

ArevaEPRDCPEm Resource

From: WILLIFORD Dennis (AREVA) [Dennis.Williford@areva.com]
Sent: Wednesday, May 25, 2011 10:10 AM
To: Tesfaye, Getachew
Cc: BENNETT Kathy (AREVA); DELANO Karen (AREVA); ROMINE Judy (AREVA); RYAN Tom (AREVA)
Subject: Response to U.S. EPR Design Certification Application RAI No. 413, FSAR Ch. 7, Supplement 11
Attachments: RAI 413 Supplement 11 Response US EPR DC.pdf

Getachew,

AREVA NP provided a schedule for technically complete and correct responses to the questions in RAI 413 on September 08, 2010. Supplement 1 response to RAI No. 413 was sent on November 19, 2010, to provide a revised schedule. Supplement 2 response to RAI No. 413 was sent on December 13, 2010, to provide a revised schedule. Supplement 3 response to RAI No. 413 was sent on January 28, 2011, to provide technically correct and complete responses to seven questions. Supplement 4 response to RAI No. 413 was sent on February 1, 2011, to provide technically correct and complete responses to seven questions. Supplement 5 response to RAI No. 413 was sent on February 23, 2011, to provide technically correct and complete responses to five questions. Supplement 6 response to RAI No. 413 was sent on February 24, 2011, to provide a revised schedule. Supplement 7 response to RAI No. 413 was sent on March 2, 2011, to provide technically correct and complete response to one question. Supplement 8 response to RAI No. 413 was sent on March 15, 2011, to provide technically correct and complete response to two questions. Supplement 9 response to RAI No. 413 was sent on March 23, 2011, to provide technically correct and complete response to ten questions. Supplement 10 response to RAI No. 413 was sent on April 20, 2011 to provide a technically correct and complete response to the final one question.

Due to additional interface and comments from the NRC Staff, the response to question 7.8-13 has been updated to provide current U.S. EPR Final Safety Analysis Report markups of Sections 7.8 and 18.7.

The attached file, "RAI 413 Supplement 11 Response US EPR DC.pdf" provides a revised technically correct and complete response to Question 07.08-13.

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 413, Question 07.08-13.

The following table indicates the respective pages in the response document that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 413 07.08-13	2	3

This concludes the formal AREVA NP response to RAI 413, and there are no questions from this RAI for which AREVA NP has not provided responses.

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

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: WELLS Russell (RS/NB)
Sent: Wednesday, April 20, 2011 7:50 AM
To: Tesfaye, Getachew
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 413, FSAR Ch. 7, Supplement 10

Getachew,

AREVA NP provided a schedule for technically complete and correct responses to the questions in RAI 413 on September 08, 2010. Supplement 1 response to RAI No. 413 was sent on November 19, 2010, to provide a revised schedule. Supplement 2 response to RAI No. 413 was sent on December 13, 2010, to provide a revised schedule. Supplement 3 response to RAI No. 413 was sent on January 28, 2011, to provide technically correct and complete responses to seven questions. Supplement 4 response to RAI No. 413 was sent on February 1, 2011, to provide technically correct and complete responses to seven questions. Supplement 5 response to RAI No. 413 was sent on February 23, 2011, to provide technically correct and complete responses to five questions. Supplement 6 response to RAI No. 413 was sent on February 24, 2011, to provide a revised schedule. Supplement 7 response to RAI No. 413 was sent on March 2, 2011, to provide technically correct and complete response to one question. Supplement 8 response to RAI No. 413 was sent on March 15, 2011, to provide technically correct and complete response to two questions. Supplement 9 response to RAI No. 413 was sent on March 23, 2011, to provide technically correct and complete response to ten questions.

The attached file, "RAI 413 Supplement 10 Response US EPR DC.pdf" provides a technically correct and complete response to Question 07.08-13, as committed.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 413, Question 07.08-13.

The following table indicates the respective pages in the enclosure that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 413 07.08-13	2	3

This concludes the formal AREVA NP response to RAI 413, and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

Russ Wells

U.S. EPR Design Certification Licensing Manager

AREVA NP, Inc.

3315 Old Forest Road, P.O. Box 10935

Mail Stop OF-57

Lynchburg, VA 24506-0935

Phone: 434-832-3884 (work)

434-942-6375 (cell)

Fax: 434-382-3884

Russell.Wells@Areva.com

From: WELLS Russell (RS/NB)

Sent: Wednesday, March 23, 2011 4:57 PM

To: Tesfaye, Getachew

Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB)

Subject: Response to U.S. EPR Design Certification Application RAI No. 413, Supplement 9

Getachew,

AREVA NP Inc. letter NRC 11:029 dated March 23, 2011 provides a technically correct and complete response to 10 of the remaining 11 questions for RAI 413. AREVA NP considers some of the material contained in the response to be proprietary information. As required by 10 CFR 2.390(b), an affidavit is provided to support the withholding of the proprietary information from public disclosure. Proprietary and non-proprietary versions of the enclosure to this letter are provided separately.

The following table indicates the respective pages in the enclosure that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 413 07.08-19	2	12
RAI 413 07.08-21	13	24
RAI 413 07.08-22	25	27
RAI 413 07.08-26	28	33
RAI 413 07.08-27	34	36
RAI 413 07.08-28	37	40
RAI 413 07.08-29	41	46
RAI 413 07.08-32	47	52
RAI 413 07.08-35	53	55
RAI 413 07.08-38	56	59

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

Question #	Response Date
RAI 413 07.08-13	April 21, 2011

Sincerely,

Russ Wells

U.S. EPR Design Certification Licensing Manager

AREVA NP, Inc.

3315 Old Forest Road, P.O. Box 10935

Mail Stop OF-57

Lynchburg, VA 24506-0935

Phone: 434-832-3884 (work)

434-942-6375 (cell)

Fax: 434-382-3884

Russell.Wells@Areva.com

From: WELLS Russell (RS/NB)

Sent: Tuesday, March 15, 2011 10:34 AM

To: 'Tesyfaye, Getachew'

Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB)

Subject: Response to U.S. EPR Design Certification Application RAI No. 413, Supplement 8

Getachew,

AREVA NP provided a schedule for technically complete and correct responses to the questions in RAI 413 on September 08, 2010. Supplement 1 response to RAI No. 413 was sent on November 19, 2010, to provide a revised schedule. Supplement 2 response to RAI No. 413 was sent on December 13, 2010, to provide a revised schedule. Supplement 3 response to RAI No. 413 was sent on January 28, 2011, to provide technically correct and complete responses to seven questions. Supplement 4 response to RAI No. 413 was sent on February 1, 2011, to provide technically correct and complete responses to seven questions. Supplement 5 response to RAI No. 413 was sent on February 23, 2011, to provide technically correct and complete responses to five questions. Supplement 6 response to RAI No. 413 was sent on February 24, 2011, to provide a revised schedule. Supplement 7 response to RAI No. 413 was sent on March 2, 2011, to provide technically correct and complete response to one question. Based on discussions with NRC, the attached file, "RAI 413 Supplement 8 Response US EPR DC.pdf" provides technically correct and complete responses to two of the remaining 13 questions, as committed.

The following table indicates the respective pages in the enclosure that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 413 07.08-17	2	3
RAI 413 07.08-42	4	6

The response schedule for the remaining questions is unchanged and is shown below.

Question #	Response Date
RAI 413 07.08-13	April 21, 2011
RAI 413 07.08-19	April 5, 2011
RAI 413 07.08-21	April 5, 2011
RAI 413 07.08-22	April 5, 2011
RAI 413 07.08-26	April 5, 2011
RAI 413 07.08-27	April 5, 2011
RAI 413 07.08-28	April 5, 2011
RAI 413 07.08-29	April 5, 2011
RAI 413 07.08-32	April 14, 2011
RAI 413 07.08-35	April 14, 2011
RAI 413 07.08-38	April 14, 2011

Sincerely,

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

From: WELLS Russell (RS/NB)
Sent: Wednesday, March 02, 2011 3:34 PM
To: 'Tesfaye, Getachew'
Cc: BRYAN Martin (External RS/NB); BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 413, Supplement 7

Getachew,

AREVA NP Inc. letter NRC 11:019 dated March 2, 2011 provides the final response for RAI 413, Supplement 7, question 07.08-39. AREVA NP considers some of the material contained in the response to be proprietary information. As required by 10 CFR 2.390(b), an affidavit is provided to support the withholding of the proprietary information from public disclosure. Proprietary and non-proprietary versions of the enclosure to this letter are provided separately.

The following table indicates the respective pages in the enclosure that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 413 07.08-39	2	30

The response schedule for the remaining questions is unchanged and is shown below.

Question #	Response Date
RAI 413 07.08-13	April 21, 2011
RAI 413 07.08-17	April 5, 2011
RAI 413 07.08-19	April 5, 2011
RAI 413 07.08-21	April 5, 2011
RAI 413 07.08-22	April 5, 2011
RAI 413 07.08-26	April 5, 2011
RAI 413 07.08-27	April 5, 2011
RAI 413 07.08-28	April 5, 2011
RAI 413 07.08-29	April 5, 2011
RAI 413 07.08-32	April 14, 2011
RAI 413 07.08-35	April 14, 2011
RAI 413 07.08-38	April 14, 2011
RAI 413 07.08-42	April 5, 2011

Sincerely,

Russ Wells

U.S. EPR Design Certification Licensing Manager

AREVA NP, Inc.

3315 Old Forest Road, P.O. Box 10935

Mail Stop OF-57

Lynchburg, VA 24506-0935

Phone: 434-832-3884 (work)

434-942-6375 (cell)

Fax: 434-382-3884

Russell.Wells@Areva.com

From: BRYAN Martin (External RS/NB)

Sent: Thursday, February 24, 2011 1:58 PM

To: Tesfaye, Getachew

Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); RYAN Tom (RS/NB); WELLS Russell (RS/NB)

Subject: Response to U.S. EPR Design Certification Application RAI No. 413, FSAR Ch. 7, Supplement 6

Getachew,

AREVA NP provided a schedule for technically complete and correct responses to the questions in RAI 413 on September 08, 2010. Supplement 1 response to RAI No. 413 was sent on November 19, 2010, to provide a revised schedule. Supplement 2 response to RAI No. 413 was sent on December 13, 2010, to provide a revised schedule. Supplement 3 response to RAI No. 413 was sent on January 28, 2011, to provide technically correct and complete responses to seven questions. Supplement 4 response to RAI No. 413 was sent on February 1, 2011, to provide technically correct and complete responses to seven questions. Supplement 5 response to RAI No. 413 was sent on February 23, 2011, to provide technically correct and complete responses to five questions.

Based upon the information presented to the NRC during the February 15, 2011, Public Meeting, the schedule for the remaining questions has been changed.

The schedule for technically correct and complete responses to the remaining 14 questions is provided below:

Question #	Response Date
RAI 413 07.08-13	April 21, 2011
RAI 413 07.08-17	April 5, 2011
RAI 413 07.08-19	April 5, 2011
RAI 413 07.08-21	April 5, 2011
RAI 413 07.08-22	April 5, 2011
RAI 413 07.08-26	April 5, 2011
RAI 413 07.08-27	April 5, 2011
RAI 413 07.08-28	April 5, 2011
RAI 413 07.08-29	April 5, 2011
RAI 413 07.08-32	April 14, 2011
RAI 413 07.08-35	April 14, 2011
RAI 413 07.08-38	April 14, 2011
RAI 413 07.08-39	April 5, 2011
RAI 413 07.08-42	April 5, 2011

Sincerely,

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

From: WELLS Russell (RS/NB)
Sent: Wednesday, February 23, 2011 2:08 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); BRYAN Martin (External RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 413, FSAR Ch. 7, Supplement 5

Getachew,

AREVA NP provided a schedule for technically complete and correct responses to the questions in RAI 413 on September 08, 2010. Supplement 1 response to RAI No. 413 was sent on November 19, 2010, to provide a revised schedule. Supplement 2 response to RAI No. 413 was sent on December 13, 2010, to provide a revised schedule. Supplement 3 response to RAI No. 413 was sent on January 28, 2011, to provide technically correct and complete responses to seven questions. Supplement 4 response to RAI No. 413 was sent on February 1, 2011, to provide technically correct and complete responses to seven questions. Based on discussions with NRC, the attached file, "RAI 413 Supplement 5 Response US EPR DC.pdf" provides technically correct and complete responses to five of the remaining 19 questions, as committed.

The following table indicates the respective pages in the response document, "RAI 413 Supplement 5 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
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RAI 413 07.08-10	2	2
RAI 413 07.08-11	3	4
RAI 413 07.08-12	5	6
RAI 413 07.08-14	7	7
RAI 413 07.08-16	8	8

The schedule for technically correct and complete responses to the remaining 14 questions is unchanged and provided below:

Question #	Response Date
RAI 413 07.08-13	March 15, 2011
RAI 413 07.08-17	March 15, 2011
RAI 413 07.08-19	March 31, 2011
RAI 413 07.08-21	March 2, 2011
RAI 413 07.08-22	March 2, 2011
RAI 413 07.08-26	March 31, 2011
RAI 413 07.08-27	March 2, 2011
RAI 413 07.08-28	March 2, 2011
RAI 413 07.08-29	March 31, 2011
RAI 413 07.08-32	March 31, 2011
RAI 413 07.08-35	March 2, 2011
RAI 413 07.08-38	March 2, 2011
RAI 413 07.08-39	March 2, 2011
RAI 413 07.08-42	March 15, 2011

Sincerely,

Russ Wells
U.S. EPR Design Certification Licensing Manager
AREVA NP, Inc.
 3315 Old Forest Road, P.O. Box 10935
 Mail Stop OF-57
 Lynchburg, VA 24506-0935
 Phone: 434-832-3884 (work)
 434-942-6375 (cell)
 Fax: 434-382-3884
Russell.Wells@Areva.com

From: BRYAN Martin (External RS/NB)
Sent: Tuesday, February 01, 2011 6:06 PM
To: 'Tefaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 413, FSAR Ch. 7, Supplement 4

Getachew,

AREVA NP provided a schedule for technically complete and correct responses to the questions in RAI 413 on September 08, 2010. Supplement 1 response to RAI No. 413 was sent on November 19, 2010, to provide a revised schedule. Supplement 2 response to RAI No. 413 was sent on December 13, 2010, to provide a revised schedule. Supplement 3 response to RAI No. 413 was sent on January 28, 2011, to provide technically correct and complete responses to seven questions. Based on discussions with NRC, the attached file, "RAI 413 Supplement 4 Response US EPR DC.pdf" provides technically correct and complete responses to seven of the remaining 26 questions, as committed.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 413 Question 07.08-20.

The following table indicates the respective pages in the response document, "RAI 413 Supplement 4 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 413 07.08-15	2	2
RAI 413 07.08-18	3	4
RAI 413 07.08-20	5	6
RAI 413 07.08-23	7	11
RAI 413 07.08-25	12	14
RAI 413 07.08-33	15	19
RAI 413 07.08-34	20	33

The schedule for technically correct and complete responses to the remaining 19 questions is unchanged and provided below:

Question #	Response Date
RAI 413 07.08-10	March 15, 2011
RAI 413 07.08-11	March 15, 2011
RAI 413 07.08-12	March 15, 2011
RAI 413 07.08-13	March 15, 2011
RAI 413 07.08-14	March 15, 2011
RAI 413 07.08-16	March 15, 2011
RAI 413 07.08-17	March 15, 2011
RAI 413 07.08-19	March 31, 2011
RAI 413 07.08-21	March 2, 2011
RAI 413 07.08-22	March 2, 2011
RAI 413 07.08-26	March 31, 2011
RAI 413 07.08-27	March 2, 2011
RAI 413 07.08-28	March 2, 2011
RAI 413 07.08-29	March 31, 2011
RAI 413 07.08-32	March 31, 2011
RAI 413 07.08-35	March 2, 2011
RAI 413 07.08-38	March 2, 2011
RAI 413 07.08-39	March 2, 2011
RAI 413 07.08-42	March 15, 2011

Sincerely,

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

From: BRYAN Martin (External RS/NB)
Sent: Friday, January 28, 2011 5:41 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 413, FSAR Ch. 7, Supplement 3

Getachew,

The proprietary and non-proprietary responses for RAI 413 Supplement 3 are submitted via AREVA NP Inc. letter, "Response to U.S. EPR Design Certification Application RAI No. 413, Supplement 3, Questions 07.08-24, 07.08-30, 07.08-31, 07.08-36, 07.08-37, 07.08-40, and 07.08-41" NRC 11:010, dated January 28, 2011. An affidavit to support withholding of information from public disclosure, per 10CFR2.390(b), is provided as an enclosure to that letter.

AREVA NP provided a schedule for technically complete and correct responses to the questions in RAI 413 on September 08, 2010. Supplement 1 response to RAI No. 413 was sent on November 19, 2010, to provide a revised schedule. Supplement 2 response to RAI No. 413 was sent on December 13, 2010, to provide a revised schedule.

The following table indicates the respective pages in the response document, "RAI 413 Supplement 3 Response US EPR DC.pdf" that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 413 07.08-24	2	11
RAI 413 07.08-30	12	12
RAI 413 07.08-31	13	22
RAI 413 07.08-36	23	24
RAI 413 07.08-37	25	26
RAI 413 07.08-40	27	38
RAI 413 07.08-41	39	43

To provide additional time to interact with the NRC a revised schedule is provided below (bolded dates have changed).

Question #	Response Date
RAI 413 07.08-10	March 15, 2011
RAI 413 07.08-11	March 15, 2011
RAI 413 07.08-12	March 15, 2011

RAI 413 07.08-13	March 15, 2011
RAI 413 07.08-14	March 15, 2011
RAI 413 07.08-15	March 2, 2011
RAI 413 07.08-16	March 15, 2011
RAI 413 07.08-17	March 15, 2011
RAI 413 07.08-18	March 2, 2011
RAI 413 07.08-19	March 31, 2011
RAI 413 07.08-20	March 2, 2011
RAI 413 07.08-21	March 2, 2011
RAI 413 07.08-22	March 2, 2011
RAI 413 07.08-23	March 2, 2011
RAI 413 07.08-25	March 2, 2011
RAI 413 07.08-26	March 31, 2011
RAI 413 07.08-27	March 2, 2011
RAI 413 07.08-28	March 2, 2011
RAI 413 07.08-29	March 31, 2011
RAI 413 07.08-32	March 31, 2011
RAI 413 07.08-33	March 2, 2011
RAI 413 07.08-34	March 2, 2011
RAI 413 07.08-35	March 2, 2011
RAI 413 07.08-38	March 2, 2011
RAI 413 07.08-39	March 2, 2011
RAI 413 07.08-42	March 15, 2011

Sincerely,

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

From: BRYAN Martin (External RS/NB)
Sent: Monday, December 13, 2010 8:40 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); RYAN Tom (RS/NB); PANNELL George (CORP/QP)
Subject: Response to U.S. EPR Design Certification Application RAI No. 413, FSAR Ch. 7, Supplement 2

Getachew,

AREVA NP provided a schedule for technically complete and correct responses to the questions in RAI 413 on September 08, 2010. Supplement 1 response to RAI No. 413 was sent on November 19, 2010, to provide a revised schedule.

To provide additional time to interact with the NRC a revised schedule is provided below (bolded dates have changed).

Question #	Response Date
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RAI 413 07.08-10	March 15, 2011
RAI 413 07.08-11	March 15, 2011
RAI 413 07.08-12	March 15, 2011
RAI 413 07.08-13	March 15, 2011
RAI 413 07.08-14	March 15, 2011
RAI 413 07.08-15	January 28, 2011
RAI 413 07.08-16	March 15, 2011
RAI 413 07.08-17	March 15, 2011
RAI 413 07.08-18	January 28, 2011
RAI 413 07.08-19	February 22, 2011
RAI 413 07.08-20	January 28, 2011
RAI 413 07.08-21	January 28, 2011
RAI 413 07.08-22	January 28, 2011
RAI 413 07.08-23	January 28, 2011
RAI 413 07.08-24	January 28, 2011
RAI 413 07.08-25	January 28, 2011
RAI 413 07.08-26	February 22, 2011
RAI 413 07.08-27	January 28, 2011
RAI 413 07.08-28	January 28, 2011
RAI 413 07.08-29	February 22, 2011
RAI 413 07.08-30	January 28, 2011
RAI 413 07.08-31	January 28, 2011
RAI 413 07.08-32	February 22, 2011
RAI 413 07.08-33	January 28, 2011
RAI 413 07.08-34	January 28, 2011
RAI 413 07.08-35	January 28, 2011
RAI 413 07.08-36	January 28, 2011
RAI 413 07.08-37	January 28, 2011
RAI 413 07.08-38	January 28, 2011
RAI 413 07.08-39	January 28, 2011
RAI 413 07.08-40	January 28, 2011
RAI 413 07.08-41	January 28, 2011
RAI 413 07.08-42	March 15, 2011

Sincerely,

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

From: BRYAN Martin (External RS/NB)
Sent: Friday, November 19, 2010 4:51 PM
To: 'Tesyfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); PANNELL George (CORP/QP)
Subject: Response to U.S. EPR Design Certification Application RAI No. 413, FSAR Ch. 7

Getachew,

AREVA NP provided a schedule for technically complete and correct responses to the questions in RAI 413 on September 08, 2010. To provide additional time to interact with the NRC a revised schedule is provided below for questions 07.08-36, 07.08-39, and 07.08-41.

Question #	Response Date
RAI 413 07.08-10	March 15, 2011
RAI 413 07.08-11	March 15, 2011
RAI 413 07.08-12	March 15, 2011
RAI 413 07.08-13	March 15, 2011
RAI 413 07.08-14	March 15, 2011
RAI 413 07.08-15	December 17, 2010
RAI 413 07.08-16	March 15, 2011
RAI 413 07.08-17	March 15, 2011
RAI 413 07.08-18	December 17, 2010
RAI 413 07.08-19	January 28, 2011
RAI 413 07.08-20	December 17, 2010
RAI 413 07.08-21	January 28, 2011
RAI 413 07.08-22	December 17, 2010
RAI 413 07.08-23	December 17, 2010
RAI 413 07.08-24	January 28, 2011
RAI 413 07.08-25	December 17, 2010
RAI 413 07.08-26	December 17, 2010
RAI 413 07.08-27	December 17, 2010
RAI 413 07.08-28	December 17, 2010
RAI 413 07.08-29	January 28, 2011
RAI 413 07.08-30	January 28, 2011
RAI 413 07.08-31	January 28, 2011
RAI 413 07.08-32	January 28, 2011
RAI 413 07.08-33	December 17, 2010
RAI 413 07.08-34	December 17, 2010
RAI 413 07.08-35	January 28, 2011
RAI 413 07.08-36	December 15, 2010
RAI 413 07.08-37	January 28, 2011
RAI 413 07.08-38	December 17, 2010
RAI 413 07.08-39	December 15, 2010
RAI 413 07.08-40	January 28, 2011
RAI 413 07.08-41	December 15, 2010
RAI 413 07.08-42	March 15, 2011

Sincerely,

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

From: BRYAN Martin (External RS/NB)
Sent: Wednesday, September 08, 2010 4:33 PM
To: Tesfaye, Getachew
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); PANNELL George (CORP/QP)
Subject: Response to U.S. EPR Design Certification Application RAI No. 413, FSAR Ch. 7

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information RAI 413.

The following table indicates the respective pages in the response document, "RAI 413 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

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A complete answer is not provided for 33 of the 33 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 413 07.08-10	March 15, 2011
RAI 413 07.08-11	March 15, 2011
RAI 413 07.08-12	March 15, 2011
RAI 413 07.08-13	March 15, 2011
RAI 413 07.08-14	March 15, 2011
RAI 413 07.08-15	December 17, 2010
RAI 413 07.08-16	March 15, 2011
RAI 413 07.08-17	March 15, 2011
RAI 413 07.08-18	December 17, 2010
RAI 413 07.08-19	January 28, 2011
RAI 413 07.08-20	December 17, 2010
RAI 413 07.08-21	January 28, 2011
RAI 413 07.08-22	December 17, 2010
RAI 413 07.08-23	December 17, 2010
RAI 413 07.08-24	January 28, 2011
RAI 413 07.08-25	December 17, 2010
RAI 413 07.08-26	December 17, 2010
RAI 413 07.08-27	December 17, 2010
RAI 413 07.08-28	December 17, 2010
RAI 413 07.08-29	January 28, 2011
RAI 413 07.08-30	January 28, 2011
RAI 413 07.08-31	January 28, 2011
RAI 413 07.08-32	January 28, 2011
RAI 413 07.08-33	December 17, 2010
RAI 413 07.08-34	December 17, 2010
RAI 413 07.08-35	January 28, 2011
RAI 413 07.08-36	November 19, 2010
RAI 413 07.08-37	January 28, 2011
RAI 413 07.08-38	December 17, 2010
RAI 413 07.08-39	November 19, 2010
RAI 413 07.08-40	January 28, 2011
RAI 413 07.08-41	November 19, 2010
RAI 413 07.08-42	March 15, 2011

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
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From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Monday, August 09, 2010 3:46 PM
To: ZZ-DL-A-USEPR-DL
Cc: Mott, Kenneth; Spaulding, Deirdre; Jackson, Terry; Canova, Michael; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 413(4772), FSAR Ch. 7

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on June 4, 2010, and discussed with your staff on July 22, 2010. Draft RAI Questions 07.08-19, 07.08-21, 07.08-23, and 07.08-41, were modified as a result of that discussion. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

Thanks,
Getachew Tesfaye
Sr. Project Manager
NRO/DNRL/NARP
(301) 415-3361

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 3016

Mail Envelope Properties (2FBE1051AEB2E748A0F98DF9EEE5A5D4727AE7)

Subject: Response to U.S. EPR Design Certification Application RAI No. 413, FSAR Ch. 7, Supplement 11
Sent Date: 5/25/2011 10:09:40 AM
Received Date: 5/25/2011 10:10:06 AM
From: WILLIFORD Dennis (AREVA)

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Tracking Status: None

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MESSAGE	32113	5/25/2011 10:10:06 AM
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Response to

Request for Additional Information No. 413(4772), Supplement 11

8/9/2010

U.S. EPR Standard Design Certification

AREVA NP Inc.

Docket No. 52-020

SRP Section: 07.08 - Diverse Instrumentation and Control Systems

Application Section: ANP-10304

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

Question 07.08-13:

Describe in detail the electrical isolation circuitry that is used between the PS and the DAS system, starting from the output of a sensor.

IEEE Std 603-1998, Section 5.6.3.1, Interconnected equipment, states, among other things, that no credible failure on the non-safety side of an isolation device shall prevent any portion of a safety system from meeting its minimum performance requirements during and following any design basis event requiring that safety function. A failure in an isolation device shall be evaluated in the same manner as a failure of other equipment in a safety system. GDC 24, states, in part, that Interconnection of the protection and control systems shall be limited to assure that safety is not significantly impaired.

BTP 7-11, "Guidance On Application And Qualification Of Isolation Devices," Revision 5 (BTP 7-11), provides guidelines for reviewing the use of electrical isolation devices to allow connections between safety and non-safety related systems. BTP 7-11 deals with the criteria and methods used to confirm that the design of isolation devices assures that credible failures in the connected non-safety channels will not prevent the safety systems from meeting their required functions. In order to address this guidance to evaluate conformance to the Commission's requirements, the staff requested design information about credited isolation devices during the second round of RAIs (ML081690513), ANP-10284Q2P, RAI question 19, for the review of the applicant's D3 topical report, "U.S. EPR Instrumentation and Control Diversity and Defense-in-Depth Methodology Topical Report," ANP-10284 (ML071760188). However, the applicant requested that the staff no longer issue a separate safety evaluation report (SER) for ANP-10284, but to incorporate the D3 review into the overall SER of the new D3 technical report, ANP-10304. The staff has utilized the entire response to RAI question 19 of ANP-10284Q2P (including all figures and schematics) when performing its safety evaluations. Therefore, the entire response should be submitted in relationship to the new D3 technical report, ANP-10304.

Response to Question 07.08-13:

In the previous DCS architecture, the diverse actuation system (DAS) was connected to the process information and control system (PICS). In the new architecture the connection between the DAS and PICS has been removed and replaced by hardwired connections to the safety information and control system (SICS). There is still a connection from the protection system (PS) to the PICS, however, there is no direct connection between the PS and the DAS.

The PS and the DAS implement similar reactor trip and engineered safety feature (ESF) actuation functions. For this reason, they also share some of the same sensors. The signal conditioning and distribution system (SCDS) receives input from safety-related sensors and black boxes, and non-safety-related sensors and black boxes needed on the SICS, DAS, and RCSL. When conditioned, these signals are distributed to the DCS where they are needed, including the PS and the DAS. The SCDS uses qualified electrical isolation devices when sending these safety-related signals to non-safety systems such as DAS.

The revision to Technical Report ANP-10304, "U.S. EPR Instrumentation and Control Diversity and Defense-in-Depth Methodology Topical Report" will be separately transmitted. To support the revision to Technical Report ANP-10304, changes to U.S. EPR FSAR Tier 2 sections that reference Technical Report ANP-10304 (with the exception of Chapter 7) are included with this response.

Proposed changes to the instrumentation and controls architecture were communicated to the NRC staff in the public meeting on February 15, 2011. U.S. EPR FSAR Tier 2, Section 7.8 was revised to incorporate the revised I&C architecture. This section is provided in its entirety with this response to facilitate NRC review, along with conforming changes to EPR FSAR Tier 2, Section 18.7

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 7.8 and 18.7 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups



7.8 Diverse I&C Systems

The safety-related instrumentation and controls (I&C) systems that execute automatic reactor trip (RT) and engineered safety feature (ESF) actuation and control functions for accident mitigation are described in Sections 7.2 and 7.3. These systems are designed to perform the required safety functions in the event of a single random failure.

The ~~overall I&C architecture~~ distributed control system (DCS) design can also withstand software common cause failure (SWCCF) that prevents the PS from performing its functions. The design has sufficient diversity and defense-in-depth to tolerate ~~the following beyond design basis events~~ an AOO or PA concurrent with a SWCCF of PS.

- ~~An anticipated transient without scram (ATWS), which is defined as an anticipated operational occurrence (AOO) followed by a failure of the RT portion of the protection system (PS).~~
- ~~An AOO or a postulated accident concurrent with a software common cause failure (CCF) that prevents the PS from performing RT or ESF actuation functions.~~

This section describes the I&C systems and functional requirements ~~provided~~ credited to mitigate these events.

~~AREVA NP~~ The U.S. EPR Diversity and Defense-in-Depth Assessment Technical Report (ANP-10304) (Reference 1) describes the following:

- The defense-in-depth concept for the U.S. EPR.
- The design features that prevent and mitigate a ~~software~~ SWCCF of the safety-related I&C systems.
- An assessment of the I&C architecture relative to each of the 14 guidelines in NUREG/CR-6303.
- The results of a plant response analysis demonstrating that the U.S. EPR satisfies applicable acceptance criteria for a postulated SWCCF of the PS concurrent with an AOO or PA.

7.8.1 Description

7.8.1.1 Systems Description

7.8.1.1.1 Safety Information and Control System

The safety information and control system (SICS) provides the ability to manually trip the reactor ~~using a hardwired actuation path that~~ and initiate system-level critical safety functions via the diverse actuation system (DAS), which is not affected by a



~~software~~ SWCCF of the PS. The SICS is the primary human machine interface (HMI) for the DAS.

The SICS is described in Section 7.1.

7.8.1.1.2 ~~Deleted~~ **Process Information and Control System**

~~The PICS provides monitoring and control of plant safety systems via the PAS, DAS, and the priority and actuator control system (PACS). The PICS is diverse from the SICS.~~

~~The PICS is not subject to the postulated CCF of the PS, and is the HMI normally used by the operator during all plant conditions, as long as it is available. Therefore, the postulated CCF of the PS will not affect the PICS in a manner that induces the operator to attempt to operate the plant outside safety limits or in violation of the limiting conditions of operation.~~

~~The PICS is described in Section 7.1.~~

7.8.1.1.3 **Diverse Actuation System**

The DAS executes manual functions initiated from ~~PIC~~SICS and automatic functions to mitigate an ATWS or ~~software~~ SWCCF of the PS. The DAS is diverse from the PS.

The DAS executes the automatic RT, ESF actuation, and alarm and display functions listed in Section 7.8.1.2. Sensor information is acquired by the DAS from the ~~PS and SAS~~ signal conditioning and distribution system (SCDS) using a hardwired signal that ~~is electrically isolated within the safety I&C systems and~~ is not affected by a ~~software~~ SWCCF. This path is described in Section 7.1.1.6. The DAS also processes the manual, system level actuation of critical safety functions as described in Section 7.8.1.2.3. ~~Section 7.8.1.2.3.~~

For RT functions, outputs from the DAS are sent to the shunt trip coils of the RT breakers, which are a diverse means of opening the breakers from the undervoltage coils which are actuated by the PS. An output is also sent to the rod control units of the CRDCS, which are a diverse means of dropping the control rods from the reactor trip contactors which are de-energized by the PS. The DAS outputs are energized to actuate. This design is diverse from the PS outputs, which are de-energized to actuate.

For ESF actuations, outputs from the DAS are sent directly to the PACS. This path is not affected by a ~~software~~ SWCCF of the PS. Outputs for turbine trip are sent directly to the turbine generator I&C via a hardwired connection (one per division). The TG I&C performs two-out-of-four voting logic on the turbine trip signals. See Figure 7.1-27—Turbine Trip Logic within Turbine Generator I&C for details.



The following features are implemented so that the automatic DAS functions do not interfere with PS actuations under normal circumstances and so that the PS is given the opportunity to actuate before the DAS:

- DAS setpoints are selected to provide reasonable assurance that they will be reached after a corresponding PS setpoint is reached.
- Voting logic within the DAS is such that single failures do not result in spurious actuations of the automatic DAS functions.
- Priority logic within the PACS dictates that in case of conflicting orders between the PS and the DAS, the PS orders have a higher priority (the priority rules are described in Section 7.1).

The DAS functions are designed so that once initiated, they proceed to completion. The DAS functions use the same techniques as the similar PS functions to satisfy this requirement. These techniques are described in Section 7.2.2.1.6 and Section 7.3.2.3.4.

The DAS ~~has online self testing features, which minimizes the need for bypassing the system for periodic testing. Portions of the DAS that are not tested by the self test features~~ shall be periodically tested to ensure the system will execute its functions. Sensors that are shared by the protection system and the DAS are periodically tested as part of the PS and are not required to be tested separately as part of the DAS periodic testing.

Alarms and indications are processed by the DAS and are sent to the PICS (via PAS) and SICS for display. The DAS provides accurate status information to the operator in the main control room on the PICS (via PAS) and on SICS. This includes system operation status (i.e., bypass, initiate, standby, normal), power availability, and any system faults or messages pertinent to plant operation. ~~Confirmation of actuation of components by DAS is obtained through check back signals from the PACS to verify the status of the actuator.~~

The DAS is further described in Section 7.1.

7.8.1.1.4 Priority and Actuator Control System

The PACS supports the execution of automatic and manual functions required to mitigate an ATWS and a ~~software~~-SWCCF of the PS. The PACS is diverse in operation from the PS. The PACS is not used in the actuation path for the RT function.

The PACS receives actuation orders from the various I&C systems and sends the order of highest priority to the plant actuators. The priority modules in the PACS are not subject to SWCCF by virtue of 100 percent combinatorial, proof-of-design testing. The PACS (including the methodology for performing 100 percent combinatorial testing) is described in Section 7.1.



7.8.1.1.5 Signal Conditioning and Distribution System

The SCDS provides conditioned signals from the sensors and black boxes to multiple DCS subsystems for further processing. The outputs of the SCDS are hardwired and are sent independently to each system and are not affected by a SWCCF of the PS.

The SCDS is also connected directly to the SICS via hardwire for the display of certain sensor information. The display of this information is not affected by a SWCCF of the PS.

The SCDS is described in Section 7.1.

7.8.1.2 Functional Descriptions

7.8.1.2.1 Automatic DAS Functions

~~The following functions are performed automatically by the DAS to mitigate an ATWS or SWCCF of the PS concurrent with an AOO or PA:~~

The following automatic DAS functions are provided to mitigate an AOO or PA concurrent with a SWCCF of the PS:

- RT on low SG pressure.
- RT on low SG level.
- RT on high SG level.
- RT on low RCS flow (two loops).
- RT on low-low RCS flow (one loop).
- RT on high neutron flux (power range).
- RT on low hot leg pressure.
- RT on high pressurizer pressure.
- Turbine trip on RT.
- EFWS actuation on low SG level.
- SIS actuation on low pressurizer pressure ~~with signal to PAS to generate partial cooldown through TBS.~~
- Main steam isolation on low SG pressure.



- Containment isolation on high activity (also includes functions that cascade from containment isolation: Annulus ventilation and Safeguards Building HVAC reconfiguration)
- MFW isolation on low SG pressure.
- MFW isolation on high SG level.
- Opening of containment H₂hydrogen mixing dampers on high containment pressure, or high containment compartments differential pressure.
- Start SBO diesels.

~~Reference 1 describes how these functions act to mitigate AOOs or PAs in the presence of an SWCCF that renders the PS ineffective.~~

7.8.1.2.2 DAS Permissives

Permissive signals are used to enable, disable, or modify the operation of DAS RT and ESF functions based on plant conditions.

The state of a permissive signal is defined either as validated or inhibited:

- A validated permissive signal carries a logical value of 1.
- An inhibited permissive signal carries a logical value of 0.

There are two Permissives, D2 and D3, which are implemented in the DAS.

D2 Permissive

The D2 Permissive is intended, in normal operation, to allow the operator to reach the shutdown states without inadvertent DAS function actuation. The D2 Permissive uses the same excore power measurement devices as the Protection System P2 Permissive. The D2 Permissive is validated when the indicated power is higher than its setpoint of 10% nominal power. The validation of the D2 Permissive will follow the same two-out-of-four logics as the P2 Permissive shown in Figure 7.2-25—P2 Permissive Logic.

The D2 Permissive is automatically validated when the power increases above 10% and can be manually inhibited when the power is below the setpoint (10% power). The validation of the D2 Permissive automatically enables all of the DAS functions (RT and ESF) except the RT on Low-low Reactor Coolant System (RCS) Flow (One Loop). The inhibition of the D2 Permissive automatically disables all of the DAS functions (RT and ESF) except the RT on Low-low RCS Flow (One Loop).



D3 Permissive

The D3 Permissive is intended to prevent a full reactor trip actuation following a partial reactor trip due to the loss of one Reactor Coolant Pump (RCP) event. The D3 Permissive uses the same excore power measurement devices as the Protection System P3 Permissive. The D3 Permissive is automatically validated when the indicated power is higher its setpoint of 70% nominal power. The validation of the D3 Permissive will follow the same ~~three~~two-out-of-four logics as shown in Figure 7.2-26—P3 Permissive Logic.

The D3 Permissive is automatically validated when the power increases above 70% and automatically inhibited when the power decreases below 70%. The validation of the D3 Permissive automatically enables the RT on the Low-low RCS Flow (One Loop). The inhibition of the D3 Permissive automatically disables the RT on a Low-low RCS Flow (One Loop).

7.8.1.2.3

Manual Functions

The following manual functions are provided to mitigate an AOO or PA concurrent with a SWCCF of the PS. The allocation of the function within the DCS design is provided.

- Manual RT (SICS/DAS/PACS) (Note 1).
- Manual EDG start (SICS/PACS) (Note 2).
- Manual component controls to support diesel generator loading (emergency diesel generators or SBOs) (SICS/PACS) (Note 2).
- Manual EFW actuation (SICS/DAS/PACS) (Note 1).
- Manual operation of EFW for long-term SG level control (SICS/PACS) (Note 2).
- Manual SI switchover to hot leg injection (SICS/PACS) (Note 2).
- Manual MSIV closure (SICS/PACS) (Note 2).
- Manual feedwater isolation (MFW and EFW) (SICS/PACS) (Note 2).
- Manual initiation of medium head safety injection (MHSI) (SICS/DAS/PACS) (Note 1).
- Manual control of MHSI (SICS/PACS) (Note 2).
- Manually extend partial cooldown (SICS/PACS) (Note 2).
- Manual depressurize RCS with pressurizer sprays (SICS/PACS) (Note 2).
- Manual actuation of extra borating system (EBS) (SICS/PACS) (Note 2).



- Manual control room HVAC reconfiguration (SICS/PACS) (Note 2).
- Manual CVCS isolation (SICS/PACS).
- Manual MSRT control (SICS/PACS) (Note 1) (Note 2).
- Manual Stage 1 containment isolation (SICS/DAS/PACS) (Note 1).
- Manual opening of containment hydrogen mixing dampers (SICS/DAS/PACS) (Note 1).

Notes:

1. Function is used to satisfy BTP 7-19 Point 4.
2. Manual component controls required for diversity and defense-in-depth are credited via the SICS/PACS path. In addition, manual component controls are provided via PICS/PAS/PACS path. The operator will perform these actions from PICS as long as PICS is available.

The manual functions are subject to evaluation and design per the human factors engineering program described in Chapter 18. All of the manual actions are analyzed during task analysis as described in Section 18.4.2. Furthermore, the actions are included in the overall population of human actions that are subject to task support verification and integrated system validation as described in Sections 18.10.3.1, 18.10.3.3, and 18.10.3.6.

~~7.8.1.2.3 Manual Actuation of Critical Safety Functions~~

~~Manual actuation of critical safety functions is provided in accordance with SECY 93-087 (Reference 3). These manual functions are processed by I&C systems that are not subject to the postulated SWCCF of the PS. The functions provided for each critical safety function, and the I&C systems that process each function are identified:~~

- ~~Reactivity control—Manual RT (SICS).~~
- ~~Gore heat removal—Manual EFW actuation (PICS—DAS).~~
- ~~Manual MSRT actuation (PICS—PAS).~~
- ~~Reactor coolant inventory—Manual SIS actuation (PICS—DAS).~~
- ~~Containment isolation—Manual stage 1 containment isolation (PICS—DAS).~~
- ~~Containment integrity—Manual SIS actuation (PICS—DAS).~~



7.8.1.2.4 Indications and Alarms

The following indications and alarms are processed by the ~~DAS~~SCDS and provided to the operator on the PICS and SICS:

- Post-Accident Monitoring Variables – The operator is provided with indications to monitor the plant following an actuation by the DAS. ~~Each division of the DAS~~The SICS acquires Type A, B, and C post-accident monitoring variables from the SCDS. The ~~DAS~~SCDS processes the information and sends it to the ~~PICS~~SICS for display to the operator. Post-accident monitoring variables are described in Section 7.5.
- Indication and Alarm of DAS Status – When an automatic RT or ESF function is actuated by DAS, alarms are generated and sent to the PICS (via PAS) and SICS to alert the operator. ~~The PICS also displays the bypassed and inoperable status of the DAS when appropriate.~~

7.8.2 Analysis

7.8.2.1 Regulatory Requirements

7.8.2.1.1 10 CFR 50.55a(a)(1) - Quality Standards

The safety-related portions of the SICS, SCDS, and the PACS meet the requirements of 10 CFR 50.55a(a)(1). See Section 7.1 for a complete description on compliance with 10 CFR 50.55a(a)(1).

7.8.2.1.2 10 CFR 50.55a(h)(3) - Safety Systems

The safety-related portion of the SICS, SCDS, and the PACS meet the requirements of 10 CFR 50.55a(h)(3). ~~The PICS and DAS are non-safety-related systems and are~~The DAS is a non-safety-related system and is independent from the safety-related I&C systems. See Section 7.1 for a complete description on compliance with 10 CFR 50.55a(h)(3).

7.8.2.1.3 10 CFR 50.62 - Requirements for Reduction of Risk from ATWS Events for Light-Water-Cooled Nuclear Power Plants

~~The DAS is provided for ATWS mitigation, and meets~~The DAS, SCDS, and PACS are provided for ATWS mitigation, and meet the requirements of 10 CFR 50.62. The DAS automatically initiates RT, turbine trip, and EFW on conditions indicative of an ATWS to mitigate the event. The DAS performs its function reliably based on the system design and quality assurance measures taken. The DAS is independent from the PS. See Section 7.1 and Section 7.8.1.1.3 for more information on the DAS.

7.8.2.1.4 GDC 1 - Quality Standards and Records

See Section 7.1 for a description of compliance with GDC 1.



7.8.2.1.5 GDC 13 - Instrumentation and Control

See Section 7.1 for a description of compliance with GDC 13.

7.8.2.1.6 GDC 19 - Control Room

See Section 7.1 for a description of compliance with GDC 19.

7.8.2.1.7 GDC 24 - Separation of Protection and Control Systems

The ~~SIGSS~~SCDS and PACS meet the requirements of GDC 24. See Section 7.1 for a description of compliance with GDC 24.

7.8.2.1.8 Generic Letter 85-06 - Quality Assurance Guidance for ATWS Equipment that is not Safety Related

AREVA NP Inc. implements quality requirements to ATWS equipment in accordance with Generic Letter 85-06, "Quality Assurance Guidance for ATWS Equipment that is not Safety Related." [\(Reference 4\)](#).

7.8.3 References

1. ANP-10304, Revision ~~13~~, "U.S. EPR Diversity and Defense-in-Depth Assessment Technical Report," AREVA NP Inc., ~~December 2009~~[May 2011](#).
2. NUREG/CR-6303, "Method for Performing Diversity and Defense-in-Depth Analysis of Reactor Protection Systems," U.S. Nuclear Regulatory Commission, December 1994.
3. SECY-93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs," U.S. Nuclear Regulatory Commission, April 1993.
4. Generic Letter 85-06, "Quality Assurance Guidance for ATWS Equipment That Is Not Safety-Related," U.S. Nuclear Regulatory Commission, April 16, 1986.

[Next File](#)

allocation of assigned operational activities, the impact of those activities on crew member roles and responsibilities, and the impact of changes to operational requirements for the operating crew as a whole. The methodology for analysis of staffing and qualifications is described in Section 18.5.

The results of the evaluation of staffing, qualifications, and integrated work design impacts the HSI design in terms of:

- How operational activities are allocated to crew members, including assignments that make operational activities more efficient or reduce workload.
- How teamwork is supported.
- Personnel qualifications.
- Required staffing levels.

18.7.1.2 System Requirements

HSIs are designed to meet several system requirements. The HSI system requirements are documented for use throughout the HSI design process. As described in Section 4.5.1 of the U.S. EPR HFE Program Management Plan (Reference 2), the design control process facilitates the translation of high level requirements to lower level requirements, design inputs to design outputs, and high level design features to lower level subsystem and component design features.

The HSI consists of the controls, alarms, and indications used by the operator for controlling and monitoring the plant. Most plant and system functions are monitored and controlled by the automation system supervised by the operations staff. However, some system and functional requirements require manual operator actions and associated monitoring activities.

Details of the HSI system requirements and HSI functions including power requirements, interactions between HSIs (e.g., the alarm system with the plant overview display system; the computerized procedure system with the workstation display system), and interaction between HSIs and instrumentation and controls (I&C) systems are addressed in Section 7.1.

Screen-based HSIs that control safety components that may cause plant transients require two steps to perform an action once the active control window is opened. The first step selects the type of action (e.g., close or throttle valve, stop pump) and the second step executes the action.

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~~For the U.S. EPR, each division of safety related mechanical and electrical components has its own safety related screen based HSI (i.e., qualified display system (QDS)). A minimum of four separate QDSs are used to control the four trains of safety related~~

~~components. A d~~Dedicated QDS displays capable of receiving all four trains of data ~~is~~are used to give the operator an overview of the plant on the SICS. The dedicated overview QDS ~~is~~ displays are for monitoring only, with one way communication, and cannot impact the plant. See Section 7.1.1.2.1 for more information on safety-related HSI.

18.7.1.2.1 Alarm Management Hierarchy

The alarms on the PICS are prioritized into levels. The PICS provides the ability to display, record, and acknowledge alarms and warnings that are necessary for the operators. A color scheme is associated with the prioritization of the alarm to inform the operator of the nature of the alarm and the priority level. The operator uses the alarm text to view alarm details. A direct navigation link associated with the alarm is also available to the operator. Direct navigation links are used along with the alarm management system to allow the operator quick access to related information and controls.

18.7.1.2.2 Loss of Non-Safety Computerized HSIs

The U.S. EPR is normally controlled from PICS, the non-safety HSI. An independent safety-related HSI back-up, SICS, provides the ability to control and monitor the plant for a limited amount of time to keep it in a safe and steady power condition. If PICS is not available or directly recoverable, the plant is shut down. The SICS consists of QDSs displays and selected hardwired controls and alarms. ~~The QDS is also safety-qualified for controlling and monitoring the plant.~~

SICS is safety-related and is designed and qualified in accordance with IEEE Class 1E standards. The PICS is a non-safety-related system. The main difference between achieving safe shutdown from the different HSI systems is that more non-safety-related plant equipment can be operated from the PICS. The SICS includes the basic functional capabilities for the operator to monitor plant conditions and control appropriate plant systems to perform the credited safe shutdown path. However, more flexibility in the path to safe shutdown is available from the PICS due to the increase in HSI for both safety-related and non-safety-related systems.

Failures in PAS will be indicated on PICS. PAS failures resulting in the unavailability of the PICS need not be distinguished from failures in PICS resulting in the unavailability of PICS. The PICS will be used in all plant conditions, as long as it is available. The PICS is declared unavailable if less than two of the four operator workstations are in an available condition. A PICS workstation is declared unavailable if one or more of the following conditions exist:

- Three or more monitors at a workstation are unusable. The workstation in the Shift ~~Supervisor~~ Manager office is not considered an operator workstation.

- Data communication is not working satisfactorily (i.e., expected feedback not received in the expected timeframe or inputs do not respond in the expected manner).
- Correlating information on PICS displays at the different workstations is not consistent.
- Information on PICS displays and relevant SICS indications are not consistent (i.e., data on PICS differs significantly from data on SICS).

Operators will respond to these issues by procedure and training and will also be alerted to perform the above verifications by the features on PICS that:

- Inform an operator through alarms or status indicators when individual or multiple data is not valid.
- Inform an operator through alarms or status indicators that critical I&C hardware is not working properly.
- Inform an operator through alarms or status indicators when system logic has not produced the expected results.

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The PICS is normally used by the operator to monitor and control process systems, and SICS is used in the unlikely event that the PICS is not available and to perform a number of safety-related permissives and resets. During normal operating conditions, the status of plant operation is displayed on both the PICS and SICS, which allows for verification that the information displayed is consistent.

There are two mechanisms that prompt a manual comparison of PICS and SICS to verify consistency.

- A periodic verification will be performed as part of normal operating procedures to verify consistency between PICS and SICS.
- If, while performing operations from PICS, an operator detects a potential error in data displayed by PICS, the operator will perform a comparison of data between PICS and SICS. This comparison will be performed by employing the same procedure used for periodic verification of consistency. If an acceptable deviation value is exceeded, then operators will discontinue use of the PICS and a transfer to SICS will be initiated. The acceptable deviation value is specified in the procedure.

The PICS also has status indication to assist the operators in determining availability. If the operator begins using the SICS, it has priority for safety-related commands.

18.7.1.2.3 Loss of Plant Automation

No manual actions are required to be taken for 30 minutes from the main control room (MCR) to maintain the plant in a safe condition during design basis events (DBE). During DBEs the trip functions of the protection system (PS) (Section 7.2) and the

plant automation of the SAS (Section 7.1) are credited to attain a safe plant state. In the unlikely event that the PS fails, the diverse actuation system (DAS) (Section 7.8) is provided to initiate functions designed to mitigate the effects of DBEs and place the plant in a safe condition. If a DAS function initiates a plant shutdown, an alarm annunciates in the control room to alert the operators that manual actions may be necessary. The SICS provides the HSI for DAS.

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18.7.1.3 Regulatory Requirements

The HSIs are designed to meet the following regulatory requirements as described in Chapter 7.

18.7.1.3.1 10 CFR 50.34(f)(2)(i) - Simulator

The U.S. EPR MCR is modeled by a simulator which provides the capability to simulate a small break loss of cooling accident. The simulator is a close replica of the U.S. EPR MCR and includes the equipment and functionality of the U.S. EPR HSI.

18.7.1.3.2 10 CFR 50.34(f)(2)(iii) - State-of-the-Art Human Factors Principles

The U.S. EPR HSIs are designed using state-of-the-art human factors principles. The HFE style guide provides human factors principles which are applied consistently throughout the U.S. EPR design process.

18.7.1.3.3 10 CFR 50.34(f)(2)(iv) - Safety Parameter Display System

The U.S. EPR HSIs meet the requirements for a safety parameter display system (SPDS) as required by NUREG-0696 (Reference 11). The parameters required to be displayed as part of the SPDS are made available on the PICS and SICS in the MCR, the Technical Support Center (TSC), and the Emergency Operations Facility. The guidance provided by NUREG-0835 and NUREG-1342 is considered when designing the SPDS and HSI. See Section 7.5 for more details.

18.7.1.3.4 10 CFR 50.34(f)(2)(v) - Bypassed and Inoperable Status

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The U.S. EPR HSIs provide indication to the operator with regards to bypassed and operable status of safety-related systems. This indication is provided on the PICS ~~and SICS~~. See Section 7.5 for more details.

18.7.1.3.5 10 CFR 50.34(f)(2)(vi) - High Point Venting

Control of the high point venting of non-condensable gases from the reactor coolant system (RCS) is provided in the MCR. This capability is provided on both PICS and SICS.

18.7.1.3.6 10 CFR 50.34(f)(2)(xi) - Relief and Safety Valve Indication

The position of the pressurizer (PZR) safety relief valve and the main steam safety relief valve is indicated in the MCR. Both indication and alarm are provided on the PICS and the SICS. See Section 7.5 for more details.

18.7.1.3.7 10 CFR 50.34(f)(2)(xii) - Auxiliary Feedwater Initiation

The U.S. EPR HSIs enable automatic (protection system) as well as manual system level initiation of the emergency feed water system from the control room, via the SICS. The PICS also displays emergency feed water system flow in the control room. See Section 7.5 for more details.

18.7.1.3.8 10 CFR 50.34(f)(2)(xvii) - Accident Monitoring Instrumentation

The U.S. EPR HSIs provide indication in the control room of containment pressure, containment water level, containment hydrogen concentration, containment radiation intensity, and noble gas effluents at potential accident release points. This indication is provided on the PICS and SICS. See Section 7.5 for more details.

18.7.1.3.9 10 CFR 50.34(f)(2)(xviii) - Inadequate Core Cooling Instrumentation

Indication of inadequate core cooling is provided in the MCR on both PICS and SICS. See Section 7.5 for more details.

18.7.1.3.10 10 CFR 50.34(f)(2)(xix) - Instruments for Monitoring Plant Conditions Following Core Damage

The U.S. EPR HSIs enable the ability to monitor plant conditions following an accident that includes core damage. This indication is provided on the PICS. See Section 7.5 for more details.

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18.7.1.3.11 10CFR50 Appendix A GDC 19

The remote shutdown station (RSS) inventory consists of PICS and SICS. The ~~PICS~~ HSI in the RSS provides the HSI for prompt hot shutdown of the reactor, including necessary I&C to maintain the unit in a safe condition. Also, the RSS HSIs provide the capability for subsequent cold shutdown of the reactor through the use of suitable procedures. The RSS is not used for normal operation of the plant.

18.7.1.3.12 10 CFR 50.55a(a)(1)

Structures and components of the safety-related I&C systems that perform safety-related functions are classified as such and are designed, fabricated, erected, constructed, tested, and inspected commensurate with the safety-related function they perform.