR FSAR Tier 2, Table 7.2-1. Plant-specific EOPs and AOPs for the U.S. EPR design needs to be performed; however, the plant-specific EOPs and AOPs for the U.S. EPR design have not yet been written. The plant-specific EOPs will be developed from a TBD that will be based on hundreds of safety analyses, which are not yet completed. U.S. EPR FSAR Tier 2, Section 13.5.2.1.2 states that the EOPs for the U.S. EPR design will be based on the same symptom-based approach and mitigation strategies as the B&W Unit EOP TBD. This document, which represents the vendor EPG, provides the bases that were used to develop the plant-specific EOPs for currently operating plants that have the B&W nuclear steam supply system. The relevant NRC regulation requirements that will be used as acceptance criteria during the development of the EPGs and EOPs are provided in U.S. EPR FSAR Tier 2, Chapter 13.4.2.1.4. Since EPGs and EOPs have not been developed, the points in time and plant conditions for allowance of manual control are not known, the justification for permitting initiation or control subsequent to initiation solely by manual means is not known, and the expected range of environmental conditions imposed on the

operator during normal, abnormal and accident conditions throughout manual operations is not known.

- f) The PACS does not have variables with spatial dependence or sensors required for protective purposes. The PS sends a signal to the PACS to automatically initiate each ESF function except the Turbine Trip. U.S. EPR FSAR Tier 2, Table 7.3-1 provides the ESF functions and the range of each variable; however, the PACS is not utilized for the performance of a Turbine Trip ESF function.
- g) Information concerning transient and steady-state motive and control power and environmental conditions during normal, abnormal and accident conditions is for safety systems provided as follows:
- Electrical Information is provided in U.S. EPR FSAR Tier 2, Section 8.2.2.4, Tables 8.3-1, 8.3-11 and 8.3-12.
 - Radiation zone information is provided in U.S. EPR FSAR Tier 2, Figures 12.3-21 through 12.3-29, 12.3-64 through 12.3-66, 12.3-70, and 12.3-81.
 - Environmental conditions are provided in: FSAR Table 9.4.14-1.
 - Electromagnetic and radio-frequency interference qualification is provided in U.S. EPR FSAR Tier 2 Section 7.1.3.4.17.
 - Seismic and dynamic qualification of electrical and I&C equipment is provided in U.S. EPR FSAR Tier 2, Section 3.10.2.
 - Methodology for qualifying safety-related electrical equipment is provided in U.S. EPR FSAR Tier 2, Appendix 3D.
 - Seismic qualification techniques are provided in U.S. EPR FSAR Tier 2, Appendix 3E.
- h) Information about conditions that have the potential of degrading safety system performance is provided as follows:
- Fire, for which fire protection compliance information is provided in U.S. EPR FSAR Tier 2, Section 3.1.1.3.1.
 - Wind and tornado loading, for which information is provided in U.S. EPR FSAR Tier 2, Section 3.3.
 - Safeguards Building flooding, for which the analysis is provided in U.S. EPR FSAR Tier 2, Section 3.4.3.4.
 - Missile projection, for which protection information is provided in U.S. EPR FSAR Tier 2, Section 3.5.
 - Environmental qualification of electrical equipment, which includes fluid system separation, equipment separation and redundancy, is provided in U.S. EPR FSAR Tier 2, Section 3.11.
 - Loss of ventilation to electrical equipment, for which information is provided in U.S. EPR FSAR Tier 2, Section 3.11.4.
 - The PACS is contained within Seismic Category I structures. Information pertaining to pipe breaks is provided in U.S. EPR FSAR Tier 2, Section 3.4.3.1.

- The SICS in the MCR is not normally used by the operator. The SICS is used for controls that are not available on PICS, and when PICS is not available. The U.S. EPR I&C design allows for multiple I&C systems to send requests to a given actuator using priority management. To preclude operator error from the SICS, during normal operation, the operational I&C disable switch on the SICS is set so that PAS can send commands to the PACS, thereby allowing automatic commands from the PAS to override manual commands from the SICS. Additional information is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.6.5.
 - Independence between safety-related I&C systems and non-safety related I&C systems is maintained to prevent failure in a non-safety system from affecting the PACS. Additional information is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.6.4.
- i) The PACS will be designed to meet the applicable requirements and guidance identified in U.S. EPR FSAR Tier 2, Section 7.1.1.2.1.

Information about the TXS platform design is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.2.1. System design principles are addressed in U.S. EPR FSAR Tier 2, Section 7.1.1.6.

- j) The PS performs the protective actions for the U.S EPR. Reactor trips are listed in U.S. EPR FSAR Tier 2, Table 7.2-1 and each reactor trip set-point is provided in U.S. EPR FSAR Tier 2, Table 15.0-7. The PS processes both automatic and manual ESF functions.

U.S. EPR FSAR Tier 2, Table 7.3-1 provides the ESF functions and the range of each variable. The PACS is not utilized for the performance of a turbine trip ESF function.

Critical points in time or plant conditions that define the proper completion of a safety function are addressed in plant-specific EOPs and AOPs; however, the plant-specific EOPs and AOPs for the U.S. EPR design have not yet been written. The plant-specific EOPs will be developed from a TBD that will be based on hundreds of safety analyses, which are not yet completed. U.S. EPR FSAR Tier 2, Section 13.5.2.1.2 states that the EOPs for the U.S. EPR design will be based on the same symptom-based approach and mitigation strategies as the B&W Unit EOP TBD. This document, which represents the vendor EPG, provides the bases that were used to develop the plant-specific EOPs for currently operating plants that have the B&W nuclear steam supply system.

The relevant NRC regulation requirements that will be used as acceptance criteria during the development of the EPGs and EOPs are provided in U.S. EPR FSAR Tier 2, Section 13.4.2.1.4.

- k) For safety-related systems, independence is established so that a single failure does not result in the loss of the safety function of the process system. Information for safety-related equipment protective provisions is provided in U.S. EPR FSAR Tier 2, Section 7.1.3.6.10.
- l) DCS design principles are addressed in U.S. EPR FSAR Tier 2, Section 7.1.1.6. The other special design basis that is imposed on the I&C systems design is the defense-in-depth and diversity analysis based on a software common cause failure. The overall defense-in-depth and diversity is described in Reference 1.

Incore Instrumentation System

Information about the incore instrumentation system (IIS) is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.5.2. Specific information for the IIS for IEEE 603-1998, Clause 4 is as follows:

- a) The modes of operation of the U.S. EPR are provided in U.S. EPR FSAR Tier 2, Chapter 16, Table 3.3.1-1. The AOOs and PAs that require protective action are analyzed in U.S. EPR FSAR Tier 2, Chapter 15. The initiating events analyzed are listed in U.S. EPR FSAR Tier 2, Table 15.0-1. The initial conditions analyzed for each event are presented in U.S. EPR FSAR Tier 2, Table 15.0-5.
- b) The IIS is designed so that safety-related functions required for an AOO or PA are performed in the presence of the following:
 - Single detectable failures within the IIS.
 - Failures caused by the single failure.
 - Failures and spurious system actions that cause or are caused by the AOO or PA requiring the safety function.

SPNDs provide input signals to PS for the performance of a reactor trip due to Low DNBR and a reactor trip due to High Linear Power Density (HLPD) reactor trip.

- c) BISI of safety-related systems is provided by the PICS. BISI is also addressed in U.S. EPR FSAR Tier 2, Sections 7.1.3.1.4, 7.5.2.1.1, 7.5.2.2.4, and 7.5.2.2.5.
- d) The IIS provides SPND signals to the PS for reactor trip due to Low DNBR and HLPD. The PS processes both automatic and manual reactor trip functions.

The PS initiates automatic reactor trip to mitigate the effects of AOOs and PAs. The PS automatically initiates a reactor trip when selected variables, provided in U.S. EPR FSAR Tier 2, Table 7.2-1 exceed setpoints that are indicative of conditions that require protective action. U.S. EPR FSAR Tier 2, Table 7.2-1 provides the protective function and the range of each variable.

The analytical limit for reactor trip setpoints is provided in U.S. EPR FSAR Tier 2, Table 15.0-7.

RAI 414, Question 7.3-30 provides time response information for each variable associated with protective functions of the PS.

- e) The SICS provides a manual reactor trip signal to the PS.

For the U.S. EPR, protective actions are performed by the PS, and the reactor trips are provided in U.S. EPR FSAR Tier 2, Table 7.2-1. Plant-specific EOPs and AOPs for the U.S. EPR design need to be developed. The plant-specific EOPs will be developed from a TBD that will be based on hundreds of safety analyses, which are not yet completed. The emergency operating procedure development is described in U.S. EPR FSAR Tier 2, Chapter 13.5.2.1.2, which states that the EOPs for the U.S. EPR design will be based on the same symptom-based approach and mitigation strategies as the B&W Unit EOP TBD.

This document, which represents the vendor EPG, provides the bases that were used to develop the plant-specific EOPs for currently operating plants that have the B&W nuclear steam supply system. The relevant NRC regulation requirements that will be used as acceptance criteria during the development of the EPGs and EOPs are provided in U.S. EPR FSAR Tier 2, Chapter 13.4.2.1.4. Since EPGs and EOPs have not been developed, the points in time and plant conditions for allowance of manual control are not known, the justification for permitting initiation or control subsequent to initiation solely by manual means is not known, and the expected range of environmental conditions imposed on the operator during normal, abnormal and accident conditions throughout manual operations is not known.

- f) The SPNDs have spatial dependence required for protective purposes. The minimum number of SPNDs required for protective purposes is provided in U.S. EPR FSAR Tier 2, Chapter 16, Table 3.3.1-1.
- g) Information concerning transient and steady-state motive and control power and environmental conditions during normal, abnormal and accident conditions is for safety systems provided as follows:
 - Electrical Information is provided in U.S. EPR FSAR Tier 2, Section 8.2.2.4, Tables 8.3-1, 8.3-11 and 8.3-12.
 - Radiation zone information is provided in U.S. EPR FSAR Tier 2, Figures 12.3-21 through 12.3-29, 12.3-64 through 12.3-66, 12.3-70, and 12.3-81.
 - Environmental conditions are provided in U.S. EPR FSAR Tier 2, Table 9.4.14-1.
 - Electromagnetic and radio-frequency interference qualification is provided in U.S. EPR FSAR Tier 2, Section 7.1.3.4.17.
 - Seismic and dynamic qualification of electrical and I&C equipment is provided in U.S. EPR FSAR Tier 2, Section 3.10.2.
 - Methodology for qualifying safety-related electrical equipment is provided in U.S. EPR FSAR Tier 2, Appendix 3D.
 - Seismic qualification techniques are provided in U.S. EPR FSAR Tier 2, Appendix 3E
- h) Information about conditions that have the potential of degrading safety system performance is provided as follows:
 - Fire, for which fire protection compliance information is provided in U.S. EPR FSAR Tier 2, Section 3.1.1.3.1.
 - Wind and tornado loading, for which information is provided in U.S. EPR FSAR Tier 2, Section 3.3.
 - Safeguards Building flooding, for which the analysis is provided in U.S. EPR FSAR Tier 2, Section 3.4.3.4.
 - Missile projection, for which protection information is provided in U.S. EPR FSAR Tier 2, Section 3.5.

- Environmental qualification of electrical equipment, which includes fluid system separation, equipment separation and redundancy, is provided in U.S. EPR FSAR Tier 2, Section 3.11.
 - Loss of ventilation to electrical equipment, for which information is provided in U.S. EPR FSAR Tier 2, Section 3.11.4.
 - The IIS is contained within the Seismic Category I structures. Information pertaining to pipe breaks is provided in U.S. EPR FSAR Tier 2, Section 3.4.3.1.
 - The calculation of Low DNBR and HLPD is performed by the PS. The P2 permissive condition bypasses both the Low DNBR and HLPD reactor trip function at low power levels. To preclude operator error, this bypass is automatically removed as power increase above the P2 permissive setpoint. Additional information is provided in U.S. EPR FSAR Tier 2, Sections 7.2.1.2.1 and 7.2.1.2.2.
 - Independence between safety-related I&C systems and non-safety related I&C systems is maintained to prevent failure in a non-safety system from affecting the IIS. Additional information is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.6.4.
- i) The IIS will be designed to meet the applicable requirements and guidance identified in U.S. EPR FSAR Tier 2, Section 7.1.1.2.1.

Information about the TXS platform design is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.2.1. System design principles are addressed in U.S. EPR FSAR Tier 2, Section 7.1.1.6.

- j) The PS performs the protective actions for the U.S. EPR. Reactor trips are listed in U.S. EPR FSAR Tier 2, Table 7.2-1, and reactor trip setpoints are provided in U.S. EPR FSAR Tier 2, Table 15.0-7.

Critical points in time or plant conditions that define the proper completion of a safety function are addressed in plant-specific EOPs and AOPs; however, the plant-specific EOPs and AOPs for the U.S. EPR design have not yet been written. The plant-specific EOPs will be developed from a TBD that will be based on hundreds of safety analyses, which are not yet completed. U.S. EPR FSAR Tier 2, Section 13.5.2.1.2 states that the EOPs for the U.S. EPR design will be based on the same symptom-based approach and mitigation strategies as the B&W Unit EOP TBD. This document, which represents the vendor EPG, provides the bases that were used to develop the plant-specific EOPs for currently operating plants that have the B&W nuclear steam supply system.

The relevant NRC regulation requirements that will be used as acceptance criteria during the development of the EPGs and EOPs are provided in U.S. EPR FSAR Tier 2, Section 13.4.2.1.4.

- k) For safety-related systems, independence is established so that a single failure does not result in the loss of the safety function of the process system. Information for safety-related equipment protective provisions is provided in U.S. EPR FSAR Tier 2, Section 7.1.3.6.10.
- l) DCS design principles are addressed in U.S. EPR FSAR Tier 2, Section 7.1.1.6. The other special design basis that is imposed on the I&C systems design is the defense-in-depth and

diversity analysis based on a software common cause failure. The overall defense-in-depth and diversity is described in Reference 1.

Excure Instrumentation System

Information about the excure instrumentation system (EIS) is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.5.3. Specific information for the EIS for IEEE 603-1998, Clause 4 is as follows:

- a) The modes of operation of the U.S. EPR are provided in U.S. EPR FSAR Tier 2, Chapter 16, Table 3.3.1-1. The AOO or PA that require protective action are analyzed in U.S. EPR FSAR Tier 2, Chapter 15. The initiating events analyzed are listed in U.S. EPR FSAR Tier 2, Table 15.0-1. The initial conditions analyzed for each event are presented in U.S. EPR FSAR Tier 2, Table 15.0-5.
- b) The EIS is designed so that safety-related functions required for an AOO or PA are performed in the presence of the following:
 - Single detectable failures within the EIS.
 - Failures caused by the single failure.
 - Failures and spurious system actions that cause or are caused by the AOO or PA requiring the safety function.
 - Intermediate range neutron detector signals are sent to the PS for a Low Doubling Time reactor trip and High Neutron Flux reactor trip.
 - Power range neutron detector signals are sent to the PS for a High Neutron Flux Rate of Change reactor trip.
- c) BISI of safety-related systems is provided by the PICS. BISI is also addressed in U.S. EPR FSAR Tier 2, Sections 7.1.3.1.4, 7.5.2.1.1, 7.5.2.2.4, and 7.5.2.2.5.
- d) The EIS provides intermediate range neutron detector signals and power range neutron detector signals to the PS for automatic reactor trips.

The PS processes both automatic and manual reactor trip functions. The PS initiates automatic reactor trip to mitigate the effects of AOO and PAs. The PS automatically initiates a reactor trip when selected variables, provided in U.S. EPR FSAR Table 7.2-1 exceed setpoints that are indicative of conditions that require protective action. U.S. EPR FSAR Tier 2, Table 7.2-1 provides the protective function and the range of each variable.

The analytical limit for reactor trip setpoints is provided in U.S. EPR FSAR Tier 2, Table 15.0-7.

RAI 414, Question 7.3-30 provides time response information for each variable associated with protective functions of the PS.

- e) The SICS provides a manual reactor trip signal to the PS.

For the U.S. EPR, protective actions are performed by the PS and the reactor trips are provided in U.S. EPR FSAR Tier 2, Table 7.2-1. Plant-specific EOPs and AOPs for the U.S.

EPR design need to be developed. The plant-specific EOPs will be developed from a TBD that will be based on hundreds of safety analyses, which are not yet completed. U.S. EPR FSAR Tier 2, Section 13.5.2.1.2 states that the EOPs for the U.S. EPR design will be based on the same symptom-based approach and mitigation strategies as the B&W Unit EOP TBD. This document, which represents the vendor EPG, provides the bases that were used to develop the plant-specific EOPs for currently operating plants that have the B&W nuclear steam supply system. The relevant NRC regulation requirements that will be used as acceptance criteria during the development of the EPGs and EOPs are provided in U.S. EPR FSAR Tier 2, Chapter 13.4.2.1.4. Since EPGs and EOPs have not been developed, the points in time and plant conditions for allowance of manual control are not known, the justification for permitting initiation or control subsequent to initiation solely by manual means is not known, and the expected range of environmental conditions imposed on the operator during normal, abnormal and accident conditions throughout manual operations is not known.

- f) The EIS does not have variables that have spatial dependence or sensors required for protective purposes.
- g) Information concerning transient and steady-state motive and control power and environmental conditions during normal, abnormal and accident conditions is for safety systems provided as follows:
 - Electrical Information is provided in U.S. EPR FSAR Tier 2, Section 8.2.2.4, Tables 8.3-1, 8.3-11 and 8.3-12.
 - Radiation zone information is provided in U.S. EPR FSAR Tier 2, Figures 12.3-21 through 12.3-29, 12.3-64 through 12.3-66, 12.3-70, and 12.3-81.
 - Environmental conditions are provided in U.S. EPR FSAR Tier 2, Table 9.4.14-1.
 - Electromagnetic and radio-frequency interference qualification is provided in U.S. EPR FSAR Tier 2, Section 7.1.3.4.17.
 - Seismic and dynamic qualification of electrical and I&C equipment is provided in U.S. EPR FSAR Tier 2, Section 3.10.2.
 - Methodology for qualifying safety-related electrical equipment is provided in U.S. EPR FSAR Tier 2, Appendix 3D.
 - Seismic qualification techniques are provided in U.S. EPR FSAR Tier 2, Appendix 3E
- h) Information about conditions that have the potential of degrading safety system performance is provided as follows:
 - Fire, for which fire protection compliance information is provided in U.S. EPR FSAR Tier 2, Section 3.1.1.3.1.
 - Wind and tornado loading, for which information is provided in U.S. EPR FSAR Tier 2, Section 3.3.
 - Safeguards Building flooding, for which the analysis is provided in U.S. EPR FSAR Tier 2, Section 3.4.3.4.
 - Missile projection, for which protection information is provided in U.S. EPR FSAR Tier 2, Section 3.5.

- Environmental qualification of electrical equipment, which includes fluid system separation, equipment separation and redundancy, is provided in U.S. EPR FSAR Tier 2, Section 3.11.
 - Loss of ventilation to electrical equipment, for which information is provided in U.S. EPR FSAR Tier 2, Section 3.11.4.
 - The EIS is contained within the Seismic Category I structures. Information pertaining to pipe breaks is provided in U.S. EPR FSAR Tier 2, Section 3.4.3.1.
 - The function of a reactor trip on High Neutron Flux and Low Doubling Time is performed by the PS. The P6 permissive condition bypasses both the High Neutron Flux and Low Doubling Time function above a fixed core thermal power level. This bypass is automatically removed when core thermal power decrease below the P6 permissive setpoint to preclude operator error. Additional information is provided in U.S. EPR FSAR Tier 2, Sections 7.2.1.2.8 and 7.2.1.2.9.
 - Independence between safety-related I&C systems and non-safety related I&C systems is maintained to prevent failure in a non-safety system from affecting the EIS. Additional information is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.6.4.
- i) The EIS will be designed to meet the applicable requirements and guidance identified in U.S. EPR FSAR Tier 2, Section 7.1.1.2.1.

Information about the TXS platform design is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.2.1. System design principles are addressed in U.S. EPR FSAR Tier 2, Section 7.1.1.6.

- j) The PS performs the protective actions for the U.S EPR. Reactor trips are listed in U.S. EPR FSAR Tier 2, Table 7.2-1 and reactor trip setpoints are provided in U.S. EPR FSAR Tier 2, Table 15.0-7.

Critical points in time or plant conditions that define the proper completion of a safety function are addressed in plant-specific EOPs and AOPs; however, the plant-specific EOPs and AOPs for the U.S EPR design have not yet been written. The plant-specific EOPs will be developed from a TBD that will be based on hundreds of safety analyses, which are not yet completed. U.S. EPR FSAR Tier 2, Section 13.5.2.1.2 states that the EOPs for the U.S. EPR design will be based on the same symptom-based approach and mitigation strategies as the B&W Unit EOP TBD. This document, which represents the vendor EPG, provides the bases that were used to develop the plant-specific EOPs for currently operating plants that have the B&W nuclear steam supply system.

The relevant NRC regulation requirements that will be used as acceptance criteria during the development of the EPGs and EOPs are provided in U.S. EPR FSAR Tier 2, Section 13.4.2.1.4.

- k) For safety-related systems, independence is established so that a single failure does not result in the loss of the safety function of the process system. Information for safety-related equipment protective provisions is provided in U.S. EPR FSAR Tier 2, Section 7.1.3.6.10.
- l) Distributed control system (DCS) design principles are addressed in U.S. EPR FSAR Tier 2, Section 7.1.1.6. The other special design basis that is imposed on the I&C systems design

is the defense-in-depth and diversity analysis based on a software common cause failure. The overall defense-in-depth and diversity is described in Reference 1.

Boron Concentration System

Information about the boron concentration system (BCMS) is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.5.4. Specific information for the BCMS for IEEE 603-1998, Clause 4 is as follows:

- a) The modes of operation of the U.S. EPR are provided in U.S. EPR FSAR Tier 2 Chapter 16, Table 3.3.1-1. The AOOs and PAs requiring protective action are analyzed in U.S. EPR FSAR Tier 2, Chapter 15. The initiating events analyzed are listed in U.S. EPR FSAR Tier 2, Table 15.0-1. The initial conditions analyzed for each event are presented in U.S. EPR FSAR Tier 2, Table 15.0-5.
- b) The BCMS is designed so that safety-related functions required for an AOO or PA are performed in the presence of the following:
 - Single detectable failures within the BCMS.
 - Failures caused by the single failure.
 - Failures and spurious system actions that cause or are caused by the AOO or PA requiring the safety function.

The BCMS provides boron concentration input signal to the PS for the CVCS Isolation for Anti-Dilution function as listed in U.S. EPR FSAR Tier 2, Table 7.3-1. This function is addressed in U.S. EPR FSAR Tier 2, Section 7.3.1.2.11.

- c) BISI of safety-related systems is provided by the PICS. BISI is also addressed in U.S. EPR FSAR Tier 2, Sections 7.1.3.1.4, 7.5.2.1.1, 7.5.2.2.4, and 7.5.2.2.5.
- d) The BCMS provides boron concentration input signal to the PS for the CVCS Isolation for Anti-Dilution function, as listed in U.S. EPR FSAR Tier 2, Table 7.3-1. This function is addressed in U.S. EPR FSAR Tier 2, Section 7.3.1.2.11.

The PS processes both automatic and manual ESF functions to mitigate the effects of AOO and PA. U.S. EPR FSAR Tier 2, Table 7.3-1 provides the ESF functions and the range of each variable.

RAI 414, Question 7.3-30 provides time response information for each variable associated with protective functions of the PS.

- e) CVCS Isolation on Anti-Dilution Mitigation may be performed manually as indicated by U.S. EPR FSAR Tier 2, Table 7.3-5.

Plant-specific EOPs and AOPs for the U.S. EPR design need to be developed. The plant-specific EOPs will be developed from a TBD that will be based on hundreds of safety analyses, which are not yet completed. U.S. EPR FSAR Tier 2, Section 13.5.2.1.2 states that the EOPs for the U.S. EPR design will be based on the same symptom-based approach and mitigation strategies as the B&W Unit EOP TBD. This document, which represents the vendor EPG, provides the bases that were used to develop the plant-specific EOPs for

currently operating plants that have the B&W nuclear steam supply system. The relevant NRC regulation requirements that will be used as acceptance criteria during the development of the EPGs and EOPs are provided in U.S. EPR FSAR Tier 2, Section 13.4.2.1.4. Since EPGs and EOPs have not been developed, the points in time and plant conditions for allowance of manual control are not known, the justification for permitting initiation or control subsequent to initiation solely by manual means is not known, and the expected range of environmental conditions imposed on the operator during normal, abnormal and accident conditions throughout manual operations is not known.

- f) The BCMS does not have variables that have spatial dependence for protective purposes.
- g) Information concerning transient and steady-state motive and control power and environmental conditions during normal, abnormal and accident conditions is for safety systems provided as follows:
- Electrical Information is provided in U.S. EPR FSAR Tier 2, Section 8.2.2.4, and Tables 8.3-1, 8.3-11 and 8.3-12.
 - Radiation zone information is provided in U.S. EPR FSAR Tier 2, Figures 12.3-21 through 12.3-29, 12.3-64 through 12.3-66, 12.3-70, and 12.3-81.
 - Environmental conditions are provided in U.S. EPR FSAR Tier 2, Table 9.4.14-1.
 - Electromagnetic and radio-frequency interference qualification is provided in U.S. EPR FSAR Tier 2, Section 7.1.3.4.17.
 - Seismic and dynamic qualification of electrical and I&C equipment is provided in U.S. EPR FSAR Tier 2, Section 3.10.2.
 - Methodology for qualifying safety-related electrical equipment is provided in U.S. EPR FSAR Tier 2, Appendix 3D.
 - Seismic qualification techniques are provided in U.S. EPR FSAR Tier 2, Appendix 3E.
- h) Information about conditions that have the potential of degrading safety system performance is provided as follows:
- Fire, for which fire protection compliance information is provided in U.S. EPR FSAR Tier 2, Section 3.1.1.3.1.
 - Wind and tornado loading, for which information is provided in U.S. EPR FSAR Tier 2, Section 3.3.
 - Safeguards Building flooding, for which the analysis is provided in U.S. EPR FSAR Tier 2, Section 3.4.3.4.
 - Missile projection, for which protection information is provided in U.S. EPR FSAR Tier 2, Section 3.5.
 - Environmental qualification of electrical equipment, which includes fluid system separation, equipment separation and redundancy, is provided in U.S. EPR FSAR Tier 2, Section 3.11.
 - Loss of ventilation to electrical equipment, for which information is provided in U.S. EPR FSAR Tier 2, Section 3.11.4.

- The BCMS is contained within a Seismic Category I structure. Information pertaining to pipe breaks is provided in U.S. EPR FSAR Tier 2, Section 3.4.3.1.
 - CVCS Isolation on Anti-Dilution Mitigation may be performed manually from the SICS. The MCR and RSS will be designed to minimize human error and incorporate human reliability evaluations as a means to preclude operator error. Additional information is provided in U.S. EPR FSAR Tier 2, Sections 7.1.1.6.5, 18.7.2, 18.7.4, and in Tier 1, Table 3.4-1.
 - Independence between safety-related I&C systems and non-safety related I&C systems is maintained as a means to prevent failure in a non-safety system from affecting the BCMS. Additional information is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.6.4.
- i) The BCMS will be designed to meet the applicable requirements and guidance identified in U.S. EPR FSAR Tier 2, Section 7.1.1.2.1.

Information about the TXS platform design is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.2.1. System design principles are addressed in U.S. EPR FSAR Tier 2, Section 7.1.1.6.

- j) The BCMS provides boron concentration input signal to the PS for the CVCS Isolation for Anti-Dilution function as listed in Table 7.3-1 and the PS performs the protective actions for the U.S. EPR.

Critical points in time or plant conditions that define the proper completion of a safety function are addressed in plant-specific EOPs and AOPs; however, the plant-specific EOPs and AOPs for the U.S. EPR design have not yet been written. The plant-specific EOPs will be developed from a TBD that will be based on hundreds of safety analyses, which are not yet completed. U.S. EPR FSAR Tier 2, Section 13.5.2.1.2 states that the EOPs for the U.S. EPR design will be based on the same symptom-based approach and mitigation strategies as the B&W Unit EOP TBD. This document, which represents the vendor EPG, provides the bases that were used to develop the plant-specific EOPs for currently operating plants that have the B&W nuclear steam supply system.

The relevant NRC regulation requirements that will be used as acceptance criteria during the development of the EPGs and EOPs are provided in U.S. EPR FSAR Tier 2, Section 13.4.2.1.4.

- k) For safety-related systems, independence is established so that a single failure does not result in the loss of the safety function of the process system. Information for safety-related equipment protective provisions is provided in U.S. EPR FSAR Tier 2, Section 7.1.3.6.10.
- l) DCS design principles are addressed in U.S. EPR FSAR Tier 2, Section 7.1.1.6. The other special design basis that is imposed on the I&C systems design is the defense-in-depth and diversity analysis based on a software common cause failure. The overall defense-in-depth and diversity is described in Reference 1.

Radiation Monitoring System

The radiation monitoring system (RMS) does not perform automatic system actuations.

Information about the RMS is provided in U.S. EPR FSAR Section 7.1.1.5.5. Specific information for the RMS for IEEE 603-1998, Clause 4 is as follows:

- a) The modes of operation of the U.S. EPR are provided in U.S. EPR FSAR Tier 2, Chapter 16, Table 3.3.1-1. The AOOs and postulated accident PAs requiring protective action are analyzed in U.S. EPR FSAR Tier 2, Chapter 15. The initiating events analyzed are listed in U.S. EPR FSAR Tier 2, Table 15.0-1. The initial conditions analyzed for each event are presented in U.S. EPR FSAR Tier 2, Table 15.0-5.
- b) The RMS is designed so that safety-related functions required for an AOO or PA are performed in the presence of the following:
 - Single detectable failures within the RMS.
 - Failures caused by the single failure.
 - Failures and spurious system actions that cause or are caused by the AOO or PA requiring the safety function.
 - High Range Containment Radiation monitors provide an input signal to the PS for the Containment Isolation ESF function.
 - MCR air intake duct activity radiation monitors provide an input signal to the PS for the MCR air conditioning system isolation and filtering ESF function.
- c) BISI of safety-related systems is provided by the PICS. BISI is also addressed in U.S. EPR FSAR Tier 2, Sections 7.1.3.1.4, 7.5.2.1.1, 7.5.2.2.4, and 7.5.2.2.5.
- d) The RMS provides high range containment radiation monitor signals and MCR air intake duct activity radiation monitor signals to the PS for performance of ESF functions.

The PS processes both automatic and manual ESF functions to mitigate the effects of AOO and PA. U.S. EPR FSAR Tier 2, Table 7.3-1 provides the ESF functions and the range of each variable.

RAI 414, Question 7.3-30 provides time response information for each variable associated with protective functions of the PS.

- e) Containment Isolation and CRACS Isolation and Filtering functions may be performed manually as indicated by U.S. EPR FSAR Tier 2, Table 7.3-5.

For the U.S. EPR, protective actions are performed by the PS and the reactor trips are provided in U.S. EPR FSAR Tier 2, Table 7.2-1. EOPs and AOPs for the U.S. EPR design need to be developed. The plant-specific EOPs will be developed from a TBD that will be based on hundreds of safety analyses, which are not yet completed. U.S. EPR FSAR Tier 2, Section 13.5.2.1.2 states that the EOPs for the U.S. EPR design will be based on the same symptom-based approach and mitigation strategies as the B&W Unit EOP TBD. This document, which represents the vendor EPG, provides the bases that were used to develop the plant-specific EOPs for currently operating plants that have the B&W nuclear steam supply system. The relevant NRC regulation requirements that will be used as acceptance criteria during the development of the EPGs and EOPs are provided in U.S. EPR FSAR Tier 2, Chapter 13.4.2.1.4. Since EPGs and EOPs have not been developed, the points in time

and plant conditions for allowance of manual control are not known, the justification for permitting initiation or control subsequent to initiation solely by manual means is not known, and the expected range of environmental conditions imposed on the operator during normal, abnormal and accident conditions throughout manual operations is not known.

- f) The RMS does not have variables that have spatial dependence or sensors required for protective purposes.
- g) Information concerning transient and steady-state motive and control power and environmental conditions during normal, abnormal and accident conditions is for safety systems provided as follows:
- Electrical Information is provided in U.S. EPR FSAR Tier 2, Section 8.2.2.4, and Tables 8.3-1, 8.3-11 and 8.3-12.
 - Radiation zone information is provided in U.S. EPR FSAR Tier 2, Figures 12.3-21 through 12.3-29, 12.3-64 through 12.3-66, 12.3-70, and 12.3-81.
 - Environmental conditions are provided in U.S. EPR FSAR Tier 2, Table 9.4.14-1.
 - Electromagnetic and radio-frequency interference qualification is provided in U.S. EPR FSAR Tier 2, Section 7.1.3.4.17.
 - Seismic and dynamic qualification of electrical and I&C equipment is provided in U.S. EPR FSAR Tier 2, Section 3.10.2.
 - Methodology for qualifying safety-related electrical equipment is provided in U.S. EPR FSAR Tier 2, Appendix 3D.
 - Seismic qualification techniques are provided in U.S. EPR FSAR Tier 2, Appendix 3E.
- h) Information about conditions that have the potential of degrading safety system performance is provided as follows:
- Fire, for which fire protection compliance information is provided in U.S. EPR FSAR Tier 2, Section 3.1.1.3.1.
 - Wind and tornado loading, for which information is provided in U.S. EPR FSAR Tier 2, Section 3.3.
 - Safeguards Building flooding, for which the analysis is provided in U.S. EPR FSAR Tier 2, Section 3.4.3.4.
 - Missile projection, for which protection information is provided in U.S. EPR FSAR Tier 2, Section 3.5.
 - Environmental qualification of electrical equipment, which includes fluid system separation, equipment separation and redundancy, is provided in U.S. EPR FSAR Tier 2, Section 3.11.
 - Loss of ventilation to electrical equipment, for which information is provided in U.S. EPR FSAR Tier 2, Section 3.11.4.
 - The safety related portions of the RMS providing input to the PS are contained within a Seismic Category I structure. Information pertaining to pipe breaks is provided in U.S. EPR FSAR Tier 2, Section 3.4.3.1.

- Containment Isolation and main control room air conditioning system (CRACS) Isolation and Filtering functions may be performed manually from the SICS. The MCR and RSS will be designed to minimize human error and incorporate human reliability evaluations to preclude operator error. Additional information is provided in U.S. EPR FSAR Tier 2, Sections 7.1.1.6.5, 18.7.2, 18.7.4, and in Tier 1, Table 3.4-1.
 - Independence between safety-related I&C systems and non-safety related I&C systems is maintained to prevent failure in a non-safety system from affecting the RMS. Additional information is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.6.4.
- i) The RMS will be designed to meet the applicable requirements and guidance necessary to interface with the TXS platform.

Information about the TXS platform design is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.2.1. System design principles are addressed in U.S. EPR FSAR Tier 2, Section 7.1.1.6.

- j) The RMS provides radiation monitoring signals to the PS for the Containment Isolation and MCR Air Conditioning System Isolation and Filtering functions as listed in U.S. EPR FSAR Tier 2, Table 7.3-1 and the PS performs the protective actions for the U.S. EPR.

Critical points in time or plant conditions that define the proper completion of a safety function are addressed in plant-specific EOPs and AOPs; however, the plant-specific EOPs and AOPs for the U.S. EPR design have not yet been written. The plant-specific EOPs will be developed from a TBD that will be based on hundreds of safety analyses, which not yet completed. U.S. EPR FSAR Tier 2, Section 13.5.2.1.2 states that the EOPs for the U.S. EPR design will be based on the same symptom-based approach and mitigation strategies as the B&W Unit EOP TBD. This document, which represents the vendor EPG, provides the bases that were used to develop the plant-specific EOPs for currently operating plants that have the B&W nuclear steam supply system.

The relevant NRC regulation requirements that will be used as acceptance criteria during the development of the EPGs and EOPs are provided in U.S. EPR FSAR Tier 2, Section 13.4.2.1.4.

- k) For safety-related systems, independence is established so that a single failure does not result in the loss of the safety function of the process system. Information for safety-related equipment protective provisions is provided in U.S. EPR FSAR Tier 2, Section 7.1.3.6.10.
- l) The RMS provides input to the SCDS. DCS design principles are addressed in U.S. EPR FSAR Tier 2 Section 7.1.1.6. The other special design basis that is imposed on the I&C systems design is the defense-in-depth and diversity analysis based on a software common cause failure. The overall defense-in-depth and diversity is described in Reference 1.

Hydrogen Monitoring System (HMS)

Information about the HMS is provided in U.S. EPR FSAR Tier 2, Sections 6.2.5 and 7.1.1.5.6. Specific information for the HMS for IEEE 603-1998, Clause 4 is as follows:

- a) The modes of operation of the U.S EPR are provided in U.S. EPR FSAR Tier 2, Chapter 16, Table 3.3.1-1. The AOOs and PAs requiring protective action are analyzed in U.S. EPR FSAR Tier 2 Chapter 15. The initiating events analyzed are listed in U.S. EPR FSAR Tier 2, Table 15.0-1. The initial conditions analyzed for each event are presented in U.S. EPR FSAR Tier 2, Table 15.0-5.
- b) The HMS is designed so that safety-related functions required for an AOO or PA are performed in the presence of the following:
- Single detectable failures within the HMS.
 - Failures caused by the single failure.
 - Failures and spurious system actions that cause or are caused by the AOO or PA requiring the safety function.

The HMS does not provide any signals to the PS for protective functions.

- c) BISI of safety-related systems is provided by the PICS. BISI is also addressed in U.S. EPR FSAR Tier 2, Sections 7.1.3.1.4, 7.5.2.1.1, 7.5.2.2.4, and 7.5.2.2.5.
- d) The HMS does not provide any signals to the PS for protective functions.
- e) The HMS does not provide any signals to the PS for protective functions.
- f) The HMS does not have variables that have spatial dependence or sensors required for protective purposes.
- g) Information concerning transient and steady-state motive and control power and environmental conditions during normal, abnormal and accident conditions is for safety systems provided as follows:
- Electrical Information is provided in U.S. EPR FSAR Tier 2, Section 8.2.2.4, and Tables 8.3-1, 8.3-11 and 8.3-12.
 - Radiation zone information is provided in U.S. EPR FSAR Tier 2, Figures 12.3-21 through 12.3-29, 12.3-64 through 12.3-66, 12.3-70, and 12.3-81.
 - Environmental conditions are provided in U.S. EPR FSAR Tier 2, Table 9.4.14-1.
 - Electromagnetic and radio-frequency interference qualification is provided in U.S. EPR FSAR Tier 2, Section 7.1.3.4.17.
 - Seismic and dynamic qualification of electrical and I&C equipment is provided in U.S. EPR FSAR Tier 2, Section 3.10.2.
 - Methodology for qualifying safety-related electrical equipment is provided in U.S. EPR FSAR Tier 2, Appendix 3D.
 - Seismic qualification techniques are provided in U.S. EPR FSAR Tier 2, Appendix 3E.
- h) Information about conditions that have the potential of degrading safety system performance is provided as follows:

- Fire, for which fire protection compliance information is provided in U.S. EPR FSAR Tier 2, Section 3.1.1.3.1.
 - Wind and tornado loading, for which information is provided in U.S. EPR FSAR Tier 2, Section 3.3.
 - Safeguards Building flooding, for which the analysis is provided in U.S. EPR FSAR Tier 2, Section 3.4.3.4.
 - Missile projection, for which protection information is provided in U.S. EPR FSAR Tier 2, Section 3.5.
 - Environmental qualification of electrical equipment, which includes fluid system separation, equipment separation and redundancy, is provided in U.S. EPR FSAR Tier 2, Section 3.11.
 - Loss of ventilation to electrical equipment, for which information is provided in U.S. EPR FSAR Tier 2, Section 3.11.4.
- i) The HMS will be designed to meet the applicable requirements and guidance necessary to interface with the TXS platform. Information about the TXS platform is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.2.1.
- j) The HMS does not provide any signals to the PS for protective functions. Plant conditions for the operation of the HMS are provided in U.S. EPR FSAR Tier 2, Section 6.2.5.3 and Section 19.2.3.3.2.
- k) For safety-related systems, independence is established so that a single failure does not result in the loss of the safety function of the process system. Information for safety-related equipment protective provisions is provided in U.S. EPR FSAR Tier 2, Section 7.1.3.6.10.
- l) The HMS continuously measures the hydrogen concentration in containment during and after the accident, and remains functional during and after exposure to the accident environmental conditions in accordance with 10 CFR 50.44(c)(4)(ii).

Signal Conditioning and Distribution System

Information about the signal conditioning and distribution system (SCDS) is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.4.8. Specific information for the SCDS for IEEE 603-1998, Clause 4 is as follows:

- a) The modes of operation of the U.S. EPR are provided in U.S. EPR FSAR Tier 2, Chapter 16, Table 3.3.1-1. The AOOs and postulated accident PAs requiring protective action are analyzed in U.S. EPR FSAR Tier 2, Chapter 15. The initiating events analyzed are listed in U.S. EPR FSAR Tier 2, Table 15.0-1. The initial conditions analyzed for each event are presented in U.S. EPR FSAR Tier 2, Table 15.0-5.
- b) The SCDS is designed so that safety-related functions required for an AOO or PA are performed in the presence of the following:
- Single detectable failures within the SCDS.
 - Failures caused by the single failure.

- Failures and spurious system actions that cause or are caused by the AOO or PA requiring the safety function.

The SCDS receives hardwired inputs from sensors or black boxes and sends hardwired signal outputs to the PS.

- c) BISI of safety-related systems is provided by the PICS. BISI is also addressed in U.S. EPR FSAR Tier 2, Sections 7.1.3.1.4, 7.5.2.1.1, 7.5.2.2.4, and 7.5.2.2.5.
- d) The SCDS receives hardwired inputs from sensors or black boxes and sends hardwired signal outputs to the PS.

The PS processes both automatic and manual reactor trip functions. The PS initiates automatic reactor trip to mitigate the effects of AOOs and PAs. The PS automatically initiates a reactor trip when selected variables, provided in U.S. EPR FSAR Tier 2, Table 7.2-1, exceed setpoints that are indicative of conditions that require protective action. U.S. EPR FSAR Tier 2, Table 7.2-1 provides the protective function and the range of each variable.

The PS processes both automatic and manual ESF functions to mitigate the effects of AOO and PA. U.S. EPR FSAR Tier 2, Table 7.3-1 provides the ESF functions and the range of each variable.

The analytical limit for reactor trip setpoints is provided in U.S. EPR FSAR Tier 2, Table 15.0-7.

RAI 414, Question 7.3-30 provides time response information for each variable associated with protective functions of the PS.

- e) The list of ESF functions that may be performed manually is provided indicated in U.S. EPR FSAR Tier 2, Table 7.3-5.

For the U.S. EPR, protective actions are performed by the PS and the reactor trips are provided in U.S. EPR FSAR Tier 2, Table 7.2-1. Plant-specific EOPs and AOPs for the U.S. EPR design need to be developed. The plant-specific EOPs will be developed from a TBD that will be based on hundreds of safety analyses, which are not yet completed. U.S. EPR FSAR Tier 2, Section 13.5.2.1.2 states that the EOPs for the U.S. EPR design will be based on the same symptom-based approach and mitigation strategies as the B&W Unit EOP TBD. This document, which represents the vendor EPG, provides the bases that were used to develop the plant-specific EOPs for currently operating plants that have the B&W nuclear steam supply system. The relevant NRC regulation requirements that will be used as acceptance criteria during the development of the EPGs and EOPs are provided in U.S. EPR FSAR Tier 2, Section 13.4.2.1.4. Since EPGs and EOPs have not been developed, the points in time and plant conditions for allowance of manual control are not known, the justification for permitting initiation or control subsequent to initiation solely by manual means is not known, and the expected range of environmental conditions imposed on the operator during normal, abnormal and accident conditions throughout manual operations is not known.

- f) The SCDS does not have variables that have spatial dependence or sensors required for protective purposes.
- g) Information concerning transient and steady-state motive and control power and environmental conditions during normal, abnormal and accident conditions is for safety systems provided as follows:
- Electrical Information is provided in U.S. EPR FSAR Tier 2, Section 8.2.2.4, and Tables 8.3-1, 8.3-11 and 8.3-12.
 - Radiation zone information is provided in U.S. EPR FSAR Tier 2, Figures 12.3-21 through 12.3-29, 12.3-64 through 12.3-66, 12.3-70, and 12.3-81.
 - Environmental conditions are provided in U.S. EPR FSAR Tier 2, Table 9.4.14-1.
 - Electromagnetic and radio-frequency interference qualification is provided in U.S. EPR FSAR Tier 2, Section 7.1.3.4.17.
 - Seismic and dynamic qualification of electrical and I&C equipment is provided in U.S. EPR FSAR Tier 2, Section 3.10.2.
 - Methodology for qualifying safety-related electrical equipment is provided in U.S. EPR FSAR Tier 2, Appendix 3D.
 - Seismic qualification techniques are provided in U.S. EPR FSAR Tier 2, Appendix 3E.
- h) Information about conditions that have the potential of degrading safety system performance is provided as follows:
- Fire, for which fire protection compliance information is provided in U.S. EPR FSAR Tier 2, Section 3.1.1.3.1.
 - Wind and tornado loading, for which information is provided in U.S. EPR FSAR Tier 2, Section 3.3.
 - Safeguards Building flooding, for which the analysis is provided in U.S. EPR FSAR Tier 2, Section 3.4.3.4.
 - Missile projection, for which protection information is provided in U.S. EPR FSAR Tier 2, Section 3.5.
 - Environmental qualification of electrical equipment, which includes fluid system separation, equipment separation and redundancy, is provided in U.S. EPR FSAR Tier 2, Section 3.11.
 - Loss of ventilation to electrical equipment, for which information is provided in U.S. EPR FSAR Tier 2, Section 3.11.4.
 - The safety-related portions of the SCDS providing input to the PS are contained within a Seismic Category I structure. Information pertaining to pipe breaks is provided in U.S. EPR FSAR Tier 2, Section 3.4.3.1.
 - The SCDS does not perform actuation functions.
 - Independence between safety-related I&C systems and non-safety related I&C systems is maintained as a means to prevent failure in a non-safety system from affecting the SCDS. Additional information is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.6.4.

- i) The SCDS will be designed to meet the applicable requirements and guidance identified in U.S. EPR FSAR Section 7.1.1.2.1.

Information about the TXS platform design is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.2.1. System design principles are addressed in U.S. EPR FSAR Tier 2, Section 7.1.1.6.

- j) The PS performs the protective actions for the U.S. EPR. Reactor trips are listed in U.S. EPR FSAR Tier 2, Table 7.2-1, and reactor trip setpoints are provided in U.S. EPR FSAR Tier 2, Table 15.0-7.

Critical points in time or plant conditions that define the proper completion of a safety function are addressed in plant-specific EOPs and AOPs; however, the plant-specific EOPs and AOPs for the U.S. EPR design have not yet been written. The plant-specific EOPs will be developed from a TBD that will be based on hundreds of safety analyses, which are not yet completed. U.S. EPR FSAR Tier 2, Section 13.5.2.1.2 states that the EOPs for the U.S. EPR design will be based on the same symptom-based approach and mitigation strategies as the B&W Unit EOP TBD. This document, which represents the vendor EPG, provides the bases that were used to develop the plant-specific EOPs for currently operating plants that have the B&W nuclear steam supply system.

The relevant NRC regulation requirements that will be used as acceptance criteria during the development of the EPGs and EOPs are provided in U.S. EPR FSAR Tier 2, Section 13.4.2.1.4.

- k) For safety-related systems, independence is established so that a single failure does not result in the loss of the safety function of the process system. Information for safety-related equipment protective provisions is provided in U.S. EPR FSAR Tier 2, Section 7.1.3.6.10.
- l) DCS design principles are addressed in U.S. EPR FSAR Tier 2, Section 7.1.1.6. The other special design basis that is imposed on the I&C systems design is the defense-in-depth and diversity analysis based on a software common cause failure. The overall defense-in-depth and diversity is described in Reference 1.

Rod Position Measurement System

Information about the rod position measurement system (RPMS) is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.5.14. Specific information for the RPMS for IEEE 603-1998, Clause 4 is as follows:

- a) The modes of operation of the U.S. EPR are provided in U.S. EPR FSAR Tier 2, Chapter 16, Table 3.3.1-1. The AOOs and PAs requiring protective action are analyzed in U.S. EPR FSAR Tier 2, Chapter 15. The initiating events analyzed are listed in U.S. EPR FSAR Tier 2, Table 15.0-1. The initial conditions analyzed for each event are presented in U.S. EPR FSAR Tier 2, Table 15.0-5.
- b) The RPMS is designed so that safety-related functions required for an AOO or PA are performed in the presence of the following:
- Single detectable failures within the RPMS.

- Failures caused by the single failure.
- Failures and spurious system actions that cause or are caused by the AOO or PA requiring the safety function.

The RPMS provides a RCCA position measurement signal to the PS for the performance of a Low DNBR reactor trip.

- c) BISI of safety-related systems is provided by the PICS. BISI is also addressed in U.S. EPR FSAR Tier 2, Sections 7.1.3.1.4, 7.5.2.1.1, 7.5.2.2.4, and 7.5.2.2.5.
- d) The RPMS provides a RCCA position measurement signal to the PS for the performance of a Low DNBR reactor trip

The PS processes both automatic and manual reactor trip functions. The PS initiates automatic reactor trip to mitigate the effects of AOOs and PAs. The PS automatically initiates a reactor trip when selected variables, provided in U.S. EPR FSAR Tier 2, Table 7.2-1, exceed setpoints that are indicative of conditions that require protective action. U.S. EPR FSAR Tier 2, Table 7.2-1 provides the protective function and the range of each variable.

The analytical limit for reactor trip setpoints is provided in U.S. EPR FSAR Tier 2, Table 15.0-7.

RAI 414, Question 7.3-30 provides time response information for each variable associated with protective functions of the PS.

- e) The SICS provides a manual reactor trip signal to the PS.

For the U.S. EPR, protective actions are performed by the PS and the reactor trips are provided in U.S. EPR FSAR Tier 2, Table 7.2-1. EOPs and AOPs for the U.S. EPR design need to be developed. The plant-specific EOPs will be developed from a TBD that will be based on hundreds of safety analyses, which are not yet completed. U.S. EPR FSAR Tier 2, Chapter 13.5.2.1.2 states that the EOPs for the U.S. EPR design will be based on the same symptom-based approach and mitigation strategies as the B&W Unit EOP TBD. This document, which represents the vendor EPG, provides the bases that were used to develop the plant-specific EOPs for currently operating plants that have the B&W nuclear steam supply system. The relevant NRC regulation requirements that will be used as acceptance criteria during the development of the EPGs and EOPs are provided in U.S. EPR FSAR Tier 2, Chapter 13.4.2.1.4. Since EPGs and EOPs have not been developed, the points in time and plant conditions for allowance of manual control are not known, the justification for permitting initiation or control subsequent to initiation solely by manual means is not known, and the expected range of environmental conditions imposed on the operator during normal, abnormal and accident conditions throughout manual operations is not known.

- f) The RPMS does not have variables that have spatial dependence or sensors required for protective purposes.

- g) Information concerning transient and steady-state motive and control power and environmental conditions during normal, abnormal and accident conditions is for safety systems provided as follows:
- Electrical Information is provided in U.S. EPR FSAR Tier 2, Section 8.2.2.4, and Tables 8.3-1, 8.3-11 and 8.3-12.
 - Radiation zone information is provided in U.S. EPR FSAR Tier 2, Figures 12.3-21 through 12.3-29, 12.3-64 through 12.3-66, 12.3-70, and 12.3-81.
 - Environmental conditions are provided in: U.S. EPR FSAR Tier 2, Table 9.4.14-1.
 - Electromagnetic and radio-frequency interference qualification is provided in U.S. EPR FSAR Tier 2, Section 7.1.3.4.17.
 - Seismic and dynamic qualification of electrical and I&C equipment is provided in U.S. EPR FSAR Tier 2, Section 3.10.2.
 - Methodology for qualifying safety-related electrical equipment is provided in U.S. EPR FSAR Tier 2, Appendix 3D.
 - Seismic qualification techniques are provided in U.S. EPR FSAR Tier 2, Appendix 3E.
- h) Information about conditions that have the potential of degrading safety system performance is provided as follows:
- Fire, for which fire protection compliance information is provided in U.S. EPR FSAR Tier 2, Section 3.1.1.3.1.
 - Wind and tornado loading, for which information is provided in U.S. EPR FSAR Tier 2, Section 3.3.
 - Safeguards Building flooding, for which the analysis is provided in U.S. EPR FSAR Tier 2, Section 3.4.3.4.
 - Missile projection, for which protection information is provided in U.S. EPR FSAR Tier 2, Section 3.5.
 - Environmental qualification of electrical equipment, which includes fluid system separation, equipment separation and redundancy, is provided in U.S. EPR FSAR Tier 2, Section 3.11.
 - Loss of ventilation to electrical equipment, for which information is provided in U.S. EPR FSAR Tier 2, Section 3.11.4.
 - The RPMS providing input to the PS are contained within a Seismic Category I structure. Information pertaining to pipe breaks is provided in U.S. EPR FSAR Tier 2, Section 3.4.3.1.
 - The calculation of Low DNBR is performed by the PS. The P2 permissive condition bypasses the Low DNBR reactor trip function at low power levels. This bypass is automatically removed as power increase above the P2 permissive setpoint to preclude operator error. Additional information is provided in U.S. EPR FSAR Tier 2, Section 7.2.1.2.1.

- Independence between safety-related I&C systems and non-safety related I&C systems is maintained to prevent failure in a non-safety system from affecting the RPMS. Additional information is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.6.4.
- i) The RPMS will be designed to meet the applicable requirements and guidance identified in U.S. EPR FSAR Tier 2, Section 7.1.1.2.1.

Information about the TXS platform design is provided in U.S. EPR FSAR Tier 2, Section 7.1.1.2.1. System design principles are addressed in U.S. EPR FSAR Tier 2, Section 7.1.1.6.

- j) The PS performs the protective actions for the U.S. EPR. Reactor trips are listed in U.S. EPR FSAR Tier 2, Table 7.2-1 and reactor trip setpoints are provided in U.S. EPR FSAR Table 15.0-7.

Critical points in time or plant conditions that define the proper completion of a safety function are addressed in plant-specific EOPs and AOPs; however, the plant-specific EOPs and AOPs for the U.S. EPR design have not yet been written. The plant-specific EOPs will be developed from a TBD that will be based on hundreds of safety analyses, which are not yet completed. U.S. EPR FSAR Tier 2, Section 13.5.2.1.2 states that the EOPs for the U.S. EPR design will be based on the same symptom-based approach and mitigation strategies as the B&W Unit EOP TBD. This document, which represents the vendor EPG, provides the bases that were used to develop the plant-specific EOPs for currently operating plants that have the B&W nuclear steam supply system.

The relevant NRC regulation requirements that will be used as acceptance criteria during the development of the EPGs and EOPs are provided in U.S. EPR FSAR Tier 2, Section 13.4.2.1.4.

- k) For safety-related systems, independence is established so that a single failure does not result in the loss of the safety function of the process system. Information for safety-related equipment protective provisions is provided in U.S. EPR FSAR Tier 2, Section 7.1.3.6.10.
- l) DCS design principles are addressed in U.S. EPR FSAR Tier 2, Section 7.1.1.6. The other special design basis that is imposed on the I&C systems design is the defense-in-depth and diversity analysis based on a software common cause failure. The overall defense-in-depth and diversity is described in Reference 1.

FSAR Impact:

U.S. EPR FSAR, Tier 2, Section 7.3.1 and Table 7.3-5 will be revised as described in the response and indicated on the enclosed markup.

References:

1. ANP-10304, Revision 4, "U.S. EPR Diversity and Defense-In-Depth Assessment Technical Report," AREVA NP Inc., June 2011.

U.S. EPR Final Safety Analysis Report Markups

2.4.4 Safety Automation System

1.0 Description

The safety automation system (SAS) provides control and monitoring of safety systems.

The SAS provides the following safety related functions:

- Provides control and monitoring of systems required to transfer the plant to cold shutdown and maintain it in this state following an anticipated operational occurrence (AOO) or postulated accident (PA).
- Provides control and monitoring of safety-related functions of auxiliary support systems.
- Provides safety interlock functions.

2.0 Arrangement

2.1 The location of the SAS equipment is ~~located~~ as listed in Table 2.4.4-1—Safety Automation System Equipment.

2.2 Physical separation exists between ~~the four~~ divisions of the SAS as listed in Table 2.4.4-1.

2.3 Physical separation exists between Class 1E SAS equipment and non-Class 1E equipment.

3.0 Mechanical Design Features

3.1 Equipment identified as Seismic Category I in Table 2.4.4-1 can withstand seismic design basis loads without loss of safety function.

4.0 I&C Design Features, Displays and Controls

4.1 Class 1E SAS equipment listed in Table 2.4.4-1 can ~~perform its safety~~ function when subjected to electromagnetic interference (EMI), radio-frequency interference (RFI), electrostatic discharges (ESD), and power surges.

4.2 The SAS receives input signals from the sources listed in Table 2.4.4-2—Safety Automation System ~~Input Signals~~ Automatic Functions and Input Variables.

4.3 ~~Deleted. The SAS provides the output signals to the recipients listed in Table 2.4.4-3—Safety Automation System Output Signals.~~

4.4 The SAS provides the interlocks listed in Table 2.4.4-~~4~~3—Safety Automation System Interlocks.

4.5 The SAS system design and application software are developed using a process composed of six lifecycle phases with each phase having outputs which must conform to the requirements of that phase. The six lifecycle phases are the following:

07.01-37

- By introducing and varying, a substitute input of the same nature as the measured variable.
- By cross-checking between channels that bear a known relationship to each other.
- By specifying equipment that is stable and the period of time it retains its calibration during post-accident conditions.

4.16 Deleted.

4.17 Hardwired disconnects exist between the service unit (SU) and each divisional monitoring and service interface (MSI) of the SAS. The hardwired disconnects prevent the connection of the SU to more than a single division of the SAS.

07.01-37

4.18 The SAS performs the automatic functions listed in Table 2.4.4-52—Safety Automation System Automatic Functions and Input Variables.

4.19 During data communication, the SAS function processors receive only the pre-defined messages for that specific function processor. Other messages are ignored.

4.20 SAS self-test features are capable of detecting faults consistent with the requirements of the SAS.

4.21 SAS connections to the SICS are hardwired for manual grouped controls.

4.22 SAS manual grouped controls and indications are available on the SICS in the MCR.

4.23 Permissive P15 provides operating bypass capability for the following SAS functions:

- Safety Injection and Heat Removal System - Automatic Trip of LHSI Pump (in RHR Mode) on Low Delta Psat.
- Safety Injection and Heat Removal System - Automatic Trip of LHSI Pump (in RHR Mode) on Low Loop Level.

5.0 Electrical Power Design Features

5.1 ~~Class 1E SAS~~ The components designated as Class 1E in Table 2.4.4-1 are powered from a Class 1E division as listed in Table 2.4.4-1 in a normal or alternate feed condition.

6.0 Environmental Qualification

6.1 Components listed as Class 1E in Table 2.4.4-1 can perform their function under normal environmental conditions, AOOs, and accident and post-accident environmental conditions.

6.07.0 System Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.4.4-64 lists the SAS ITAAC.

07.01-37

Table 2.4.4-2—Safety Automation System Input Signals

Item #	Signal	Source	# Divisions	IEEE Class 1E
1	Steam Generator Pressure	Signal Conditioning and Distribution System (SCDS)	4	Yes
2	Main Steam Relief Control Valve Position	Priority and Actuator Control System (PACS)	4	Yes
3	Neutron Flux from Power Range Detector (PRD) for Nuclear Power Calculation	SCDS	4	Yes
4	Main Steam Relief Isolation Valve Position	PACS	4	Yes
5	Steam Generator Level (WR)	SCDS	4	Yes
6	Emergency Feedwater Flow	SCDS	4	Yes

07.01-37

07.01-37

Table 2.4.4-2— Safety Automation System Automatic Functions and Input Variables (7 Sheets)

<u>Table System</u>	<u>Function Name</u>	<u>Input Variable</u>
<u>Annulus Ventilation System (AVS)</u>	<u>Accident Filtration Train Heater Control</u>	<u>Train 1 Post Heater Temperature</u>
		<u>Train 4 Post Heater Temperature</u>
	<u>Accident Train Switchover</u>	<u>Pressure</u>
		<u>Post Heater Temperature</u>
		<u>Filter Bank Isolation Inlet Damper Position</u>
		<u>Filter Bank Isolation Outlet Damper Position</u>
	<u>Exhaust Fan Signal</u>	
<u>Component Cooling Water System (CCWS)</u>	<u>CCWS Common 1.b Automatic Backup Switchover of Train 1 to Train 2 and Train 2 to Train 1</u>	<u>Train 1 Loss of ESWS Signal</u>
		<u>Train 1 Pump Pressure</u>
		<u>Train 1 Flow Rate</u>
		<u>Train 1 Surge Tank Level</u>
		<u>Train 2 Loss of ESWS Signal</u>
		<u>Train 2 Pump Pressure</u>
		<u>Train 2 Flow Rate</u>
		<u>Train 2 Surge Tank Level</u>
	<u>CCWS Common 2.b Automatic Backup Switchover of Train 3 to Train 4 and Train 4 to Train 3</u>	<u>Train 3 Loss of ESWS Signal</u>
		<u>Train 3 Pump Pressure</u>
		<u>Train 3 Flow Rate</u>
		<u>Train 3 Surge Tank Level</u>
		<u>Train 4 Loss of ESWS Signal</u>
		<u>Train 4 Pump Pressure</u>
		<u>Train 4 Flow Rate</u>
		<u>Train 4 Surge Tank Level</u>
	<u>CCWS Emergency Temperature Control</u>	<u>Heat Exchanger Temp</u>
		<u>Heat Exchanger Bypass Valve Position</u>
	<u>CCWS Emergency Leak Detection</u>	<u>Surge Tank Level</u>
		<u>CCWS Chiller Inlet Flow</u>
<u>CCWS Chiller Outlet Flow</u>		
<u>Common Supply Outlet Flow</u>		

07.01-37

Table 2.4.4-2— Safety Automation System Automatic Functions and Input Variables (7 Sheets)

<u>Table System</u>	<u>Function Name</u>	<u>Input Variable</u>
	<u>CCWS Emergency Leak Detection – Switchover Valves Leakage or Failure</u>	<u>Common Supply Inlet Flow</u>
		<u>Surge Tank 1 Level</u>
		<u>Surge Tank 2 Level</u>
		<u>Surge Tank 3 Level</u>
	<u>CCWS Switchover Valves Interlock</u>	<u>Surge Tank 4 Level</u>
		<u>Train 1 Common 1a Supply Valve Position</u>
		<u>Train 1 Common 1a Return Valve Position</u>
		<u>Train 1 Common 1b Supply Valve Position</u>
		<u>Train 1 Common 1b Return Valve Position</u>
		<u>Train 2 Common 1a Supply Valve Position</u>
		<u>Train 2 Common 1a Return Valve Position</u>
		<u>Train 2 Common 1b Supply Valve Position</u>
	<u>CCWS RCP Thermal Barrier Containment Isolation Valve Interlock</u>	<u>Train 2 Common 1b Return Valve Position</u>
		<u>Common 1b Return Outer Valve Position</u>
		<u>Common 1b Supply Outer Valve Position</u>
		<u>Common 2b Return Outer Valve Position</u>
		<u>Common 2b Supply Outer Valve Position</u>
		<u>Common 1b Return Inner Valve Position</u>
		<u>Common 1b Supply Inner Valve Position</u>
		<u>Common 2b Return Inner Valve Position</u>
<u>Common 2b Supply Inner Valve Position</u>		

07.01-37

Table 2.4.4-2— Safety Automation System Automatic Functions and Input Variables (7 Sheets)

<u>Table System</u>	<u>Function Name</u>	<u>Input Variable</u>
	<u>SCWS Condenser Supply Water Flow Control</u>	<u>Condenser Refrigerant Pressure</u>
<u>Emergency Feedwater System (EFWS)</u>	<u>SG Closed Loop Level Control</u>	<u>SG Level</u>
	<u>Pump Flow Protection</u>	<u>Pump Flow Signal</u>
<u>Essential Service Water Pump Building Ventilation System (ESWPBVS)</u>	<u>ESWPBVS ESWS Pump Rooms Temperature Control</u>	<u>Pump Room Temperature</u>
<u>Fuel Building Ventilation System (FBVS)</u>	<u>Safety-Related Room Heater Control</u>	<u>Room Temperature</u>
	<u>FBVS EBS / FPCS Pump Rooms Heat Removal</u>	<u>Recirculation Temperature</u>
<u>Fuel Pool Cooling and Purification System (FPCPS)</u>	<u>FPCPS Pump Trip on Low Spent Fuel Pool (SFP) Level</u>	<u>SFP Level</u>
<u>In-Containment Refueling Water Storage Tank System (IRWST)</u>	<u>IRWST Boundary Isolation for Preserving IRWST Water Inventory Interlock</u>	<u>IRWST Level</u>
<u>Main Control Room Air Conditioning System (CRACS)</u>	<u>Iodine Filtration Train Heater Control</u>	<u>Carbon Filter Isolation Damper Position</u>
		<u>Exhaust Fan Signal</u>
	<u>Heater Control for Outside Inlet Air</u>	<u>Downstream Temperature</u>
		<u>Inlet Damper Position</u>
	<u>Outlet Damper Position</u>	
<u>Pressure Control</u>	<u>MCR Differential Pressure</u>	
<u>Cooler Temperature Control</u>	<u>Supply Air Temperature</u>	
<u>Main Steam System (MSS)</u>	<u>Steam Generator MSRCV Regulation during Pressure Control</u>	<u>MSRIV Position</u>
		<u>MSRIV Actuation Signal (from PS)</u>
		<u>MSRT Setpoint (from PS)</u>
		<u>SG Pressure</u>
	<u>Steam Generator MSRCV Regulation during Standby Position Pressure Control</u>	<u>MSRCV Position</u>
	<u>Nuclear Power Calculation (from PS)</u>	
<u>Safeguard Building Controlled-Area Ventilation System (SBVS)</u>	<u>SIS/RHRS Pump Rooms Heat Removal</u>	<u>Pump Room Temperature</u>
		<u>SIS/RHR Pump Running Signal</u>

07.01-37

Table 2.4.4-2— Safety Automation System Automatic Functions and Input Variables (7 Sheets)

<u>Table System</u>	<u>Function Name</u>	<u>Input Variable</u>
		<u>SIS/RHR Pump Stopped Signal</u>
	<u>CCWS/EFWS Valve Rooms Heat Removal</u>	<u>Room Temperature</u>
<u>Electrical Division of Safeguard Building Ventilation System (SBVSE)</u>	<u>Supply and Recirculation Exhaust Air Flow Control</u>	<u>Supply Air Temperature</u>
		<u>Outside Air Temperature</u>
		<u>Outside Air Damper Open Position Signal</u>
		<u>Outside Air Damper Closed Position Signal</u>
		<u>Exhaust Damper Open Position Signal</u>
		<u>Exhaust Damper Closed Position Signal</u>
		<u>Recirculation Damper Open Position Signal</u>
		<u>Recirculation Damper Closed Position Signal</u>
	<u>Supply Fan Safe Shut-off</u>	<u>Recirc / Exhaust Fan Stopped Signal</u>
		<u>Outside Air Damper Closed Position Signal</u>
		<u>Recirculation Damper Closed Position Signal</u>
	<u>Recirculation Fan Safe Shut-off</u>	<u>Supply Air Fan Stopped Signal</u>
	<u>Exhaust Fan Safe Shut-off</u>	<u>Exhaust Damper Closed Position</u>
	<u>Supply Air Temperature Heater Control</u>	<u>Supply Air Downstream of Heaters Temperature</u>
	<u>Freeze Protection – Supply Air Temperature</u>	<u>Outside Air Temperature</u>
<u>Supply Air Temperature Control for Supply Air Cooling</u>	<u>Supply Air Downstream of Humidifier Temperature</u>	
<u>Supply Air Temperature Control for Supply Air Heating</u>	<u>Outside Air Temperature</u>	
<u>Battery Room Heater Control</u>	<u>Battery Room Temperature</u>	

07.01-37

Table 2.4.4-2— Safety Automation System Automatic Functions and Input Variables (7 Sheets)

<u>Table System</u>	<u>Function Name</u>	<u>Input Variable</u>
	<u>Battery Room Supply Air Temperature Control</u>	<u>Battery Room Supply Air Temperature</u>
	<u>Emergency Feed Water System (EFWS) Pump Room Heat Removal</u>	<u>EFWS Pump Room Temperature</u>
	<u>Component Cooling Water System (CCWS) Pump Room Heat Removal</u>	<u>CCWS Pump Room Temperature</u>
<u>Safety Chilled Water System (SCWS)</u>	<u>SCWS Train 1 to Train 2 Switchover on Train 1 Low Evaporator Flow / Chiller Black Box Internal Fault / SCWS Chiller Evaporator Water Flow Control / LOOP Re-start Failure</u>	<u>Train 1 Chiller Evaporator Outlet Temperature</u>
		<u>Train 1 Chiller Compressor Oil Pressure</u>
		<u>Train 1 Condenser Refrigerant Pressure</u>
		<u>Train 1 Chiller Evaporator Flow Signal</u>
		<u>Train 1 Cross-Tie Valves Position Signal</u>
		<u>Train 2 Cross-Tie Valves Position Signal</u>
		<u>Train 2 Circulating Pump 1 Running Signal</u>
		<u>Train 2 Circulating Pump 2 Running Signal</u>
	<u>Train 2 Evaporator ΔP Signal</u>	
	<u>Train 2 Chiller Evaporator Flow Signal</u>	
	<u>SCWS Train 2 to Train 1 Switchover on Train 2 Low Evaporator Flow / Chiller Black Box Internal Fault / Loss of UHS-CCWS / SCWS Chiller Evaporator Water Flow Control / LOOP Re-start Failure</u>	<u>Train 1 Circulating Pump 1 Running Signal</u>
		<u>Train 1 Circulating Pump 2 Running Signal</u>
		<u>Train 1 Evaporator ΔP Signal</u>
		<u>Train 1 Chiller Evaporator Flow Signal</u>
<u>Train 1 Cross-Tie Valves Position Signal</u>		

07.01-37

Table 2.4.4-2— Safety Automation System Automatic Functions and Input Variables (7 Sheets)

<u>Table System</u>	<u>Function Name</u>	<u>Input Variable</u>
		<u>Train 2 Cross-Tie Valves Position Signal</u>
		<u>Train 2 Chiller Evaporator Flow Signal</u>
		<u>Train 2 Condenser Refrigerant Pressure</u>
		<u>Train 2 Chiller Compressor Oil Pressure</u>
		<u>Train 2 Chiller Evaporator Outlet Temperature</u>
		<u>Train 2 Condenser Flow Rate Signal</u>
	<u>SCWS Train 3 to Train 4 Switchover on Train 3 Low Evaporator Flow / Chiller Black Box Internal Fault / Loss of UHS-CCWS / SCWS Chiller Evaporator Water Flow Control / LOOP Re-start Failure</u>	<u>Train 3 Condenser Flow Rate Signal</u>
		<u>Train 3 Chiller Evaporator Outlet Temperature</u>
		<u>Train 3 Chiller Compressor Oil Pressure</u>
		<u>Train 3 Condenser Refrigerant Pressure</u>
		<u>Train 3 Chiller Evaporator Flow Signal</u>
		<u>Train 3 Cross-Tie Valves Position Signal</u>
		<u>Train 4 Cross-Tie Valves Position Signal</u>
		<u>Train 4 Circulating Pump 1 Running Signal</u>
		<u>Train 4 Circulating Pump 2 Running Signal</u>
		<u>Train 4 Evaporator ΔP Signal</u>
		<u>Train 4 Chiller Evaporator Flow Signal</u>
	<u>SCWS Train 4 to Train 3 Switchover on Train 4 Low Evaporator Flow / Chiller Black Box Internal Fault / SCWS</u>	<u>Train 3 Circulating Pump 1 Running Signal</u>
		<u>Train 3 Circulating Pump 2 Running Signal</u>

07.01-37

Table 2.4.4-2— Safety Automation System Automatic Functions and Input Variables (7 Sheets)

<u>Table System</u>	<u>Function Name</u>	<u>Input Variable</u>
	<u>Chiller Evaporator Water Flow Control / LOOP Re-start Failure</u>	<u>Train 3 Evaporator ΔP Signal</u>
		<u>Train 3 Chiller Evaporator Flow Signal</u>
		<u>Train 3 Cross-Tie Valves Position Signal</u>
		<u>Train 4 Cross-Tie Valves Position Signal</u>
		<u>Train 4 Chiller Evaporator Flow Signal</u>
		<u>Train 4 Condenser Refrigerant Pressure</u>
		<u>Train 4 Chiller Compressor Oil Pressure</u>
		<u>Train 4 Chiller Evaporator Outlet Temperature</u>
<u>Safety Injection and Residual Heat Removal System (SIS/RHRS)</u>	<u>Automatic RHRS Flow Rate Control</u>	<u>RHRS Flow Rate Signal</u>
		<u>RHRS Temperature</u>
		<u>LHSI Pump Pressure</u>
	<u>Automatic Trip of LHSI Pump (in RHR Mode) on Low ΔPsat</u>	<u>Hot Leg Temperature (WR)</u>
		<u>Hot Leg Pressure (WR)</u>
	<u>Automatic Trip of LHSI Pump (in RHR Mode) on Low Loop Level</u>	<u>Hot Leg Loop Level</u>
	<u>LHSI Valves Actuation Based on RHRS Alignment</u>	<u>RHR 1st RCPB Isolation Valve Position</u>
		<u>RHR 2nd RCPB Isolation Valve Position</u>
		<u>Outside Containment Isolation Valve Position</u>

Table 2.4.4-3—Safety Automation System Output Signals

Item #	Output Signal	Recipient	# Divisions
1	EFW Flow Control Valve Position Signal	PACS	4
2	EFW SG Level Control Valve Position Signal	PACS	4
3	Main Steam Relief Control Valve Signal	PACS	4



07.01-37

07.01-37

Table 2.4.4-43—Safety Automation System Interlocks

Isolation of Component Cooling Water System (CCWS) Trains

07.01-37

Table 2.4.4-5—Safety Automation System Automatic Functions (4 Sheets)

System	Function Name
Annulus Ventilation System (AVS)	Accident Filtration Train Heater Control
Annulus Ventilation System (AVS)	Accident Train Switchover
Component Cooling Water System (CCWS)	CCWS Common 1.b Automatic Backup Switchover of Train 1 to Train 2
Component Cooling Water System (CCWS)	CCWS Common 1.b Automatic Backup Switchover of Train 2 to Train 1
Component Cooling Water System (CCWS)	CCWS Common 2.b Automatic Backup Switchover of Train 3 to Train 4
Component Cooling Water System (CCWS)	CCWS Common 2.b Automatic Backup Switchover of Train 4 to Train 3
Component Cooling Water System (CCWS)	CCWS Emergency Temperature Control
Component Cooling Water System (CCWS)	CCWS Emergency Leak Detection
Component Cooling Water System (CCWS)	CCWS Switchover Valve Interlock
Component Cooling Water System (CCWS)	CCWS RCP Thermal Barrier Containment Isolation Valve Interlock
Component Cooling Water System (CCWS)	CCWS Switchover Valves Leakage or Failure
Component Cooling Water System (CCWS)	CCWS Condenser Supply Water Flow Control
Emergency Feedwater System (EFWS)	SG Closed Loop Level Control
Emergency Feedwater System (EFWS)	EFW Pump Flow Control
Essential Service Water System (ESWS)	Automatic ESWS Actuation from CCWS Start
Essential Service Water Pump Building Ventilation System (ESWPBVS)	Remove Heat Generated by Essential Service Water Equipment
Fuel Building Ventilation System (FBVS)	Safety-related Room Heater Control

07.01-37

Table 2.4.4-5—Safety Automation System Automatic Functions (4 Sheets)

System	Function Name
Fuel Building Ventilation System (FBVS)	Maintain Ambient Conditions for EBS and FPCS pump rooms (Recirculation Coolers)
Fuel Pool Cooling and Purification System (FPCPS)	Fuel Pool Cooling Pump Trip On Low SFP Level
In Containment Refueling Water Storage Tank System (IRWST)	IRWST Boundary Isolation for Preserving IRWST Water Inventory
Main Control Room Air Conditioning System (CRACS)	Iodine Filtration Train Heater Control
Main Control Room Air Conditioning System (CRACS)	Heater Control for Outside Inlet Air
Main Control Room Air Conditioning System (CRACS)	Pressure Control
Main Control Room Air Conditioning System (CRACS)	Cooler Temperature Control
Main Steam System (MSS)	Steam Generator MSRCV Regulation during Standby Position Control
Main Steam System (MSS)	Steam Generator MSRCV Regulation during Pressure Control
Safeguard Building Controlled Area Ventilation System (SBVS)	SIS/RHRS Pump Rooms Heat Removal
Safeguard Building Controlled Area Ventilation System (SBVS)	SIS/RHRS Valve Rooms Heat Removal
Electrical Division of Safeguard Building Ventilation System (SBVSE)	Supply and Recirculation Exhaust Air Flow Control
Electrical Division of Safeguard Building Ventilation System (SBVSE)	Supply Fan Safe Shut-off
Electrical Division of Safeguard Building Ventilation System (SBVSE)	Recirculation/Exhaust Fan Safe Shut-off
Electrical Division of Safeguard Building Ventilation System (SBVSE)	Exhaust Fan Safe Shut-off

Table 2.4.4-5—Safety Automation System Automatic Functions (4 Sheets)

System	Function Name
Electrical Division of Safeguard Building Ventilation System (SBVSE)	Supply Air Temperature
Electrical Division of Safeguard Building Ventilation System (SBVSE)	Freeze Protection—Supply Air Temperature
Electrical Division of Safeguard Building Ventilation System (SBVSE)	Freeze Protection—Heat Tracing
Electrical Division of Safeguard Building Ventilation System (SBVSE)	Supply Air Temperature Control for Cooling
Electrical Division of Safeguard Building Ventilation System (SBVSE)	Supply Air Temperature Control for Supply Air Heating
Electrical Division of Safeguard Building Ventilation System (SBVSE)	Battery Room Temperature Control
Electrical Division of Safeguard Building Ventilation System (SBVSE)	Battery Room Supply Air Temperature
Electrical Division of Safeguard Building Ventilation System (SBVSE)	Emergency Feedwater Pump Room Heat Removal
Electrical Division of Safeguard Building Ventilation System (SBVSE)	Component Cooling Water System Rooms Heat Removal
Safety Chilled Water System (SCWS)	SCWS Train 1 to Train 2 Switchover on Train 1 Low Evaporator Flow
Safety Chilled Water System (SCWS)	SCWS Train 2 to Train 1 Switchover on Train 2 Low Evaporator Flow
Safety Chilled Water System (SCWS)	SCWS Train 3 to Train 4 Switchover on Train 3 Low Evaporator Flow
Safety Chilled Water System (SCWS)	SCWS Train 4 to Train 3 Switchover on Train 4 Low Evaporator Flow
Safety Chilled Water System (SCWS)	SCWS Train 1 to Train 2 Switchover on Train 1 Chiller Black Box Internal Fault
Safety Chilled Water System (SCWS)	SCWS Train 2 to Train 1 Switchover on Train 2 Chiller Black Box Internal Fault

07.01-37

Table 2.4.4-5—Safety Automation System Automatic Functions (4 Sheets)

System	Function Name
Safety Chilled Water System (SCWS)	SCWS Train 3 to Train 4 Switchover on Train 3 Chiller Black Box Internal Fault
Safety Chilled Water System (SCWS)	SCWS Train 4 to Train 3 Switchover on Train 4 Chiller Black Box Internal Fault
Safety Chilled Water System (SCWS)	SCWS Train 2 to Train 1 Switchover on Loss of Ultimate Heat Sink (LUHS)/CCWS
Safety Chilled Water System (SCWS)	SCWS Train 3 to Train 4 Switchover on Loss of Ultimate Heat Sink (LUHS)/CCWS
Safety Chilled Water System (SCWS)	SCWS Train 1 to Train 2 Switchover on LOOP Re-start Failure
Safety Chilled Water System (SCWS)	SCWS Train 2 to Train 1 Switchover on LOOP Re-start Failure
Safety Chilled Water System (SCWS)	SCWS Train 3 to Train 4 Switchover on LOOP Re-start Failure
Safety Chilled Water System (SCWS)	SCWS Train 4 to Train 3 Switchover on LOOP Re-start Failure
Safety Chilled Water System (SCWS)	SCWS Chiller Evaporator Water Flow Control (Trains 1 and 4)
Safety Injection and Residual Heat Removal System (SIS/RHRS)	Automatic RHRS Flow Rate Control
Safety Injection and Residual Heat Removal System (SIS/RHRS)	Automatic Trip of LHSI Pump (in RHR Mode) on Low ΔP_{sat}
Safety Injection and Residual Heat Removal System (SIS/RHRS)	Automatic Trip of LHSI Pump (in RHR Mode) on Low Loop Level
Safety Injection and Residual Heat Removal System (SIS/RHRS)	LHSI Valves Actuation Based on RHRS Alignment

07.01-37

Table 2.4.4-64—Safety Automation System ITAAC (11 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
2.1	<u>The location of the SAS equipment is</u> located as listed in Table 2.4.4-1.	Inspections <u>An inspection</u> will be performed of the location of the SAS equipment.	The SAS equipment listed in Table 2.4.4-1 is located as listed in Table 2.4.4-1.
2.2	Physical separation exists between the four divisions of the SAS <u>as listed in Table 2.4.4-1.</u>	Inspections <u>An inspection</u> will be performed to verify that the divisions of the SAS are located in separate Safeguard Buildings.	The four divisions of the SAS are located in separate Safeguard Buildings as listed in Table 2.4.4-1.
2.3	Physical separation exists between Class 1E SAS equipment and non-Class 1E equipment.	<p>a. Design analyses <u>An analysis</u> will be performed to determine the required safety-related structures, separation distance, barriers, or any combination thereof to achieve adequate physical separation between Class 1E SAS equipment and non-Class 1E equipment.</p> <p>b. Inspections <u>An inspection and analysis</u> will be performed to verify that the required safety-related structures, separation distance, barriers, or any combination thereof exist between Class 1E SAS equipment and non-Class 1E equipment.</p>	<p>a. A report exists and that defines the required safety-related structures, separation distance, barriers, or any combination thereof to achieve adequate physical separation between Class 1E SAS equipment and non-Class 1E equipment.</p> <p>b. The required safety-related structures, separation distance, barriers, or any combination thereof exist between Class 1E SAS equipment and non-Class 1E equipment. Reconciliation is performed of any deviations to the design <u>analysis</u>.</p>

07.01-37

Table 2.4.4-64—Safety Automation System ITAAC (11 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
3.1	Equipment identified as Seismic Category I in Table 2.4.4-1 can withstand seismic design basis loads without loss of safety function.	<p>a. Type tests, analyses, or a combination of type tests and analyses will be performed on the equipment listed as Seismic Category I in Table 2.4.4-1 using analytical assumptions, or under conditions, which bound the Seismic Category I design requirements.</p> <p>b. Inspections will be performed of the Seismic Category I equipment listed in Table 2.4.4-1 to verify that the equipment including anchorage is installed <u>per seismic qualification report (SQDP, EQDP, or analyses) requirements as specified on the construction drawings.</u></p>	<p>a. Tests/analysis reports exist and conclude that the equipment listed as Seismic Category I in Table 2.4.4-1 can withstand seismic design basis loads without loss of safety function.</p> <p>b. Inspection reports exist and conclude that the Seismic Category I equipment listed in Table 2.4.4-1 including anchorage is installed <u>per seismic qualification report (SQDP, EQDP, or analyses) requirements as specified on the construction drawings.</u></p>
4.1	Class 1E SAS equipment <u>listed in Table 2.4.4-1</u> can perform its safety function when subjected to EMI, RFI, ESD, and power surges.	Type tests or type tests and analysis of these will be performed for the Class 1E equipment listed in Table 2.4.4-1.	A report exists and concludes that the e Equipment identified as Class 1E in Table 2.4.4-1 can perform its safety function when subjected to electromagnetic interference EMI, RFI, ESD, and power surges.
4.2	The SAS receives input signals from the sources listed in Table 2.4.4-2.	Tests <u>A test</u> will be performed <u>using test signals</u> to verify the existence of input signals.	The SAS receives input signals from the sources listed in Table 2.4.4-2.
4.3	Deleted. The SAS provides the output signals to the recipients listed in Table 2.4.4-3.	Deleted. Tests <u>A test</u> will be performed <u>using test signals</u> to verify the existence of output signals.	Deleted. The SAS provides output signals to the recipients listed in Table 2.4.4-3.
4.4	The SAS provides the interlocks listed in Table <u>2.4.4-43.</u>	Tests will be performed using test signals to verify the operation of the interlocks listed in Table 2.4.4-4.	The interlocks listed in Table <u>2.4.4-43</u> respond as specified when activated by a test signal.

07.01-37

07.01-37

07.01-37

Table 2.4.4-64—Safety Automation System ITAAC (11 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
4.5	<p>The SAS system design and application software are developed using a process composed of six lifecycle phases, with each phase having outputs which must conform to the requirements of that phase. The six lifecycle phases are the following:</p> <ol style="list-style-type: none"> 1) Basic Design Phase. 2) Detailed Design Phase. 3) Manufacturing Phase. 4) System Integration and Testing Phase 5) Installation and Commissioning Phase. 6) Final Documentation Phase. 	<ol style="list-style-type: none"> a. Analyses will be performed to verify that the outputs for the SAS basic design phase conform to the requirements of that phase. b. Analyses will be performed to verify that the outputs for the SAS detailed design phase conform to the requirements of that phase. c. Analyses will be performed to verify that the outputs for the SAS manufacturing phase conform to the requirements of that phase. d. Analyses will be performed to verify that the outputs for the SAS system integration and testing phase conform to the requirements of that phase. e. Analyses will be performed to verify that the outputs for the SAS installation and commissioning phase conform to the requirements of that phase. f. Analyses will be performed to verify that the outputs for the SAS final documentation phase conform to the requirements of that phase. 	<ol style="list-style-type: none"> a. A report exists and concludes that the outputs conform to requirements of the basic design phase of the SAS. b. A report exists and concludes that the outputs conform to requirements of the detailed design phase of the SAS. c. A report exists and concludes that the outputs conform to the requirements of the manufacturing phase of the SAS. d. A report exists and concludes that the outputs conform to the requirements of the system integration and testing phase of the SAS. e. A report exists and concludes that the outputs conform to the requirements of the installation and commissioning phase of the SAS. f. A report exists and concludes that the outputs conform to the requirements of the final documentation phase of the SAS.

Table 2.4.4-64—Safety Automation System ITAAC (11 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
4.6	Electrical isolation is provided on connections between the four SAS divisions.	<ul style="list-style-type: none"> a. Analyses will be performed to determine the test specification for electrical isolation devices on connections between the four SAS divisions. b. Type tests, analyses, or a combination of type tests and analyses will be performed on the electrical isolation devices between the four SAS divisions. c. Inspections will be performed on connections between the four SAS divisions. 	<ul style="list-style-type: none"> a. A test plan exists that provides the test specification for determining whether a device is capable of preventing the propagation of credible electrical faults on connections between the four SAS divisions. b. A report exists and concludes that the Class 1E isolation devices used between the four SAS divisions prevent the propagation of credible electrical faults. c. Class 1E electrical isolation devices exist on connections between the four SAS divisions.
4.7	Electrical isolation is provided on connections between SAS equipment and non-Class 1E equipment.	<ul style="list-style-type: none"> a. Analyses will be performed to determine the test specification for electrical isolation devices on connections between SAS equipment and non-Class 1E equipment. b. Type tests, analyses, or a combination of type tests and analyses will be performed on the electrical isolation devices between SAS equipment and non-Class 1E equipment. 	<ul style="list-style-type: none"> a. A test plan exists that provides the test specification for determining whether a device is capable of preventing the propagation of credible electrical faults on connections between SAS equipment and non-Class 1E equipment. b. A report exists and concludes that the Class 1E isolation devices used between SAS equipment and non-Class 1E equipment prevent the propagation of credible electrical faults.

07.01-37

Table 2.4.4-64—Safety Automation System ITAAC (11 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
		c. Inspections will be performed on connections between SAS equipment and non-Class 1E equipment.	c. Class 1E electrical isolation devices exist on connections between SAS equipment and non-Class 1E equipment.
4.8	Communications independence is provided between the four SAS divisions.	Tests, analyses, or a combination of tests and analyses will be performed on the SAS equipment.	<p><u>Communications independence between the SAS divisions is provided by</u> A report exists and concludes that:</p> <ul style="list-style-type: none"> • The SAS function processors do not interface directly with a network. Separate communication processors interface directly with the network. • Separate send and receive data channels are used in both the communications processor and the SAS function processor. • The SAS function processors operate in a strictly cyclic manner. • The SAS function processors operate asynchronously from the SAS communications processors.

07.01-37

Table 2.4.4-64—Safety Automation System ITAAC (11 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
4.9	Communications independence is provided between SAS equipment and non-Class 1E equipment.	Tests <u>using test signals</u> , analyses, or a combination of tests <u>using test signals</u> and analyses will be performed on the SAS equipment.	<p><u>Communications independence between SAS equipment and non-Class 1E equipment is provided by</u> A report exists and concludes that:</p> <ul style="list-style-type: none"> • Data communications between SAS function processors and non-Class 1E equipment is through a Monitoring and Service Interface (MSI). • The MSI do not interface directly with a network. Separate communication modules interface directly with the network. • Separate send and receive data channels are used in both the communications modules and the MSI. • The MSI operates <u>in</u> a strictly cyclic manner. • The MSI operates <u>asynchronously</u> from the communications modules. • The SAS uses a <u>Class 1E</u> hardware device to ensure that send unidirectional signals are sent to non-safety-related I&C systems.

07.01-37

Table 2.4.4-64—Safety Automation System ITAAC (11 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
4.10	<p>The SAS is designed so that safety-related functions required for AOOs or PAs are performed in the presence of the following:</p> <ul style="list-style-type: none"> • Single detectable failures within the SAS. • Failures caused by the single failure. • Failures and spurious system actions that cause or are caused by the AOO or PA requiring the safety function. 	<p>A failure modes and effects analysis will be performed on the SAS at the level of replaceable modules and components.</p>	<p>A report exists and concludes that the SAS is designed so that safety-related functions required for AOOs or PAs are performed in the presence of the following:</p> <ul style="list-style-type: none"> • Single detectable failures within the SAS concurrent with identifiable but non-detectable failures. • Failures caused by the single failure. • Failures and spurious system actions that cause or are caused by the AOO or PA requiring the safety function.
4.11	<p>The equipment for each SAS division is distinctly identified and distinguishable from other identifying markings placed on the equipment, and the identifications do not require frequent use of reference material.</p>	<p>Inspections will be performed on the SAS equipment to verify that the equipment for each SAS division is distinctly identified and distinguishable from other markings placed on the equipment and that the identifications do not require frequent use of reference material.</p>	<p>The equipment for each SAS division is distinctly identified and distinguishable from other identifying markings placed on the equipment, and the identifications do not require frequent use of reference material.</p>
4.12	<p>Locking mechanisms are provided on the SAS cabinet doors. Opened SAS cabinet doors are indicated in the MCR.</p>	<p>a. Inspections <u>An inspection</u> will be performed to verify the existence of locking mechanisms on the SAS cabinet doors.</p> <p>b. Tests <u>A test</u> will be performed to verify the proper operation of the locking mechanisms on the SAS cabinet doors.</p> <p>c. Tests <u>A test and inspections</u> will be performed to verify an indication exists in the MCR when a SAS cabinet door is in the open position.</p>	<p>a. Locking mechanisms exist on the SAS cabinet doors.</p> <p>b. The locking mechanisms on the SAS cabinet doors operate properly.</p> <p>c. Opened SAS cabinet doors are indicated in the MCR <u>with an SAS cabinet door is in the open position.</u></p>

07.01-37

Table 2.4.4-64—Safety Automation System ITAAC (11 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
4.13	CPU state switches are present at the SAS cabinets to restrict modifications to the SAS software.	<p>a. Inspections will be performed to verify the existence of CPU state switches that restrict modifications to the SAS software.</p> <p>b. Tests will be performed to verify that the CPU state switches restrict modifications to the SAS software.</p>	<p>a. CPU state switches are provided at the SAS cabinets.</p> <p>b. CPU state switches at the SAS cabinets restrict modifications to the SAS software.</p>
4.14	The SAS is capable of performing its safety function when <u>SAS equipment is in maintenance</u> one of the SAS divisions is out of service. <u>Bypassed SAS equipment is Out of service</u> divisions of SAS are indicated in the MCR.	<p>a. A test of the SAS will be performed <u>using test signals</u> to verify <u>the maintenance bypass functionality</u>. the SAS can perform its safety function when one of the SAS divisions is out of service.</p> <p>b. Inspections <u>A test</u> will be performed <u>using test signals</u> to verify the existence of indication in the MCR when a SAS equipment is in maintenance bypass (inoperable). <u>division is placed out of service.</u></p>	<p>a. The SAS can perform its safety functions when one of the SAS equipment is in maintenance bypass. <u>divisions is out of service.</u></p> <p>b. <u>Bypassed SAS equipment is Out of service</u> divisions of SAS are indicated in the MCR.</p>

07.01-37

Table 2.4.4-64—Safety Automation System ITAAC (11 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
4.15	<p>The operational availability of each input variable <u>listed in Table 2.4.4-2</u> can be confirmed during reactor operation including post-accident periods <u>by one of the following methods</u>:</p> <ul style="list-style-type: none"> • <u>By perturbing the monitored variable.</u> • <u>By introducing and varying, a substitute input of the same nature as the measured variable.</u> • <u>By cross-checking between channels that bear a known relationship to each other.</u> • <u>By specifying equipment that is stable and the period of time it retains its calibration during post-accident conditions.</u> 	<p>Analysis will be performed to demonstrate that the operational availability of each input variable listed in Table 2.4.4-2 can be confirmed during reactor operation including post-accident periods. by one of the following methods:</p> <ul style="list-style-type: none"> • By perturbing the monitored variable. • By introducing and varying, a substitute input of the same nature as the measured variable. • By cross-checking between channels that bear a known relationship to each other. • By specifying equipment that is stable and the period of time it retains its calibration during post-accident conditions. 	<p>A report exists and concludes that the operational availability of each input variable listed in Table 2.4.4-2 can be confirmed during reactor operation including post-accident periods by one of the following methods:</p> <ul style="list-style-type: none"> • By perturbing the monitored variable. • By introducing and varying, a substitute input of the same nature as the measured variable. • By cross-checking between channels that bear a known relationship to each other. • By specifying equipment that is stable and the period of time it retains its calibration during post-accident conditions.
4.16	Deleted.	Deleted.	Deleted.
4.17	<p>Hardwired disconnects exist between the SU and each divisional MSI of the SAS. The hardwired disconnects prevent the connection of the SU to more than a single division of the SAS.</p>	<p>a. Inspections will be performed. on the SAS to verify the existence of hardwired disconnects between the SU and each divisional MSI of SAS.</p> <p>b. Tests will be performed. on the SAS to verify that the hardwired disconnects prevent the connection of the SU to more than a single division of the SAS.</p>	<p>a. Hardwired disconnects exist between the SU and each divisional MSI of the SAS.</p> <p>b. The hardwired disconnects prevent the connection of the SU to more than a single division of the SAS.</p>

Table 2.4.4-64—Safety Automation System ITAAC (11 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
4.18	<p><u>The SAS performs ESF and Essential Auxiliary Support (EAS) automatic functions for the input variables listed in Table 2.4.4-2.</u> The SAS performs automatic functions listed in Table 2.4.4-5.</p>	<p><u>A test will be performed on the SAS using test signals.</u> Tests A test will be performed using test signals to verify the operation of automatic functions listed in Table 2.4.4-5.</p>	<p><u>The SAS generates ESF and EAS output signals after the application of a test signal for the input variables listed in Table 2.4.4-2. Upon removal of the test signal the ESF and EAS output signals shall reflect the current plant conditions. Deliberate manual action is required to return the SAS to normal.</u> The SAS generates the correct output signals for each automatic function listed in Table 2.4.4-5.</p>
4.19	<p><u>During data communication, the SAS function processors receive only the pre-defined messages for that specific function processor. Other messages are ignored.</u></p>	<p>a. <u>An analysis will be performed.</u></p> <p>b. <u>A test will be performed.</u></p>	<p>a. <u>A report determines the test specification for the SAS function processors to verify that only pre-defined messages for that specific function processor and other messages are ignored.</u></p> <p>b. <u>A report concludes that the SAS function processors receive only the pre-defined messages for that specific function processor. Other messages are ignored.</u></p>
4.20	<p><u>SAS self-test features are capable of detecting faults consistent with the requirements of the SAS.</u></p>	<p>a. <u>Analyses will be performed to determine the faults that require detection through self-test features.</u></p> <p>b. <u>Type tests, analyses or a combination of type tests and analyses will be performed to verify that faults requiring detection through self-test features are detected by the SAS equipment.</u></p>	<p>a. <u>A report identifies the faults that require detection through self-test features.</u></p> <p>b. <u>A report concludes that the SAS equipment is capable of detecting faults required to be detected by self-test features.</u></p>

07.01-37

Table 2.4.4-64—Safety Automation System ITAAC (11 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
4.21	<u>SAS connections to the SICS are hardwired for manual grouped controls.</u>	<u>Inspections will be performed.</u>	<u>SAS connections to the SICS are hardwired for manual grouped controls.</u>
4.22	<u>SAS manual grouped controls and indications are available on the SICS in the MCR.</u>	<p>a. <u>Inspections will be performed.</u></p> <p>b. <u>Tests will be performed using test signals.</u></p>	<p>a. <u>SAS manual grouped controls and indications are available on the SICS in the MCR.</u></p> <p>b. <u>SAS equipment is capable of operating manual grouped control functions from the SICS in the MCR.</u></p>
4.23	<p><u>Permissive P15 provides operating bypass capability for the following SAS functions:</u></p> <ul style="list-style-type: none"> <u>Safety Injection and Heat Removal System - Automatic Trip of LHSI Pump (in RHR Mode) on Low Delta Psat.</u> <u>Safety Injection and Heat Removal System - Automatic Trip of LHSI Pump (in RHR Mode) on Low Loop Level.</u> 	<u>A test will be performed using test signals.</u>	<p><u>A report concludes that Permissive P15 provides operating bypass capability for the following SAS functions:</u></p> <ul style="list-style-type: none"> <u>Safety Injection and Heat Removal System - Automatic Trip of LHSI Pump (in RHR Mode) on Low Delta Psat.</u> <u>Safety Injection and Heat Removal System - Automatic Trip of LHSI Pump (in RHR Mode) on Low Loop Level.</u>
5.1	<p>Class 1E SAS <u>The components designated as Class 1E in Table 2.4.4-1 are powered from a Class 1E division as listed in Table 2.4.4-1 in a normal or alternate feed condition.</u></p>	<p>a. Testing will be performed for components identified as Class 1E in Table 2.4.4-1 by providing a test signal in each normally aligned division.</p> <p>b. Testing will be performed for components identified as Class 1E in Table 2.4.4-1 by providing a test signal in each division with the alternate feed aligned to the divisional pair.</p>	<p>a. The test signal provided in the normally aligned division is present at the respective Class 1E components identified in Table 2.4.4-1.</p> <p>b. The test signal provided in each division with the alternate feed aligned to the divisional pair is present at the respective Class 1E components identified in Table 2.4.4-1.</p>

07.01-37

Table 2.4.4-64—Safety Automation System ITAAC (11 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
6.1	<p><u>Components listed as Class 1E in Table 2.4.4-1 can perform their function under normal environmental conditions, AOOs, and accident and post-accident environmental conditions.</u></p>	<p>a. <u>Type tests or type tests and analysis will be performed to demonstrate the ability of the components listed as Class 1E in Table 2.4.4-1 to perform their function under normal environmental conditions, AOOs, and accident and post-accident environmental conditions.</u></p> <p>b. <u>Components listed as Class 1E in Table 2.4.4-1 will be inspected to verify installation in accordance with the EQDP requirements.</u></p>	<p>a. <u>Environmental Qualification Data Packages (EQDP) conclude that components listed as Class 1E in Table 2.4.4-1 can perform their function under normal environmental conditions, AOOs, and accident and post-accident environmental conditions including the time required to perform their function.</u></p> <p>b. <u>Inspection reports conclude that components listed as Class 1E in Table 2.4.4-1 are installed per the EQDP requirements.</u></p>

Next File

7.3 Engineered Safety Features Systems

7.3.1 Description

The U.S. EPR provides safety-related instrumentation and controls to sense accident conditions and automatically initiate the engineered safety features (ESF) systems. ESF systems are automatically actuated when selected variables exceed setpoints that are indicative of conditions that require protective action. Additionally, the ability to manually initiate ESF systems is provided in the main control room (MCR). Manual system-level actuation of ESF systems initiates all actions performed by the corresponding automatic actuation, including starting auxiliary or supporting systems and performing required sequencing functions. The SICS provides controls in the MCR for the manual actuation of the ESF functions listed in Table 7.3-5—Protection System Manually Actuated Functions. Component-level control ESF system actuators is also provided in the MCR.

07.03-38

7.3.1.1 System Description

Automatic actuation of ESF systems and auxiliary supporting systems is performed by the protection system (PS) when selected plant parameters reach the appropriate setpoints. These automatic actuation orders are sent to the priority and actuator control system (PACS) for prioritization and interface to the actuators. An example of an ESF actuation sequence actuated by four divisions of the PS is illustrated in Figure 7.3-1 (Sheet 1), and is described as follows:

- An acquisition and processing unit (APU) in each division acquires one-fourth of the redundant sensor measurements through the signal conditioning and distribution system (SCDS) that are inputs to a given ESF actuation function.
- The APU in each division performs any required processing using the measurements acquired by that division (e.g., filtering, range conversion, calculations). The resulting variable is compared to a relevant actuation setpoint in each division. If a setpoint is breached, the APU in that division generates a partial trigger signal for the appropriate ESF function.
- The partial trigger signals from each division are sent to redundant actuation logic units (ALU) in the PS division responsible for the associated actuation. Two out of four voting is performed in each ALU on the partial trigger signals from all four divisions. If the voting logic is satisfied, an actuation order is generated.
- The actuation signals of the redundant ALU in each subsystem are combined in a hardwired “functional OR” configuration so that either redundant ALU can actuate the function.

ESF functions actuated by less than four divisions are illustrated in Figure 7.3-1 (Sheets 3 through 5).

Table 7.3-5—Protection System Manually Actuated Functions

<u>Reactor Trip</u>
<u>Containment Isolation (Stage 1)</u>
<u>Containment Isolation (Stage 2)</u>
<u>CVCS Charging Isolation</u>
<u>CVCS Isolation on Anti-Dilution Mitigation</u>
<u>EDG Actuation</u>
<u>EFWS Actuation</u>
<u>EFWS Isolation</u>
<u>Extra Borating System Isolation</u>
<u>Hydrogen Mixing Dampers Opening</u>
<u>CRACS Isolation and Filtering</u>
<u>Main Feedwater (MFW) Full Load Isolation</u>
<u>Main Steam Isolation</u>
<u>MSRIV Opening</u>
<u>MSRT Isolation</u>
<u>Partial Cooldown Actuation</u>
<u>PSRV Opening</u>
<u>RCP Trip</u>
<u>SG Isolation</u>
<u>SIS Actuation</u>
<u>Turbine Trip</u>



07.03-38