ArevaEPRDCPEm Resource

From: WILLIFORD Dennis (AREVA) [Dennis.Williford@areva.com]
Sent: Wednesday, May 30, 2012 6:10 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. 506 (5456), FSAR Ch. 14, Supplement 9
Attachments: RAI 506 Supplement 9 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the 18 questions in RAI No. 506 on September 28, 2011. Supplement 1 response was submitted on November 8, 2011 to provide technically correct and complete responses to 12 of the 18 questions. Supplement 2 response was submitted on November 17, 2011 to provide a revised response to Question 14.03.05-29. Supplement 3 response was submitted on December 1, 2011 to provide a revised schedule for 3 questions. Supplement 4 response was submitted on January 13, 2012 to provide technically correct and complete responses to 2 questions. Supplement 5 response submitted on January 19, 2012, and Supplement 6 response submitted on February 17, 2012, respectively, provided a revised schedule for the 4 remaining questions. Supplement 7 response was submitted on March 7, 2012 to provide a technically correct and complete response to one question. Supplement 8 response was submitted on March 15, 2012 to provide a technically correct and complete response to two questions, an interim response to one question (14.3.5-39) and a revised schedule for the final response to this question (14.3.5-39).

The attached file, "RAI 506 Supplement 9 Response US EPR DC.pdf," provides a technically correct and complete final response to the remaining question as promised. 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 506 Question 14.03.05-39.

The following table indicates the respective pages in the response document, "RAI 506 Supplement 9 Response US EPR DC.pdf," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 506 — 14.03.05-39	2	3

This concludes the formal AREVA NP response to RAI 506, 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

From: WILLIFORD Dennis (RS/NB)
Sent: Thursday, March 15, 2012 3:37 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. 506 (5456), FSAR Ch. 14, Supplement 8

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the 18 questions in RAI No. 506 on September 28, 2011. Supplement 1 response was submitted on November 8, 2011 to provide technically correct and complete responses to 12 of the 18 questions. Supplement 2 response was submitted on November 17, 2011 to provide a revised response to Question 14.03.05-29. Supplement 3 response was submitted on December 1, 2011 to provide a revised schedule for 3 questions. Supplement 4 response was submitted on January 13, 2012 to provide technically correct and complete responses to 2 questions. Supplement 5 response submitted on January 19, 2012, and Supplement 6 response submitted on February 17, 2012, respectively, provided a revised schedule for the 4 remaining questions. Supplement 7 response was submitted on March 7, 2012 to provide a technically correct and complete response to one question.

The attached file, “RAI 506 Supplement 8 Response US EPR DC.pdf,” provides a technically correct and complete final response to 2 of the remaining 3 questions, and an interim response to Question 14.03.05-39. 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 506 Questions 14.03.05-30, 14.03.05-39 and 14.03.05-41. Note that the details of the Hydrogen Monitoring System U. S. EPR FSAR mark-ups will be provided in the final response to Question 14.03.05-39.

The following table indicates the respective pages in the response document, “RAI 506 Supplement 8 Response US EPR DC.pdf,” that contain AREVA NP’s response to the subject questions.

Question #	Start Page	End Page
RAI 506 — 14.03.05-30	2	5
RAI 506 — 14.03.05-39	6	7
RAI 506 — 14.03.05-41	8	8

The schedule for a technically correct and complete final response to the remaining question has been changed as provided below.

Question #	Interim Response Date	Response Date
RAI 506 — 14.03.05-39	**March 15, 2012 (Actual)**	**May 30, 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, March 07, 2012 5:27 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. 506 (5456), FSAR Ch. 14, Supplement 7

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the 18 questions in RAI No. 506 on September 28, 2011. Supplement 1 response was submitted on November 8, 2011 to provide technically correct and complete responses to 12 of the 18 questions. Supplement 2 response was submitted on November 17, 2011 to provide a revised response to Question 14.03.05-29. Supplement 3 response was submitted on December 1, 2011 to provide a revised schedule for 3 questions. Supplement 4 response was submitted on January 13, 2012 to provide technically correct and complete responses to 2 questions. Supplement 5 response submitted on January 19, 2012, and Supplement 6 response submitted on February 17, 2012, respectively, provided a revised schedule for the 4 remaining questions.

The attached file, "RAI 506 Supplement 7 Response US EPR DC.pdf," provides a technically correct and complete final response to 1 of the remaining 4 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 506 Question 14.03.05-27.

The following table indicates the respective pages in the response document, "RAI 506 Supplement 7 Response US EPR DC.pdf," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 506 — 14.03.05-27	2	2

The schedule for a technically correct and complete final response to the remaining 3 questions remains unchanged as provided below.

Question #	Response Date
RAI 506 — 14.03.05-30	March 15, 2012
RAI 506 — 14.03.05-39	March 15, 2012
RAI 506 — 14.03.05-41	March 15, 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 3:55 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. 506 (5456), FSAR Ch. 14, Supplement 6

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the 18 questions in RAI No. 506 on September 28, 2011. Supplement 1 response was submitted on November 8, 2011 to provide technically correct and complete responses to 12 of the 18 questions. Supplement 2 response was submitted on November 17, 2011 to provide a revised response to Question 14.03.05-29. Supplement 3 response was submitted on December 1, 2011 to provide a revised schedule for 3 questions. Supplement 4 response was submitted on January 13, 2012 to provide technically correct and complete responses to 2 questions. Supplement 5 response was submitted on January 19, 2012 to provide a revised schedule for the 4 remaining questions.

The schedule for a technically correct and complete final response to the remaining 4 questions has been changed as provided below.

Question #	Response Date
RAI 506 — 14.03.05-27	**March 15, 2012**
RAI 506 — 14.03.05-30	**March 15, 2012**
RAI 506 — 14.03.05-39	**March 15, 2012**
RAI 506 — 14.03.05-41	**March 15, 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 10:48 AM
To: Getachew.Tesfaye@nrc.gov
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); LENTZ Tony (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 506 (5456), FSAR Ch. 14, Supplement 5

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the 18 questions in RAI No. 506 on September 28, 2011. Supplement 1 response was submitted on November 8, 2011 to provide technically correct and complete responses to 12 of the 18 questions. Supplement 2 response was submitted on November 17, 2011 to provide a revised response to Question 14.03.05-29. Supplement 3 response was submitted on December 1, 2011 to provide a revised schedule for 3 questions. Supplement 4 response was submitted on January 13, 2012 to provide technically correct and complete responses to 2 questions.

The schedule for a technically correct and complete final response to the remaining 4 questions has been changed as provided below.

Question #	Response Date
RAI 506 — 14.03.05-27	**February 21, 2012**
RAI 506 — 14.03.05-30	**February 21, 2012**
RAI 506 — 14.03.05-39	**February 21, 2012**
RAI 506 — 14.03.05-41	**February 21, 2012**

Sincerely,

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

From: WILLIFORD Dennis (CORP/QP)
Sent: Friday, January 13, 2012 12:39 PM
To: Getachew.Tesfaye@nrc.gov
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); LENTZ Tony (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 506 (5456), FSAR Ch. 14, Supplement 4

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the 18 questions in RAI No. 506 on September 28, 2011. Supplement 1 response was submitted on November 8, 2011 to provide technically correct and complete responses to 12 of the 18 questions. Supplement 2 response was submitted on November 17, 2011 to provide a revised response to Question 14.03.05-29. Supplement 3 response was submitted on December 1, 2011 to provide a revised schedule for 3 questions.

The attached file, "RAI 506 Supplement 4 Response US EPR DC.pdf" provides a technically correct and complete final response to 2 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 506 Questions 14.03.05-28 and 14.03.05-35.

The following table indicates the respective pages in the response document, “RAI 506 Supplement 4 Response US EPR DC.pdf,” that contain AREVA NP’s response to the subject questions.

Question #	Start Page	End Page
RAI 506 — 14.03.05-28	2	3
RAI 506 — 14.03.05-35	4	4

The schedule for a technically correct and complete final response to the remaining 4 questions is unchanged as provided below.

Question #	Response Date
RAI 506 — 14.03.05-27	January 19, 2012
RAI 506 — 14.03.05-30	January 19, 2012
RAI 506 — 14.03.05-39	January 19, 2012
RAI 506 — 14.03.05-41	January 19, 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 01, 2011 3:07 PM
To: Getachew.Tesfaye@nrc.gov
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); LENTZ Tony (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 506 (5456), FSAR Ch. 14, Supplement 3

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the 18 questions in RAI No. 506 on September 28, 2011. Supplement 1 response was submitted on November 8, 2011 to provide technically correct and complete responses to 12 of the 18 questions. Supplement 2 response was submitted on November 17, 2011 to provide a revised response to Question 14.03.05-29.

The schedule for providing a response to Questions 14.03.05-27, 14.03.05-28 and 14.03.05-35 has been revised as provided below. The schedule for a response to the other 3 questions remains unchanged.

Question #	Response Date
RAI 506 — 14.03.05-27	**January 19, 2012**
RAI 506 — 14.03.05-28	**January 19, 2012**

RAI 506 — 14.03.05-30	January 19, 2012
RAI 506 — 14.03.05-35	**January 19, 2012**
RAI 506 — 14.03.05-39	January 19, 2012
RAI 506 — 14.03.05-41	January 19, 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 12:11 PM
To: Getachew.Tesfaye@nrc.gov
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); LENTZ Tony (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 506 (5456), FSAR Ch. 14, Supplement 2

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the 18 questions in RAI No. 506 on September 28, 2011. Supplement 1 response to RAI 506 was submitted on November 8, 2011 to provide technically correct and complete responses to 12 of the 18 questions.

The attached file, "RAI 506 Supplement 2 Response US EPR DC.pdf" provides a technically correct and complete revised final response to Question 14.03.05-29. The response has not changed from that provided in Supplement 1, however two additional affected pages from the U.S. EPR Final Safety Analysis Report were omitted from the earlier transmittal.

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 14.03.05-29.

The following table indicates the respective pages in the response document, "RAI 506 Supplement 2 Response US EPR DC.pdf," that contain AREVA NP's revised response to the subject question.

Question #	Start Page	End Page
RAI 506 — 14.03.05-29	2	2

The schedule for a technically correct and complete response to the remaining 6 questions is unchanged as provided below.

Question #	Response Date
RAI 506 — 14.03.05-27	December 9, 2011

RAI 506 — 14.03.05-28	December 9, 2011
RAI 506 — 14.03.05-30	January 19, 2012
RAI 506 — 14.03.05-35	December 9, 2011
RAI 506 — 14.03.05-39	January 19, 2012
RAI 506 — 14.03.05-41	January 19, 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: Tuesday, November 08, 2011 4:24 PM
To: Getachew.Tesfaye@nrc.gov
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); LENTZ Tony (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 506 (5456), FSAR Ch. 14, Supplement 1

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the 18 questions in RAI No. 506 on September 28, 2011.
The attached file, "RAI 506 Supplement 1 Response US EPR DC.pdf" provides a technically correct and complete final response to 12 of the 18 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 Questions 14.03.05-25, 14.03.05-26, 14.03.05-29, 14.03.05-31, 14.03.05-32, 14.03.05-33, 14.03.05-34, 14.03.05-36, 14.03.05-37, 14.03.05-38, 14.03.05-40 and 14.03.05-42.

The following table indicates the respective pages in the response document, "RAI 506 Supplement 1 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 506 — 14.03.05-25	2	2
RAI 506 — 14.03.05-26	3	3
RAI 506 — 14.03.05-29	4	4
RAI 506 — 14.03.05-31	5	5
RAI 506 — 14.03.05-32	6	6
RAI 506 — 14.03.05-33	7	7
RAI 506 — 14.03.05-34	8	8
RAI 506 — 14.03.05-36	9	9

RAI 506 — 14.03.05-37	10	10
RAI 506 — 14.03.05-38	11	11
RAI 506 — 14.03.05-40	12	12
RAI 506 — 14.03.05-42	13	13

The schedule for a technically correct and complete response to the remaining 6 questions has been revised as provided below.

Question #	Response Date
RAI 506 — 14.03.05-27	December 9, 2011
RAI 506 — 14.03.05-28	December 9, 2011
RAI 506 — 14.03.05-30	January 19, 2012
RAI 506 — 14.03.05-35	December 9, 2011
RAI 506 — 14.03.05-39	January 19, 2012
RAI 506 — 14.03.05-41	January 19, 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, September 28, 2011 5:19 PM
To: Getachew.Tesfaye@nrc.gov
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); LENTZ Tony (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 506 (5456), FSAR Ch. 14

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 506 Response US EPR DC.pdf," provides a schedule since a technically correct and complete response to the 18 questions cannot be provided at this time.

The following table indicates the respective pages in the response document, "RAI 506 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 506 — 14.03.05-25	2	2
RAI 506 — 14.03.05-26	3	3
RAI 506 — 14.03.05-27	4	4

RAI 506 — 14.03.05-28	5	5
RAI 506 — 14.03.05-29	6	6
RAI 506 — 14.03.05-30	7	7
RAI 506 — 14.03.05-31	8	8
RAI 506 — 14.03.05-32	9	9
RAI 506 — 14.03.05-33	10	10
RAI 506 — 14.03.05-34	11	11
RAI 506 — 14.03.05-35	12	12
RAI 506 — 14.03.05-36	13	13
RAI 506 — 14.03.05-37	14	14
RAI 506 — 14.03.05-38	15	15
RAI 506 — 14.03.05-39	16	16
RAI 506 — 14.03.05-40	17	17
RAI 506 — 14.03.05-41	18	18
RAI 506 — 14.03.05-42	19	19

A complete answer is not provided for the 18 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	**Response Date**
RAI 506 — 14.03.05-25	November 8, 2011
RAI 506 — 14.03.05-26	November 8, 2011
RAI 506 — 14.03.05-27	November 8, 2011
RAI 506 — 14.03.05-28	November 8, 2011
RAI 506 — 14.03.05-29	November 8, 2011
RAI 506 — 14.03.05-30	November 8, 2011
RAI 506 — 14.03.05-31	November 8, 2011
RAI 506 — 14.03.05-32	November 8, 2011
RAI 506 — 14.03.05-33	November 8, 2011
RAI 506 — 14.03.05-34	November 8, 2011
RAI 506 — 14.03.05-35	November 8, 2011
RAI 506 — 14.03.05-36	November 8, 2011
RAI 506 — 14.03.05-37	November 8, 2011
RAI 506 — 14.03.05-38	November 8, 2011
RAI 506 — 14.03.05-39	November 8, 2011
RAI 506 — 14.03.05-40	November 8, 2011
RAI 506 — 14.03.05-41	November 8, 2011
RAI 506 — 14.03.05-42	November 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: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Tuesday, August 30, 2011 1:31 PM
To: ZZ-DL-A-USEPR-DL
Cc: Mills, Daniel; Zhang, Deanna; Morton, Wendell; Spaulding, Deirdre; Mott, Kenneth; Truong, Tung; Zhao, Jack; Jackson, Terry; Jaffe, David; Canova, Michael; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 506 (5456), FSAR Ch. 14

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 25 and 29, 2011. Draft RAI Question 14.03.05-38 has been modified 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
NRO/DNRL/NARP
(301) 415-3361

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 3932

Mail Envelope Properties (2FBE1051AEB2E748A0F98DF9EEE5A5D4C81F16)

Subject: Response to U.S. EPR Design Certification Application RAI No. 506 (5456), FSAR Ch. 14, Supplement 9
Sent Date: 5/30/2012 6:10:26 PM
Received Date: 5/30/2012 6:11:34 PM
From: WILLIFORD Dennis (AREVA)

Created By: Dennis.Williford@areva.com

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

Post Office: auscharmx02.adom.ad.corp

Files	**Size**	**Date & Time**
MESSAGE	23391	5/30/2012 6:11:34 PM
RAI 506 Supplement 9 Response US EPR DC.pdf		579315

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

Response to

Request for Additional Information No. 506(5456), Revision 0,
Supplement 9

8/30/2011

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 14.03.05 - Instrumentation and Controls - Inspections, Tests, Analyses, and Acceptance Criteria
Application Section: 2.4

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

Question 14.03.05-39:

Discuss the basis for not including ITAAC to verify single failure protection for all safety-related systems.

IEEE Std. 603-1991, Clause 5.1, requires that any single failure within the safety system shall not prevent proper protective action at the system level when required. Guidance in the application of the single-failure criterion is provided in Regulatory Guide 1.53, "Application of the Single-Failure Criterion to Nuclear Power Plant Protection Systems," which endorses IEEE Std. 379-1988, "Standard Application of the Single-Failure Criterion to Nuclear Power Generating Station Safety Systems." The applicant provided ITAACs to verify design commitment regarding single-failure protection for safety-related systems such as Protection System (U.S. EPR FSAR, Tier 1, Table 2.4.1-7, Item 4.18), SICS (Tier 1, Table 2.4.2-2, Item 4.10), and SAS (Tier 1, Table 2.4.4-6, Item 4.10). Staff requests applicant to explain why such single-failure protection ITAACs were left out for the other safety-related systems such as Incore Instrumentation System, Excore Instrumentation System, Boron Concentration Measurement System, Radiation Monitoring System, Hydrogen Monitoring System, Signal Conditioning and Distribution System, and Rod Position Measurement System.

Response to Question 14.03.05-39:

U.S. EPR FSAR Tier 1, Instrumentation and Controls Design Features, Displays and Controls commitments and inspections, tests, analyses and acceptance criteria (ITAAC) will be revised to add an ITAAC item for single failure criteria to the following:

- PACS (Section 2.4.5, Item 4.11).
- Boron Concentration Measurement System (Section 2.4.11, Item 4.4).
- Control Rod Drive Control System (Section 2.4.13, Item 4.6).
- Excore Instrumentation System (Section 2.4.17, Item 4.4).
- Incore Instrumentation System (Section 2.4.19, Item 4.4).
- Radiation Monitoring System (Section 2.4.22, Item 4.3).
- Signal Conditioning and Distribution System (Section 2.4.25, Item 4.7).
- Rod Position Measurement System (Section 2.4.26, Item 4.9).

The U.S. EPR hydrogen monitoring system (HMS) provides indication of hydrogen concentration, but does not perform automatic actions. The operator uses the information only for assessment of plant and containment conditions. The HMS employs electronic sensors, with a zero to 10 percent range, to provide continuous indication of containment hydrogen concentration, and a mechanical sub-system, with a zero to 30 percent range, using sample pipes for pulling an air sample from containment for online analysis. The mechanical sub-system is not normally in operation, but rather in a standby mode to be manually started during a beyond design basis event (BDBE). The electronic sensors were initially classified safety-related and the mechanical sub-system as non-safety related. Based on a re-evaluation of current regulations and guidance set forth in 10CFR50.34, 10CFR50.44, 10CFR50.2, RG 1.97,

Rev. 4, IEEE 497-2002, and NRC SECY-11-0137, AREVA has reclassified the HMS electronic sensor sub-system from safety-related (S) to non-safety related, supplemented grade (NS-AQ) because the HMS does not perform safety-related functions as defined in 10CFR 50.2.

U.S. EPR FSAR Tier 1, Sections 2.4.2, 2.4.4, 2.4.5, 2.4.11, 2.4.13, 2.4.17, 2.4.19, 2.4.22, 2.4.25, and 2.4.26 will be revised to clarify the implementation of the single failure criterion. In addition, U.S. EPR FSAR Tier 1, Section 2.4.14 will be revised to conform to the changes associated with the HMS reclassification.

U.S. EPR FSAR Tier 2, Tables 3.2.2 and 3.11, Sections 6.2 and 7.1, and Table 7.1-2 will be revised to conform to the changes associated with the HMS reclassification.

FSAR Impact:

U.S. EPR FSAR Tier 1, Sections 2.4.2, 2.4.4, 2.4.5, 2.4.11, 2.4.13, 2.4.14, 2.4.17, 2.4.19, 2.4.22, 2.4.25, and 2.4.26 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR FSAR Tier 2, Tables 1.9-2, 3.2.2 and 3.11, Sections 6.2 and 7.1, Table 7.1-2, and Section 14.2.12 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

3.0 Mechanical Design Features

3.1 Equipment identified as Seismic Category I in Table 2.4.2-1 can withstand seismic design basis loads without loss of safety function.

4.0 I&C Design Features, Displays and Controls

4.1 The capability to transfer control of the SICS from the MCR to the RSS exists in a fire area separate from the MCR. The transfer switches are each associated with a single division of the safety-related control and allow transfer of control without entry into the MCR.

4.2 Electrical isolation ~~exists~~ is provided between the Class 1E electrical divisions that power the controls and indications of the SICS as listed in Table 2.4.2-1.

4.3 Electrical isolation is provided on connections between the safety-related parts of the SICS and non-Class 1E equipment.

4.4 Class 1E SICS equipment listed in Table 2.4.2-1 can ~~perform its safety~~ function when subjected to electromagnetic interference (EMI), radio-frequency interference (RFI), electrostatic discharges (ESD), and power surges.

4.5 The SICS provides controls for manual actuation of reactor trip in the MCR and RSS.~~Deleted.~~

4.6 Electrical isolation is provided on connections between the RSS and the MCR for the SICS.

4.7 The SICS provides controls in the MCR for the manual actuation of the ESF functions listed in Table 2.4.2-2—Manually Actuated ESF Functions.~~Deleted.~~

4.8 The SICS provides indications of Type A, B, and C PAM variables in the MCR.~~Deleted.~~

4.9 The SICS provides, in the MCR, manual controls and indications necessary to reach and maintain safe shutdown following an AOO or PA.~~Deleted..~~

4.10 The SICS is designed so that safety-related functions required for an ~~anticipated operational occurrence (~~AOO~~)~~ or ~~postulated accident (~~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 requiring the safety function.

4.11 Locking mechanisms are provided on the SICS doors in the MCR and RSS. Opened SICS doors in the RSS are indicated in the MCR.~~Deleted.~~

Table 2.4.2-24—Safety Information and Control System ITAAC (5 6 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
4.10	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 requiring the safety function.	A failure modes and effects analysis will be performed on the SICS at the level of replaceable modules and components.	A report exists and concludes that 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 requiring the safety function.
4.11	Locking mechanisms are provided on the SICS doors in the MCR and RSS. Opened SICS doors in the RSS are indicated in the MCR.Deleted.	a. An inspection will be performed.Deleted. b. A test will be performed. c. A test will be performed.	a. Locking mechanisms exist on the SICS doors in the MCR and RSS.Deleted. b. The locking mechanisms on the SICS doors in the MCR and RSS operate properly. c. Opened SICS doors in the RSS are indicated in the MCR when a SICS door is in the open position.
4.12	Controls on the SICS in the RSS perform the function listed in Table 2.4.2-3.Deleted.	Tests will be performed using manual controls on the SICS in the RSS.Deleted.	Controls on the SICS in the RSS perform the function listed in Table 2.4.2-3.Deleted.
4.13	The SICS provides controls in the MCR for blocking the PAS signals in the PACS through a set of operational I&C disable switches. Deleted.	Tests will be performed to verify that the operational I&C disable switches block the PAS signals in the PACS. Deleted.	The operational I&C disable switches perform their function to block the PAS signals in the PACS.Deleted.
4.14	Deleted.	Deleted.	Deleted.
4.15	Deleted.	Deleted.	Deleted.

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.

4.6 Electrical isolation is provided on connections between the four SAS divisions.

4.7 Electrical isolation is provided on connections between SAS equipment and non-Class 1E equipment.

4.8 Communications independence is provided between the four SAS divisions.

4.9 Communications independence is provided between SAS equipment and non-Class 1E equipment.

4.10 The SAS is designed so that safety-related functions required for AOOs or PAs 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.

4.11 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.

4.12 Locking mechanisms are provided on the SAS cabinet doors. Opened SAS cabinet doors are indicated in the MCR.

4.13 CPU state switches are present at the SAS cabinets to restrict modifications to the SAS software.

4.14 The SAS is capable of performing its safety function when SAS equipment is in maintenance bypass~~one of the SAS divisions is out of service~~. Bypassed SAS equipment is ~~Out of service divisions of SAS are~~ indicated in the MCR.

4.15 The operational availability of each input variable listed in Table 2.4.4-2 listed can be confirmed during reactor operation including post-accident periods by one of the following methods:

- By perturbing the monitored variable.

Table 2.4.4-~~6~~4—Safety Automation System ITAAC (11 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
4.10	The SAS is designed so that safety-related functions required for AOOs or PAs 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.	A failure modes and effects analysis will be performed on the SAS at the level of replaceable modules and components.	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: • 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	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.	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.	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.
4.12	Locking mechanisms are provided on the SAS cabinet doors. Opened SAS cabinet doors are indicated in the MCR.	a. ~~Inspections~~ An inspection will be performed ~~to verify the existence of locking mechanisms on the SAS cabinet doors~~. b. ~~Tests~~ A test will be performed ~~to verify the proper operation of the locking mechanisms on the SAS cabinet doors~~. c. ~~Tests~~ A test ~~and inspections~~ will be performed ~~to verify an indication exists in the MCR when a SAS cabinet door is in the open position~~.	a. Locking mechanisms exist on the SAS cabinet doors. b. The locking mechanisms on the SAS cabinet doors operate properly. c. Opened SAS cabinet doors are indicated in the MCR with an SAS cabinet door is in the open position.

4.3 Class 1E PACS equipment listed in Table 2.4.5-1 can ~~perform its safety~~ function when subjected to electromagnetic interference (EMI), radio-frequency interference (RFI), electrostatic discharges (ESD), and power surges.

4.4 The input wiring from other I&C systems to the PACS is properly connected.

4.5 The capability for testing of the PACS is provided while retaining the capability of the PACS to accomplish its safety function. PACS divisions in test are indicated in the MCR.

4.6 Locking mechanisms are provided on the PACS cabinet doors. Opened PACS cabinet doors are indicated in the MCR.

4.7 The equipment for each PACS 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.

4.8 The PACS provides a position indication signal to the safety information and control system (SICS) for each containment isolation valve (Type B post-accident monitoring (PAM) variable) listed in Table 2.4.5-2.

4.9 Non-Class 1E PACS communication module associated with Class 1E equipment will not cause a failure of a PACS priority module when subjected to EMI, RFI, ESD and power surges.

4.10 The capability of 100% combinatorial testing of the PACS priority module is provided to preclude a software common cause failure.

4.11 The PACS is designed so that safety-related functions required for an anticipated operational occurrence (AOO) or postulated accident (PA) are performed in the presence of the following:

- Single failure 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.

5.0 Electrical Power Design Features

5.1 ~~Class 1E PACS~~ The components designated as Class 1E in Table 2.4.5-1 are powered from a Class 1E division as listed in Table 2.4.5-1 in a normal or alternate feed condition.

6.0 Environmental Qualification

6.1 Components listed as Class 1E in Table 2.4.5-1 can perform their function under normal environmental conditions, AOOs, and accident and post-accident environmental conditions.

Table 2.4.5-3—Priority and Actuator Control System ITAAC (5 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
4.8	The PACS provides a position indication signal to the SICS for each containment isolation valve (Type B PAM variable) listed in Table 2.4.5-2.	Tests will be performed using test signals. ~~to verify that the PACS provides position indication signals to the SICS for each containment isolation valve.~~	The PACS provides a position indication signal to the SICS for each containment isolation valve listed in Table 2.4.5-2.
4.9	Non-Class 1E PACS communication module associated with Class 1E equipment will not cause a failure of a PACS priority module when subjected to EMI, RFI, ESD and power surges	Tests, analyses, or a combination of tests and analyses will be performed ~~on the communication module~~.	~~A report exists and concludes that the~~ Non-Class 1E PACS communication module will not cause a failure of PACS priority module when subjected to EMI, RFI, ESD, and power surges.
4.10	The capability of 100% combinatorial testing of the PACS priority module is provided to preclude a software common cause failure.	A type test will be performed using test signals. ~~on the PACS priority module to preclude consideration of a software common cause failure.~~	The capability of 100% combinatorial testing of the PACS priority module is provided to preclude a software common cause failure. ~~A report exists and concludes that 100% combinatorial type testing on the PACS priority module has been successfully completed.~~
4.11	The PACS is designed so that safety-related functions required for an AOO or PA are performed in the presence of the following: • Single 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.	A failure modes and effects analysis will be performed on the PACS at the level of replaceable modules and components.	A report concludes that the PACS is designed so that safety-related functions required for an AOO or PA are performed in the presence of the following: • Single 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.

2.4.11 Boron Concentration Measurement System

1.0 Description

The boron concentration measurement system (BCMS) measures the boron concentration in the chemical and volume control system (CVCS).

The BCMS has the following safety-related function:

- Sends boron concentration measurement signals to the signal conditioning and distribution system (SCDS).

2.0 Arrangement

2.1 The location of the BCMS equipment is ~~located~~ as listed in Table 2.4.11–1—Boron Concentration Measurement System Equipment.

3.0 Mechanical Design Features

3.1 Equipment identified as Seismic Category I in Table 2.4.11-1 can withstand seismic design basis loads without loss of safety function.

4.0 I&C Design Features, Displays and Controls

4.1 The BCMS provides output signals to the recipients listed in Table 2.4.11-2—Boron Concentration Measurement System Output Signals.

4.2 The BCMS equipment classified as Class 1E listed in Table 2.4.11-1 can ~~perform its safety~~ function when subjected to electromagnetic interference (EMI), radio-frequency interference (RFI), electrostatic discharges (ESD), and power surges.

4.3 Locking mechanisms are provided on the BCMS cabinet doors. Opened BCMS cabinet doors are indicated in the MCR.

4.4 The BCMS is designed so that safety-related functions required for an anticipated operational occurrence (AOO) or postulated accident (PA) are performed in the presence of the following:

- Single detectable failures within the BCMS 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.

5.0 Electrical Power Design Features

5.1 The components designated ~~identified~~ as Class 1E in Table 2.4.11-1 are powered from the Class 1E division as listed in Table 2.4.11-1 in a normal or alternate feed condition.

Table 2.4.11-3—Boron Concentration Measurement System ITAAC (2 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
		c. A test will be performed.	c. Opened BCMS cabinet doors are indicated in the MCR when a BCMS cabinet door is in the open position.
4.4	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 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.	A failure modes and effects analysis will be performed on the BCMS at the level of replaceable modules and components.	A report concludes that 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 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.
5.1	The components designated ~~identified~~ as Class 1E in Table 2.4.11-1 are powered from the Class 1E division as listed in Table 2.4.11-1 in a normal or alternate feed condition.	a. Testing will be performed ~~for components identified as Class 1E in Table 2.4.11-1~~ by providing a test signal in each normally aligned division. b. Testing will be performed ~~for components identified as Class 1E in Table 2.4.11-1~~ by providing a test signal in each division with the alternate feed aligned to the divisional pair.	a. The test signal provided in the normally aligned division is present at the respective Class 1E components identified in Table 2.4.11-1. 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 2.4.11-1.

2.4.13 Control Rod Drive Control System

1.0 Description

The control rod drive control system (CRDCS) controls the actuation of power to the control rod drive mechanisms (CRDM).

The CRDCS has the following safety-related functions:

- Interrupts power to the CRDMs via the reactor trip contactors.
- Provides signals that report the status of the reactor trip contactors to the Signal Conditioning and Distribution System (SCDS).

The CRDCS provides the following non-safety-related functions:

- Actuates the rod cluster control assemblies through the CRDMs.

2.0 Arrangement

2.1 The location of the CRDCS equipment is ~~located~~ as listed in Table 2.4.13-1—Control Rod Drive Control System Equipment.

3.0 Mechanical Design Features

3.1 Equipment identified as Seismic Category I in Table 2.4.13-1 can withstand seismic design basis loads without loss of safety function.

4.0 I&C Design Features, Displays and Controls

4.1 The CRDCS equipment classified as Class 1E listed in Table 2.4.13-1 can ~~perform its safety~~ function when subjected to electromagnetic interference (EMI), radio-frequency interference (RFI), electrostatic discharges, and power surges.

4.2 The CRDCS receives inputs from the sources listed in Table 2.4.13-2—Control Rod Drive Control System Input Signals.

4.3 Each reactor trip contactor listed in Table 2.4.13-1 opens when an RT signal is received from the corresponding PS division.

4.4 The CRDCS limits the rod cluster control assembly (RCCA) bank withdrawal rate to a maximum value of 30 in per minute or less.

4.5 The CRDCS provides output signals to the recipients listed in Table 2.4.13-3—Control Rod Drive Control System Output Signals.

4.6 The CRDCS is designed so that safety-related functions required for an anticipated operational occurrence (AOO) or postulated accident (PA) are performed in the presence of the following:

- Single detectable failures within the CRDCS 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.

5.0 Environmental Qualifications

5.1 Components listed as Class 1E in Table 2.4.13-1 can perform their function under normal environmental conditions, AOOs, and accident and post-accident environmental conditions.

~~5.0~~6.0 System Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.4.13-~~3~~ 4 lists the CRDCS ITAAC.

Table 2.4.13-34—Control Rod Drive Control System ITAAC (2 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
4.4	The CRDCS limits the RCCA bank withdrawal rate to a maximum value of 30 in per minute or less.	Tests A test will be performed to determine the maximum RCCA bank withdrawal rateusing test signals.	The CRDCS limits the RCCA bank withdrawal rate to a maximum value of 30 inches per minute or less.
4.5	The CRDCS provides output signals to the recipients listed in Table 2.4.13-3.	A test will be performed using test signals.	The CRDCS provides output signals to the recipients listed in Table 2.4.13-3.
4.6	The CRDCS 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 CRDCS 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.	A failure modes and effects analysis will be performed on the CRDCS at the level of replaceable modules and components.	A report concludes that the CRDCS 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 CRDCS 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.
5.1	Components listed as Class 1E in Table 2.4.11-1 will perform their function under normal environmental conditions, AOOs, and accident and post-accident environmental conditions.	a. Type tests or type tests and analysis will be performed to demonstrate the ability of the components listed as Class 1E in Table 2.4.11-1 to perform their function under normal environmental conditions, AOOs, and accident and post-accident environmental conditions.	a. Environmental Qualification Data Packages (EQDP) conclude that components listed as Class 1E in Table 2.4.11-1 can perform their function under normal environmental conditions, AOOs, and accident and post-accident environmental conditions including the time required to perform their function.

2.4.14 Hydrogen Monitoring System

1.0 Description

The hydrogen monitoring system (HMS) provides for the monitoring of hydrogen concentration in the containment atmosphere.

The HMS has the following non-safety -related function:

- Provides containment Measures the hydrogen concentration in containmentsignals to SCDS.

2.0 Arrangement

2.1 The location of the HMS system equipment is located as listed in Table 2.4.14-1—Hydrogen Monitoring System Equipment.

3.0 Mechanical Design Features

3.1 Equipment identified as Seismic Category I in Table 2.4.14-1 can withstand seismic design basis loads without loss of safety function.

4.0 I&C Design Features, Displays and Controls

4.1 The HMS equipment classified as Class 1E listed in Table 2.4.14-1 can perform its safety function when subjected to electromagnetic interference (EMI), radio-frequency interference (RFI), electrostatic discharges (ESD), and power surges.

4.2 The HMS provides output signals to the recipients listed in Table 2.4.14-2—Hydrogen Monitoring System Output Signals.

5.0 Electrical Power Design Features

5.1 The components designated identified as Class 1E in Table 2.4.14-1 are powered from the Class 1E division as listed in Table 2.4.14-1 in a normal or alternate feed condition.

6.0 Environmental Qualifications

6.1 Components designated as harsh environment listed as Class 1E in Table 2.4.14-1 that are designated as harsh environment, will perform their function under normal environmental conditions, containment test conditions, anticipated operational occurrences (AOO), and accident and post-accident environmental conditions.in the environments that exist during and following design basis events.

7.0 System Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.4.14-2 3 lists the HMS ITAAC.

All indicated changes are in response to RAI 506, Question 14.03.05-39

Table 2.4.14-1—Hydrogen Monitoring System Equipment

Description	Tag Number (1)	Location	Seismic Category	IEEE Class 1E (2)	Harsh Environment
Hydrogen Sensor	30JMU10CQ001	Reactor Building	I	Note 3 1^N $4^A 2^A$	Harsh Yes
Hydrogen Sensor	30JMU10CQ002	Reactor Building	I	Note 3 4^N $3^A 1^N$ $4^A 2^A$	Harsh Yes
Hydrogen Sensor	30JMU10CQ003	Reactor Building	I	Note 3 1^N $4^A 2^A$	Harsh Yes
Hydrogen Sensor	30JMU10CQ004	Reactor Building	I	Note 3 4^N $3^A 1^N$ $4^A 2^A$	Harsh Yes
Hydrogen Sensor	30JMU10CQ005	Reactor Building	I	Note 3 1^N $4^A 2^A$	Harsh Yes
Hydrogen Sensor	30JMU10CQ006	Reactor Building	I	Note 3 4^N $3^A 1^N$ $4^A 2^A$	Harsh Yes
Hydrogen Sensor	30JMU10CQ007	Reactor Building	I	Note 3 1^N $4^A 2^A$	Harsh Yes

Hydrogen Sensor	30JMU10CQ008	Reactor Building	I	Note 3 4^N 3^A~~1~~^{N} ~~2~~^{A}	Harsh
Hydrogen Sensor	30JMU10CQ009	Reactor Building	I	Note 3 1^N 2^A	Harsh
Hydrogen Sensor	30JMU10CQ010	Reactor Building	I	Note 3 4^N 3^A~~1~~^{N} ~~2~~^{A}	Harsh
Hydrogen Sensor	30JMU10CQ011	Reactor Building	I	Note 3 1^N 2^A	Harsh
Hydrogen Sensor	30JMU10CQ012	Reactor Building	I	Note 3 4^N 3^A~~1~~^{N} ~~2~~^{A}	Harsh
Hydrogen Monitoring Signal Processing Unit	30JMU10GH001	Safeguard Building	I	Note 3 1^N ~~4~~^{A}2^A	Mild~~No~~
Hydrogen Monitoring Signal Processing Unit	30JMU10GH002	Safeguards Building	I	Note 3 4^N 3^A	Mild

1) Equipment tag numbers are provided for information and are not part of the design certification.

2) ^{N} denotes the division the component is normally powered from. ^{A} denotes the division the component is powered from when alternate feed is implemented.

2)3) The operation of the component is non-safety related and not class 1E. It is powered from a class 1E source.

Table 2.4.14-2—Hydrogen Monitoring System Output Signals

Item #	Output Signal	Recipient	# Divisions
1	Containment Hydrogen Concentration	SCDS	2

Table 2.4.14-23—Hydrogen Monitoring System ITAAC (2 4 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
2.1	The location of the HMS equipment is located as listed in Table 2.4.14-1.	Inspections An inspection will be performed of the location of the HMS equipment.	The HMS equipment listed in Table 2.4.14-1 is located as listed in Table 2.4.14-1.
3.1	Equipment identified as Seismic Category I in Table 2.4.14-1 can withstand seismic design basis loads without loss of safety function.	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 2.4.14-1 using analytical assumptions, or under conditions, which bound the Seismic Category I design requirements. b. Inspections will be performed of the Seismic Category I equipment listed in Table 2.4.14-1 to verify that the equipment including anchorage is installed per seismic qualification report (SQDP, EQDP, or analyses) requirementsas specified on the construction drawings.	a. Tests/analysis reports exist and conclude that the equipment listed as Seismic Category I in Table 2.4.14-1 withstand seismic design basis loads without loss of safety function. b. Inspection reports exist and conclude that the Seismic Category I equipment listed in Table 2.4.14-1 including anchorage is installed per seismic qualification report (SQDP, EQDP, or analyses) requirementsas specified on the construction drawings.
4.1	The HMS equipment classified as Class 1E listed in Table 2.4.14-1 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 2.4.14-1.	A report exists and concludes that the eEquipment listed as Class 1E in Table 2.4.14-1 can perform its safety function when subjected to EMI, RFI, ESD, and power surges.
4.2	The HMS provides output signals to the recipients listed in Table 2.4.14-2.	A test will be performed using test signals.	The HMS provides output signals to the recipients listed in Table 2.4.14-2.

Table 2.4.14-23—Hydrogen Monitoring System ITAAC (2 4 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
5.1	The components designated identified as Class 1E in Table 2.4.14-1 are powered from the Class 1E division as listed in Table 2.4.14-1 in a normal or alternate feed condition.	a. Testing will be performed for components identified as Class 1E in Table 2.4.14-1 by providing a test signal in each normally aligned division. b. Testing will be performed for components identified as Class 1E in Table 2.4.14-1 by providing a test signal in each division with the alternate feed aligned to the divisional pair.	a. The test signal provided in the normally aligned division is present at the respective Class 1E components identified in Table 2.4.14-1. 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 2.4.14-1.
6.1	Components designated as harsh environment listed as Class 1E in Table 2.4.14-1 that are designated as harsh environment, will perform their function under normal environmental conditions, containment test conditions, anticipated operational occurrences, and accident and post-accident environmental conditions. in the environments that exist during and following design basis events.	a. Type tests or type tests and analysis will be performed to demonstrate the ability of the components designated as harsh environment listed as Class 1E in Table 2.4.14-1 to perform their function under normal environmental conditions, containment test conditions, anticipated operational occurrences, and accident and post-accident environmental conditions. for the environmental conditions that could occur during and following design basis events.	a. Environmental Qualification Data Packages (EQDPs) exist and conclude that the components designated as harsh environment listed as Class 1E in Table 2.4.14-1 can perform their function under normal environmental conditions, containment test conditions, anticipated operational occurrences, and accident and post-accident environmental conditions, during and following design basis events including the time required to perform the listed function.

2.4.17 Excore Instrumentation System

1.0 Description

The excore instrumentation system (EIS) provides signals indicative of neutron flux level conditions to other I&C systems.

The EIS has the following safety related function:

- Provides neutron flux level signals to the signal conditioning and distribution system (SCDS).

2.0 Arrangement

2.1 The location of the EIS equipment is ~~located~~ as listed in Table 2.4.17-1—Excore Instrumentation System Equipment.

3.0 Mechanical Design Features

3.1 Equipment identified as Seismic Category I in Table 2.4.17-1 can withstand seismic design basis loads without loss of safety function.

4.0 I&C Design Features, Displays and Controls

4.1 The EIS equipment classified as Class 1E listed in Table 2.4.17-1 can ~~perform its safety~~ function when subjected to electromagnetic interference (EMI), radio-frequency interference (RFI), electrostatic discharges (ESD), and power surges.

4.2 The EIS provides output signals to the recipients listed in Table 2.4.17-2—Excore Instrumentation System Output Signals.

4.3 Locking mechanisms are provided on the EIS cabinet doors. Opened EIS cabinet doors are indicated in the MCR.

4.4 The EIS is designed so that safety-related functions required for an anticipated operational occurrence (AOO) or postulated accident (PA) are performed in the presence of the following:

- Single detectable failures within the EIS 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.

5.0 Electrical Power Design Features

5.1 The components designated ~~identified~~ as Class 1E in Table 2.4.17-1 are powered from the Class 1E division as listed in Table 2.4.17-1 in a normal or alternate feed condition.

Table 2.4.17-3—Excore Instrumentation System ITAAC (2 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
		c. A test will be performed	c. Opened EIS cabinet doors are indicated in the MCR when a EIS cabinet door is in the open position.
4.4	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 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.	A failure modes and effects analysis will be performed on the EIS at the level of replaceable modules and components.	A report concludes that 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 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.
5.1	The components designated ~~identified~~ as Class 1E in Table 2.4.17-1 are powered from the Class 1E division as listed in Table 2.4.17-1 in a normal or alternate feed condition.	a. Testing will be performed ~~for components identified as Class 1E in Table 2.4.17-1~~ by providing a test signal in each normally aligned division. b. Testing will be performed ~~for components identified as Class 1E in Table 2.4.17-1~~ by providing a test signal in each division with the alternate feed aligned to the divisional pair.	a. The test signal provided in the normally aligned division is present at the respective Class 1E components identified in Table 2.4.17-1. 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 2.4.17-1.

2.4.19 Incore Instrumentation System

1.0 Description

The incore instrumentation system (ICIS) provides information about the conditions inside the reactor core.

The ICIS has the following safety safety-related functions:

- Provides self powered neutron detector (SPND) output signals to signal conditioning and distribution system (SCDS).
- Provides a measurement of core outlet temperature signals to SCDS.

2.0 Arrangement

2.1 The location of the ICIS equipment is located as listed in Table 2.4.19-1—Incore Instrumentation System Equipment.

3.0 Mechanical Design Features

3.1 Equipment identified as Seismic Category I in Table 2.4.19-1 can withstand seismic design basis loads without loss of safety function.

4.0 I&C Design Features, Displays and Controls

4.1 The ICIS equipment classified as Class 1E listed in Table 2.4.19-1 can perform its safety function when subjected to electromagnetic interference (EMI), radio-frequency interference (RFI), electrostatic discharges (ESD), and power surges.

4.2 The ICIS provides output signals to the recipients listed in Table 2.4.19-2—Incore Instrumentation System Output Signals.

4.3 Locking mechanisms are provided on the ICIS cabinet doors. Opened ICIS cabinet doors are indicated in the MCR.

4.4 The ICIS is designed so that safety-related functions required for an anticipated operational occurrence (AOO) or postulated accident (PA) are performed in the presence of the following:

- Single detectable failures within the ICIS 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.

Table 2.4.19-3—Incore Instrumentation System ITAAC (2 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
4.3	Locking mechanisms are provided on the ICIS cabinet doors. Opened ICIS cabinet doors are indicated in the MCR.	a. An inspection will be performed. b. A test will be performed. c. A test will be performed.	a. Locking mechanisms exist on the ICIS cabinet doors. b. The locking mechanisms on the ICIS cabinet doors operate properly. c. Opened ICIS cabinet doors are indicated in the MCR when a ICIS cabinet door is in the open position.
4.4	The ICIS 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 ICIS 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.	A failure modes and effects analysis will be performed on the ICIS at the level of replaceable modules and components.	A report concludes that the ICIS 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 ICIS 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.

2.4.22 Radiation Monitoring System

1.0 Description

The radiation monitoring system (RMS) provides surveillance of ionizing radiation comprising all provisions dealing with the occurrence of ionizing radiation within the plant and measures related to the health control of personnel who could be exposed to radiation.

The radiation monitoring system provides the following safety-related function:

- Provides safety-related signals to the SCDS.

The radiation monitoring system provides the following non-safety related function:

- Provides non-safety-related signals to the SCDS.

2.0 Arrangement

2.1 The location of the RMS equipment is ~~located~~ as listed in Table 2.4.22-1—Radiation Monitoring System Equipment.

3.0 Mechanical Design Features

3.1 Components identified as Seismic Category I in Table 2.4.22-1 can withstand seismic design basis loads without a loss of safety function.

4.0 I&C Design Features, Displays and Controls

4.1 The RMS provides the output signals to the recipients listed in Table 2.4.22-2—Radiation Monitoring System Output Signals.

4.2 Locking mechanisms are provided on the RMS cabinet doors. Opened RMS cabinet doors are indicated in the MCR.~~Deleted.~~

4.3 The RMS is designed so that safety-related functions required for an anticipated operational occurrence (AOO) or postulated accident (PA) are performed in the presence of the following:

- Single detectable failures within the RMS 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.

4.4 Class 1E RMS equipment listed in Table 2.4.22-1 can function when subjected to electromagnetic interference (EMI), radio-frequency interference (RFI), electrostatic discharges (ESD), and power surges.

Table 2.4.22-3—Radiation Monitoring System ITAAC(2 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
4.3	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 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.	A failure modes and effects analysis will be performed on the RMS at the level of replaceable modules and components.	A report concludes that 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 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.
4.4	Class 1E RMS equipment listed in Table 2.4.22-1 can function when subjected to EMI, RFI, ESD, and power surges.	Type tests or type tests and analyses will be performed.	Equipment identified as Class 1E in Table 2.4.22-1 can function when subjected to EMI, RFI, ESD, and power surges.
5.1	The components designated identified as Class 1E in Table 2.4.22-1 are powered from the Class 1E division as listed in Table 2.4.22-1 in a normal or alternate feed condition.	a. Testing will be performed for components identified as Class 1E in Table 2.4.22-1 by providing a test signal in each normally aligned division. b. Testing will be performed for components identified as Class 1E in Table 2.4.22-1 by providing a test signal in each division with the alternate feed aligned to the divisional pair.	a. The test signal provided in the normally aligned division is present at the respective Class 1E components identified in Table 2.4.22-1. 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 2.4.22-1.

4.6 Locking mechanisms are provided on the SCDS cabinet doors. Opened SCDS cabinet doors are indicated in the MCR.

4.7 The SCDS is designed so that safety-related functions required for an anticipated operational occurrence (AOO) or postulated accident (PA) are performed in the presence of the following:

- Single detectable failures within the SCDS 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.

5.0 Electrical Power Design Features

5.1 ~~Class 1E SCDS~~ The components designated as Class 1E in Table 2.4.25-1 are powered from a Class 1E division as listed in Table 2.4.25-1 in a normal or alternate feed condition.

6.0 Environmental Qualifications

6.1 Components listed as Class 1E in Table 2.4.25-1 can perform their function under normal environmental conditions, AOOs, and accident and post-accident environmental conditions.

~~6.0~~7.0 Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.4.25-4 lists the SCDS ITAAC.

Table 2.4.25-4—Signal Conditioning and Distribution System ITAAC (4 Sheets)

	Commitment Wording	Inspection, Tests, Analyses	Acceptance Criteria
		c. Inspections will be performed on the connections between the SCDS Class 1E equipment and non-Class1E equipment.	c. Class 1E electrical isolation devises exist on connections between the SCDS Class 1E equipment and non Class 1E equipment.
4.5	The SCDS equipment listed as Class 1E listed in Table 2.4.25-1 can perform its safety function when subjected to EMI, RFI, ESD, and power surges.	Type tests, tests, analyses or a combination of these will be performed on the Class 1E equipment listed in Table 2.4.25-1.	A report exists and concludes that the eEquipment listed as Class 1E in Table 2.4.25-1 can perform its safety function when subjected to EMI, RFI, ESD, and power surges.
4.6	Locking mechanisms are provided on the SCDS cabinet doors. Opened SCDS cabinet doors are indicated in the MCR.	a. An inspection will be performed. b. A test will be performed. c. A test will be performed.	a. Locking mechanisms exist on the SCDS cabinet doors. b. The locking mechanisms on the SCDS cabinet doors MCR operate properly. c. Opened SCDS cabinet doors are indicated in the MCR when a SCDS cabinet door is in the open position.
4.7	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 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.	A failure modes and effects analysis will be performed on the SCDS at the level of replaceable modules and components.	A report concludes that 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 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.

5. Installation and Commissioning Phase.

6. Final Documentation Phase.

4.4 ~~The~~ RPMS equipment listed as Class 1E listed in Table 2.4.26-1 can ~~perform its safety~~ function when subjected to electromagnetic interference (EMI), radio-frequency interference (RFI), electrostatic discharges (ESD), and power surges.

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

4.6 CPU state switches are provided at the RPMS cabinets to restrict modifications to the RPMS software.

4.7 Communications independence is provided between RPMS equipment and non-Class 1E equipment.

4.8 Locking mechanisms are provided on the RPMS cabinet doors. Opened RPMS cabinet doors are indicated in the MCR.

4.9 The RPMS is designed so that safety-related functions required for an anticipated operational occurrence (AOO) or postulated accident (PA) are performed in the presence of the following:

- Single detectable failures within the RPMS 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.

4.10 Electrical isolation is provided on connections between RPMS equipment and non-Class 1E equipment.

4.11 The RPMS uses TXS system communication messages that are sent with a specific protocol.

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

5.0 Electrical Power Design Features

5.1 ~~Class 1E RPMS~~ The components designated as Class 1E in Table 2.4.26-1 are powered from a Class 1E division as listed in Table 2.4.26-1 in a normal or alternate feed condition.

Table 2.4.26-4—Rod Position Measurement System ITAAC (4 Sheets)

	Commitment Wording	Inspection, Tests, Analyses	Acceptance Criteria
4.9	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 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.	A failure modes and effects analysis will be performed on the RPMS at the level of replaceable modules and components.	A report concludes that 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 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.
4.10	Electrical isolation is provided on connections between RPMS equipment and non-Class 1E equipment.	a. Analyses will be performed to determine the test specification for electrical isolation devices on connections between RPMS equipment and non-Class 1E equipment.	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 RPMS 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 RPMS equipment and non-Class 1E equipment.	b. A report exists and concludes that the Class 1E isolation devices used between RPMS equipment and non-Class 1E equipment prevent the propagation of credible electrical faults.
		c. Inspections will be performed on connections between RPMS equipment and non-Class 1E equipment.	c. Class 1E electrical isolation devices exist on connections between RPMS equipment and non-Class 1E equipment.

Table 1.9-2—U.S. EPR Conformance with Regulatory Guides
Sheet 1 of 19

RG / Rev	Description	U.S. EPR Assessment	FSAR Section(s)
Division 1 Regulatory Guides			
1.1, 11/1970	Net Positive Suction Head for Emergency Core Cooling and Containment Heat Removal System Pumps	Y	6.3.2.2
1.3, R2	Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Boiling Water Reactors	N/A-BWR	N/A
1.4, R2	Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Pressurized Water Reactors	N/A-SUP (Refer to RG 1.145 and RG 1.183)	N/A
1.5, 03/1971	Assumptions Used for Evaluating the Potential Radiological Consequences of a Steam Line Break Accident for Boiling Water Reactors	N/A-BWR	N/A
1.6, 03/1971	Independence Between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems	Y	Table 8.1-1
			8.3.1.2.4
			8.3.2.2.3
1.7, R43	Control of Combustible Gas Concentrations in Containment	Y	3.8.1.3.1
			3.8.2.3.1
			6.2.5.3.3
1.8, R3	Qualification and Training of Personnel for Nuclear Power Plants	N/A-COL	N/A
1.9, R4	Application and Testing of Safety-Related Diesel Generators in Nuclear Power Plants	Y	Table 8.1-1
			8.3
			8.4
1.11, 03/1971	Instrument Lines Penetrating Primary Reactor Containment	Y	3.6.2
			6.2.4
1.12, R2	Nuclear Power Plant Instrumentation for Earthquakes	Y	3.7.4
1.13, R2	Spent Fuel Storage Facility Design Basis	Y	3.5
			9.1.2
			9.1.3
			9.1.5.2.2
			9.4.2.1
1.14, R1	Reactor Coolant Pump Flywheel Integrity	Y	5.4.1

Table 3.2.2-1—Classification Summary
Sheet 94 of 194

KKS System or Component Code	SSC Description	Safety Classification (Note 15)	Quality Group Classification	Seismic Category (Note 16)	10 CFR 50 Appendix B Program (Note 5)	Location (Note 17)	Comments/ Commercial Code
CRU	**Process Information & Control System**	NS-AQ	N/A	II	Yes	2UJK, 3UJK	
CYE	**Plant Fire Alarm System**	NS-AQ	N/A	NSC	No	All	NFPA
JMU	**Hydrogen Monitoring System**						
JMU	Containment Isolation Valves and Associated Piping	S	B	I	Yes	UJA, 1UJH, 4UJH	ASME Class 2[2]
30JMU50/51 BZ001-004	Gas Samplers	NS-AQ	N/A	II	Yes	UJA	
30JMU10 CQ001-~~007~~012	Hydrogen Sensors	~~S~~NS-AQ	N/A	I	Yes	UJA	RG 1.7
30JMU20 CQ001-005	Hydrogen Sensors	NS-AQ	N/A	II	Yes	UFA	
30JMU50/51 GH001	Local Control Unit	NS-AQ	N/A	II	Yes	1UJH, 4UJH	
JMU	Piping inside Containment up to Process and Analysis Modules outside Containment (except Containment Isolation)	NS-AQ	C	II	Yes	UJA, 1UJH, 4UJH	ASME Class 3[3]
30JMU50/51 BZ010	Process and Analysis Module	NS-AQ	N/A	II	Yes	1UJH, 4UJH	

Table 3.2.2-1—Classification Summary
Sheet 95 of 194

KKS System or Component Code	SSC Description	Safety Classification (Note 15)	Quality Group Classification	Seismic Category (Note 16)	10 CFR 50 Appendix B Program (Note 5)	Location (Note 17)	Comments/ Commercial Code
30JMU10 GH001	Signal Processing Unit	~~S~~NS-AQ	N/A	I	Yes	1UJH~~, 4UJH~~	RG 1.7
30JMU10 GH002	Signal Processing Unit	NS-AQ	N/A	I	Yes	4UJH	RG 1.7
JS	**Reactor Control, Surveillance & Limitation System**	NS-AQ	N/A	II	Yes	UJA, UJH	
CLE51/52, CLF51/52, CLG51/52, CLH51/52	**Signal Conditioning and Distribution System (SCDS)**						
30CLE51	SCDS Cabinets Division 1	S	N/A	I	Yes	1UJK	
30CLF51	SCDS Cabinets Division 2	S	N/A	I	Yes	2UJK	
30CLG51	SCDS Cabinets Division 3	S	N/A	I	Yes	3UJK	
30CLH51	SCDS Cabinets Division 4	S	N/A	I	Yes	4UJK	
30CLE52	SCDS Cabinets Division 1	NS-AQ	N/A	I	Yes	1UJK	
30CLF52	SCDS Cabinets Division 2	NS-AQ	N/A	I	Yes	2UJK	
30CLG52	SCDS Cabinets Division 3	NS-AQ	N/A	I	Yes	3UJK	

Table 3.11-1—List of Environmentally Qualified Electrical/I&C Equipment Sheet 96 of 135

Name Tag (Equipment Description)	Tag Number	Local Area KKS ID (Room Location)	EQ Environment (Note 1)	Radiation Environment Zone (Note 2)	EQ Designated Function (Note 3)	Safety Class (Note 4)	EQ Program Designation (Note 5)
Contactor Module	34BUA10BZ002	31UJK 18027	M	M	RT ES SI	S 1E EMC	Y (5) Y (6)
Contactor Module	34BUA10BZ003	31UJK 18027	M	M	RT ES SI	S 1E EMC	Y (5) Y (6)
Contactor Module	34BUA10BZ004	31UJK 18027	M	M	RT ES SI	S 1E EMC	Y (5) Y (6)
Contactor Module	34BUA11BZ001	31UJK 18027	M	M	RT ES SI	S 1E EMC	Y (5) Y (6)
Contactor Module	34BUA11BZ002	31UJK 18027	M	M	RT ES SI	S 1E EMC	Y (5) Y (6)
Contactor Module	34BUA11BZ003	31UJK 18027	M	M	RT ES SI	S 1E EMC	Y (5) Y (6)
Contactor Module	34BUA11BZ004	31UJK 18027	M	M	RT ES SI	S 1E EMC	Y (5) Y (6)
Contactor Module	34BUA12BZ001	31UJK 18027	M	M	RT ES SI	S 1E EMC	Y (5) Y (6)
Contactor Module	34BUA12BZ002	31UJK 18027	M	M	RT ES SI	S 1E EMC	Y (5) Y (6)
Contactor Module	34BUA12BZ003	31UJK 18027	M	M	RT ES SI	S 1E EMC	Y (5) Y (6)
Contactor Module	34BUA12BZ004	31UJK 18027	M	M	RT ES SI	S 1E EMC	Y (5) Y (6)
Hydrogen Monitoring System (HCMS)							
Hydrogen Monitoring Signal Processing Unit	30JMU10GH001	31UJH10011	M	M	SI	~~S~~NS-AQ ~~1E~~ EMC	~~Y (1)~~ Y (~~5~~5) Y (6)
Hydrogen Monitoring Signal Processing Unit	30JMU10GH002	34UJH10011	M	M	SI	NS-AQ EMC	Y (5) Y (6)
H2 Sensor UJA	30JMU10CQ001	30UJA40001	H	H	SI	~~S~~NS-AQ ~~1E~~ EMC	Y (1) Y(5)
H2 Sensor UJA	30JMU10CQ002	~~30UJA34019~~30UJA40001	H	H	SI	~~S~~NS-AQ ~~1E~~ EMC	Y (1) Y(5)
H2 Sensor UJA	30JMU10CQ003	30UJA34003	H	H	SI	~~S~~NS-AQ ~~1E~~ EMC	Y (1) Y(5)
H2 Sensor UJA	30JMU10CQ004	~~30UJA29014~~30UJA34003	H	H	SI	~~S~~NS-AQ ~~1E~~ EMC	Y (1) Y(5)
H2 Sensor UJA	30JMU10CQ005	30UJA23008	H	H	SI	~~S~~NS-AQ ~~1E~~ EMC	Y (1) Y(5)
H2 Sensor UJA	30JMU10CQ006	~~30UJA29013~~30UJA23008	H	H	SI	~~S~~NS-AQ ~~1E~~ EMC	Y (1) Y(5)
H2 Sensor UJA	30JMU10CQ007	30UJA29014	H	H	SI	~~S~~NS-AQ ~~1E~~ EMC	Y (1) Y(5)
H2 Sensor UJA	30JMU10CQ008	30UJA29014	H	H	SI	NS-AQ EMC	Y (1) Y(5)
H2 Sensor UJA	30JMU10CQ009	30UJA29013	H	H	SI	NS-AQ EMC	Y (1) Y(5)
H2 Sensor UJA	30JMU10CQ010	30UJA29013	H	H	SI	NS-AQ EMC	Y (1) Y(5)
H2 Sensor UJA	30JMU10CQ011	30UJA34019	H	H	SI	NS-AQ EMC	Y (1) Y(5)
H2 Sensor UJA	30JMU10CQ012	30UJA34019	H	H	SI	NS-AQ EMC	Y (1) Y(5)
H2 Sensor UFA	30JMU20CQ001	30UFA10082	M	H	SII	NS-AQ EMC	Y(2) Y(5) Y(6)
H2 Sensor UFA	30JMU20CQ002	30UFA10082	M	H	SII	NS-AQ EMC	Y(2) Y(5) Y(6)
H2 Sensor UFA	30JMU20CQ003	30UFA10082	M	H	SII	NS-AQ EMC	Y(2) Y(5) Y(6)

stratification. The PARs are installed above the floor to provide unobstructed inflow and for easy access to facilitate maintenance. They are located to avoid direct contact with spray water from the severe accident heat removal system, and the PAR cover also protects the catalyst from direct spray and aerosol deposition.

The PARs are designed to withstand severe accident ambient conditions. This includes the capability of reducing hydrogen under severe accident conditions as specified in Table 6.2.5-1. As is the case for other severe accident components, the PARs provide reasonable assurance that the equipment can perform its identified function during severe accident conditions as described in Section 19.2. The U.S. EPR severe accident evaluation is presented in Reference 8.

6.2.5.2.2 Hydrogen Monitoring System

Two subsystems of the HMS measure hydrogen concentrations within containment. The low range system measures hydrogen concentrations in the containment atmosphere during design basis events. The high range system measures hydrogen and steam concentrations in the containment atmosphere during and after beyond design basis events. The design and performance parameters for the subsystems are listed in Table 6.2.5-2—HMS Design and Performance Parameters.

The low range system consists of hydrogen sensors arranged in the following containment areas:

- Upper dome.
- Upper pressurizer compartment.
- Upper steam generator compartments 1/2 and 3/4.
- Annular rooms.

~~The low range HMS signal processing unit is located in Safeguard Building 1 and is powered from the Class 1E electrical power supply~~The low range HMS signal processing units are located in Safeguards Buildings 1 and 4. They are both powered from the Class 1E electrical power supply. Isolation is provided between power supply and signal processing units. Hydrogen concentrations are measured continuously during plant operation and are available for display in the main control room. A hydrogen concentration measurement that exceeds one percent by volume actuates an alarm in the main control room to indicate a release of hydrogen to the containment atmosphere. A hydrogen concentration measurement that exceeds four percent by volume actuates an alarm indicating that the flammability limit in air has been exceeded. The loss of a measuring channel or failure of ~~the~~a signal processing unit is also indicated.

has no effect on the PARs and rupture and convection foils, and will cause the fail-safe mixing dampers to fail-safe open.

The CGCS is designed to operate in DBAs with elevated temperature, pressure and radiation. The mixing dampers, rupture and convection foils open early in the accident progression on pressure differential or temperature differential. If the DBA transitions into a Severe Accident, these components have to maintain integrity only. Their operation is not affected by localized pressure and temperature increase due to hydrogen combustion.

The PARs are designed for DBA, as well as SA conditions.

The PARs are not pressure retaining components and are open at the bottom and the top, therefore, are unaffected by localized pressure increase. The design covers hydrogen combustion temperature peaks and SA radiation.

The CGCS operates effectively in a steam-saturated atmosphere (steam concentration greater than 55 percent by volume), and will function during and after exposure to the environmental conditions created by the burning of hydrogen, including local detonations. Equipment survivability analyses, described in Section 19.2.4.4.5, consider hydrogen concentrations equivalent to that generated from a fuel clad-coolant reaction involving 100 percent of the fuel cladding surrounding the active fuel region. The low range and high range HMS systems are capable of operating during design basis accidents and severe accidents, respectively.

The low range hydrogen sensors are located inside the containment and meet the single failure criterion. These sensors are located in ~~seven~~ physically separated areas of the containment. Additionally, the signal processing is carried out by separate channel cards installed within the signal processing units that ~~is~~are located outside containment. The sensors and cables located inside containment are designed to remain operable during DBAs. The failure of one sensor or cable does not influence the reliability or accuracy of the other sensors.

The high range monitor for the HMS utilizes measuring modules and associated equipment of each independent train. The trains meet the single failure criterion by being physically separated and located in Safeguard Building 1 for train 1 and Safeguard Building 4 for train 2. The gas samplers of each train are installed in different areas of the containment. Each train is equipped with measuring points inside and outside the equipment rooms so that in case a measuring unit is lost, the measuring information can be substituted by the redundant train.

6.2.5.4 Inspection and Testing Requirements

Preoperational testing is performed to verify the design adequacy and performance of the CGCS and HMS system components. Preoperational tests are addressed in

Table 6.2.5-2—HMS Design and Performance Parameters

Parameter	Value
Low range HMS in containment	
• Number of sensors	~~7~~12
• Typical measurement range (hydrogen)	0-10 volume %
• Measurement frequency	Continuous
High range HMS in containment	
• Number of trains	2
• Number of sampling points per train	4
• Typical measurement range (hydrogen)	0-30 volume %
• Typical measurement range (steam)	30-70 volume %
• Approximate measurement frequency	3 min.

Access to the internally set parameters (e.g., calibration factors, alarm thresholds, and analog output ranges) is prohibited while the instrument is in operation. However, a dedicated portable test computer allows access to the internal parameters when the RMS is removed from service, and the test procedures described above are done with the help of this test computer. While the instrument is removed from service for testing, maintenance, or repair, it is put in a test mode that makes any output signal or alarm invalid.

The RMS consists of various detectors and processing equipment throughout the plant. Refer to Section 7.3.1 for radiation monitors used in ESF actuation functions. For radiation monitors used for PAM, refer to Section 7.5.1. For other monitoring functions, refer to Chapter 11 and Chapter 12.

7.1.1.5.6 Hydrogen Monitoring System

Classification

The hydrogen monitoring system (HMS) is classified as non-safety-related, supplemented grade (NS-AQ).

Description

The HMS is described in Section 6.2.5.

The HMS components incorporate features for periodic and unscheduled maintenance, repair, and inspection. The purpose of these system inspection and maintenance capabilities is to minimize the occurrence of system faults and to increase HMS availability. Inspection intervals depend on the local situation and the working condition of the HMS. If a subsystem or component of the HMS is unavailable or removed for maintenance, inspection or repair, the ability of the redundant divisions to perform their functions is not impaired.

Access to the internally set parameters (e.g., calibration factors, alarm thresholds, and analog output ranges) is prohibited while the instrument is in operation. However, a dedicated portable test computer allows access to the internal parameters when the HMS is removed from service, and the test procedures described above are done with the help of this test computer. While the instrument is removed from service for testing, maintenance, or repair, it is put in a test mode that makes any output signal or alarm invalid.

7.1.1.5.7 Reactor Pressure Vessel Level Measurement System

Classification

The reactor pressure vessel level (RPVL) measurement system is classified as non-safety-related, supplemented grade (NS-AQ).

7.1.3.6.9 Design Basis: Critical Points in Time or Plant Conditions (Clause 4.j)

The safety-related systems meet the requirements of Clause 4.j of IEEE Std 603-1998 (Reference 1).

Compliance with Clause 4.j is described in Section 7.2.2 and Section 7.3.2.

7.1.3.6.10 Design Basis: Equipment Protection Provisions (Clause 4.k)

The safety-related systems meet the requirements of Clause 4.k of IEEE Std 603-1998 (Reference 1).

The I&C systems provide the capability to implement equipment protection of the safety-related process systems. Equipment protection can be implemented as an operational I&C function or a safety-related I&C function. The categorization is derived from process system requirements. Safety-related I&C functions have priority over operational I&C functions as described in Section 7.1.1.6. Refer to Chapter 5, Chapter 6, Chapter 8, Chapter 9, Chapter 10, and Chapter 11 for descriptions of the process systems.

The U.S. EPR contains equipment protective functions that may prevent a piece of safety-related equipment from performing its function. If a piece of safety-related equipment is prevented from performing its function by an equipment protective function, then a single failure has occurred. This scenario is functionally equivalent to that piece of equipment failing to perform its safety-related function due to any number of failure mechanisms. 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-related function. Therefore, no single equipment protective function can prevent performance of a safety-related function.

7.1.3.6.11 Design Basis: Special Design Basis (Clause 4.l)

The safety-related systems meet the requirements of Clause 4.l of IEEE Std 603-1998 (Reference 1).

A SWCCF of the PS concurrent with an AOO or PA is considered in the design. The D3 principles described in Section 7.1.1.6 provide sufficient means to mitigate this SWCCF. Section 7.8 describes the D3 assessment.

7.1.3.6.12 Single Failure Criterion (Clause 5.1)

The safety-related systems meet the requirements of Clause 5.1 of IEEE Std 603-1998 (Reference 1).

As defined by IEEE 603-1998 (Reference 1), the PS, SAS, SICS, and PACS have only detectable failures, and no identifiable but non-detectable failures.

An FMEA for the protective functions executed by the PS is described in ANP-10309P (Reference 6). An FMEA for the functions executed by SAS is provided in Table 7.1-7. Demonstration of the single failure criterion for the execute features is provided with the description of the process systems in Chapter 5, Chapter 6, Chapter 8, Chapter 9, Chapter 10, and Chapter 11.

7.1.3.6.13 Completion of Protective Action (Clauses 5.2 and 7.3)

The safety-related systems meet the requirements of Clause 5.2 of IEEE Std 603-1998 (Reference 1). When initiated by a safety-related system, protective actions proceed to completion. Return to normal operation requires deliberate operator intervention.

Once opened by the PS, the reactor trip breakers remain open until the reactor trip signal has cleared and they are able to be manually closed. The reactor trip signal is only cleared when the initiating plant variable returns to within an acceptable range.

Refer to Section 7.3.2.3 for a description of completion of protection action for ESF actuation functions.

The execute features within the U.S. EPR are designed so that once initiated, the protective actions continue until completion, in accordance with IEEE Std 603-1998, Clause 7.3.

7.1.3.6.14 Quality (Clause 5.3)

The safety-related systems meet the requirements of Clause 5.3 of IEEE Std 603-1998 (Reference 1). The safety-related systems are within the scope of the U.S. EPR quality assurance program (QAP) described in Section 17.5. The TXS hardware quality is described in EMF-2110(NP)(A) (Reference 3).

The digital safety systems meet the additional guidance of IEEE Std 7-4.3.2-2003 (Reference 18). This guidance addresses software quality processes for the use of digital technology in safety systems.

TXS system software is developed in accordance with the processes described in EMF-2110 (NP)(A) (Reference 3).

The application software of the digital safety systems conform to the guidance of IEEE Std 7-4.3.2-2003 (Reference 18), with the following exception:

- Alternate V&V methods are used. These methods are described and justified in ANP-10272-A (Reference 5).

The application software is developed in accordance with the software development and V&V processes that are summarized in Section 7.1.1.2 and described in detail in ANP-10272-A. These processes provide an acceptable method of software

All indicated changes are in response to RAI 506, Question 14.03.05-39

Table 7.1-2—I&C System Requirements Matrix
Sheet 1 of 7

Applicable Regulations and Guidance	10 CFR 50 50.55a(a)(1)	50.55a(h)(3)	50.34(f)(2)(v)	50.34(f)(2)(xi)	50.34(f)(2)(xii)	50.34(f)(2) (xiv)	50.34(f)(2) (xvii)	50.34(f)(2) (xviii)	50.34(f)(2) (xix)	50.34(f)(2) (xx)	50.62
Industry Standard		IEEE Std 603-1991 (1)(2)									
Safety Information and Control System (S)	x	x		x	x		x	x	x	x	
Process Information and Control System (NS-AQ)			x	x	x		x	x	x		
Protection System (S)	x	x	x		x	x		x		x	
Safety Automation System (S)	x	x	x								
Priority and Actuator Control System (S)	x	x	x	x	x	x				x	x
Reactor Control, Surveillance & Limitation System (NS)											
Process Automation System (NS)			x	x	x		x	x	x		
Turbine Generator I&C (NS)											
Control Rod Drive Control System (NS)	x	x	x								
Incore Instrumentation System (S)	x	x	x					x	x		
Excore Instrumentation System (S)	x	x	x						x		
Boron Concentration Measurement System (S)	x	x	x						x		
Radiation Monitoring System (S)	x	x	x			x	x		x		
Hydrogen Monitoring System ~~(S)~~(NS-AQ)	x	x	x				x		x		
Reactor Pressure Vessel Level Measurement System (NS-AQ)	x	x	x					x	x		
Seismic Monitoring System (NS)											
Loose Parts Monitoring System (NS)											
Vibration Monitoring System (NS)											
Fatigue Monitoring System (NS)											
Leak Detection System (NS)											
Signal Conditioning and Distribution System (S)	x	x	x		x	x	x	x	x	x	x
Diverse Actuation System (NS-AQ)											x
Rod Position Measurement System (S)	x	x									

All indicated changes are in response to RAI 506, Question 14.03.05-39

Table 7.1-2—I&C System Requirements Matrix
Sheet 3 of 7

Applicable Regulations and Guidance	General Design Criteria											
	GDC 1	GDC 2	GDC 4	GDC 10	GDC 13	GDC 15	GDC 16	GDC 19	GDC 20	GDC 21	GDC 22	GDC 23
Industry Standard												
Safety Information and Control System (S)	x	x	x		x			x				
Process Information and Control System (NS-AQ)					x			x				
Protection System (S)	x	x	x	x	x	x	x	x	x	x	x	x
Safety Automation System (S)	x	x	x	x	x							
Priority and Actuator Control System (S)	x	x	x	x	x	x	x	x	x	x	x	x
Reactor Control, Surveillance & Limitation System (NS)				x	x	x						
Process Automation System (NS)				x	x	x		x				
Turbine Generator I&C (NS)					x			x				
Control Rod Drive Control System (NS)	x	x	x	x	x			x				
Incore Instrumentation System (S)	x	x	x	x	x			x	x	x	x	x
Excore Instrumentation System (S)	x	x	x	x	x			x	x	x	x	x
Boron Concentration Measurement System (S)	x	x	x	x	x			x	x	x	x	x
Radiation Monitoring System (S)	x	x	x		x			x	x	x	x	x
Hydrogen Monitoring System (NS-AQ)	x	x	x		x			x				
Reactor Pressure Vessel Level Measurement System (NS-AQ)	x	x	x		x			x				
Seismic Monitoring System (NS)		x			x			x				
Loose Parts Monitoring System (NS)					x			x				
Vibration Monitoring System (NS)					x			x				
Fatigue Monitoring System (NS)					x			x				
Leak Detection System (NS)		x			x			x				
Signal Conditioning and Distribution System (S)	x	x	x	x	x	x	x	x	x	x	x	x
Diverse Actuation System (NS-AQ)					x							
Rod Position Measurement System (S)	x	x	x	x	x			x	x	x	x	x
Notes:												

All indicated changes are in response to RAI 506, Question 14.03.05-39

Table 7.1-2—I&C System Requirements Matrix
Sheet 4 of 7

Applicable Regulations and Guidance	General Design Criteria										SRM to SECY 93-087	
	GDC 24	GDC 25	GDC 28	GDC 29	GDC 33	GDC 34	GDC 35	GDC 38	GDC 41	GDC 44	II.Q	II.T
Industry Standard												
Safety Information and Control System (S)											x	x
Process Information and Control System (NS-AQ)												x
Protection System (S)	x	x	x	x	x	x	x	x	x	x		
Safety Automation System (S)					x	x	x	x		x		
Priority and Actuator Control System (S)	x	x			x	x	x	x	x	x	x	
Reactor Control, Surveillance & Limitation System (NS)			x	x								
Process Automation System (NS)			x									
Turbine Generator I&C (NS)												
Control Rod Drive Control System (NS)			x	x								
Incore Instrumentation System (S)	x	x		x								
Excore Instrumentation System (S)	x	x		x								
Boron Concentration Measurement System (S)	x	x		x								
Radiation Monitoring System (S)	x	x		x								
Hydrogen Monitoring System ~~(S)~~(NS-AQ)												
Reactor Pressure Vessel Level Measurement System (NS-AQ)												
Seismic Monitoring System (NS)												
Loose Parts Monitoring System (NS)												
Vibration Monitoring System (NS)												
Fatigue Monitoring System (NS)												
Leak Detection System (NS)												
Signal Conditioning and Distribution System (S)	x	x	x	x	x	x	x	x	x		x	
Diverse Actuation System (NS-AQ)											x	
Rod Position Measurement System (S)	x	x		x								
Notes:												

Table 7.1-2—I&C System Requirements Matrix
Sheet 5 of 7

Applicable Regulations and Guidance	Regulatory Guides									
	1.22	1.47	1.53	1.62	1.75	1.97	1.105	1.118	1.151	1.152
Industry Standard			IEEE Std 379-2000		IEEE Std 384-1992	IEEE Std 497-2002	ISA-67.04-1994(1)	IEEE Std 338-1987	ISA-S67.02-1980	IEEE Std 7-4.3.2-2003
Safety Information and Control System (S)	x		x	x	x	x		x		x
Process Information and Control System (NS-AQ)		x				x				
Protection System (S)	x	x	x	x	x	x	x	x	x	x
Safety Automation System (S)		x	x		x					x
Priority and Actuator Control System (S)	x	x	x	x	x	x		x		
Reactor Control, Surveillance & Limitation System (NS)									x	
Process Automation System (NS)		x				x			x	
Turbine Generator I&C (NS)										
Control Rod Drive Control System (NS)	x	x	x	x	x					
Incore Instrumentation System (S)	x	x	x		x	x				
Excore Instrumentation System (S)	x	x	x		x	x				
Boron Concentration Measurement System (S)	x	x	x		x	x				
Radiation Monitoring System (S)	x	x	x		x	x				
Hydrogen Monitoring System ~~(S)~~(NS-AQ)		x	x		x	x			x	
Reactor Pressure Vessel Level Measurement System (NS-AQ)		x	x		x	x				
Seismic Monitoring System (NS)										
Loose Parts Monitoring System (NS)										
Vibration Monitoring System (NS)										
Fatigue Monitoring System (NS)										
Leak Detection System (NS)										
Signal Conditioning and Distribution System (S)	x	x	x		x	x		x	x	
Diverse Actuation System (NS-AQ)										
Rod Position Measurement System (S)	x	x	x		x	x				x

Notes: on Table 7.1–2; Sheet 5 of 7

1. U.S. EPR follows ISA-67.04.01-2006.

All indicated changes are in response to RAI 506, Question 14.03.05-39

Table 7.1-2—I&C System Requirements Matrix
Sheet 6 of 7

Applicable Regulations and Guidance	Regulatory Guides									
	1.168	1.169	1.170	1.171	1.172	1.173	1.180	1.189	1.204	1.209
Industry Standard	IEEE Std 1012-1998 IEEE Std 1028-1997	IEEE Std 828-1990 IEEE Std 1042-1987	IEEE Std 829- 1983	IEEE Std 1008-1987	IEEE Std 830- 1993	IEEE Std 1074-1995	Various Standards		IEEE Std 1050-1996	IEEE Std 323-2003
Safety Information and Control System (S)	x	x	x	x	x	x	x	x	x	x
Process Information and Control System (NS-AQ)								x		
Protection System (S)	x	x	x	x	x	x	x	x	x	x
Safety Automation System (S)	x	x	x	x	x	x	x		x	x
Priority and Actuator Control System (S)							x	x	x	
Reactor Control, Surveillance & Limitation System (NS)										
Process Automation System (NS)								x		
Turbine Generator I&C (NS)										
Control Rod Drive Control System (NS)							x		x	
Incore Instrumentation System (S)							x		x	
Excore Instrumentation System (S)							x	x	x	
Boron Concentration Measurement System (S)							x		x	
Radiation Monitoring System (S)							x		x	
Hydrogen Monitoring System ~~(S)~~(NS-AQ)							x		x	
Reactor Pressure Vessel Level Measurement System (NS-AQ)							x		x	
Seismic Monitoring System (NS)										
Loose Parts Monitoring System (NS)										
Vibration Monitoring System (NS)										
Fatigue Monitoring System (NS)										
Leak Detection System (NS)										
Signal Conditioning and Distribution System (S)							x	x	x	
Diverse Actuation System (NS-AQ)										
Rod Position Measurement System (S)	x	x	x	x	x	x	x		x	x
Notes:										

Table 7.1-2—I&C System Requirements Matrix
Sheet 7 of 7

Applicable Regulations and Guidance	Branch Technical Positions															
	7-1	7-2	7-3	7-4	7-5	7-8	7-9	7-10	7-11	7-12	7-13	7-14	7-17	7-18	7-19	7-21
Industry Standard																
Safety Information and Control System (S)		x				x		x	x			x		x	x	x
Process Information and Control System (NS-AQ)		x						x								
Protection System (S)	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x
Safety Automation System (S)									x			x	x	x		x
Priority and Actuator Control System (S)	x	x		x		x		x	x				x		x	
Reactor Control, Surveillance & Limitation System (NS)					x											
Process Automation System (NS)								x								
Turbine Generator I&C (NS)																
Control Rod Drive Control System (NS)					x				x							
Incore Instrumentation System (S)						x		x	x							
Excore Instrumentation System (S)						x		x	x							
Boron Concentration Measurement System (S)						x		x	x							
Radiation Monitoring System (S)						x		x	x							
Hydrogen Monitoring System ~~(S)~~(NS-AQ)								x	x							
Reactor Pressure Vessel Level Measurement System (NS-AQ)								x	x							
Seismic Monitoring System (NS)																
Loose Parts Monitoring System (NS)																
Vibration Monitoring System (NS)																
Fatigue Monitoring System (NS)																
Leak Detection System (NS)																
Signal Conditioning and Distribution System (S)	x	x		x	x	x	x	x	x		x				x	
Diverse Actuation System (NS-AQ)															x	
Rod Position Measurement System (S)					x			x	x			x	x	x	x	x
Notes:																

Next File

3.4.3 Simulated high radiation signal at the radiation detector.

3.5 Record alarm actuations at local and remote locations, as appropriate.

4.0 DATA REQUIRED

4.1 The monitor response to check source, as necessary.

4.2 Technical data associated with the source.

4.3 Signal levels necessary to cause alarm actuation.

4.4 Response time of the monitor.

5.0 ACCEPTANCE CRITERIA

5.1 Verify that the process and effluent radiological monitoring system operates as follows:

5.1.1 Radiation monitors are installed on effluent paths as shown on plant layout drawings.

5.1.2 The radiation monitors have been source checked to verify response.

5.1.3 Preliminary alarm setpoints have been established and calibrated in the equipment.

5.1.4 Upon activating the alarm setpoint, automatic actions (valve closure, pumps stopping, etc.) occur as designed.

5.1.5 Radiation monitors function as described in Section 11.5.1.

5.2 Radiation monitoring instrumentation used to perform process and effluent monitoring that is described in Table 11.5-1 will meet the design requirements for the radiation monitor. This includes, but is not limited to, the following that could adversely impact the ability to measure the parameters described in Table 11.5-1:

5.2.1 Range.

5.2.2 Response time.

5.2.3 Sensitivity.

5.2.4 Maximum anticipated drift between calibrations.

14.2.12.11.21 Hydrogen Monitoring System (Test #145)

1.0 OBJECTIVE

1.1 To demonstrate the proper operation of the non-safety-related hydrogen monitoring system (HMS).

1.2 To demonstrate electrical independence and redundancy of safety-related power supplies.

All indicated changes are in response to RAI 506, Question 14.03.05-39

2.0 PREREQUISITES

2.1 Construction activities on the hydrogen monitoring system have been completed.

2.2 Hydrogen monitoring instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Electrical power systems required for the hydrogen monitoring system are available.

2.4 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Verify hydrogen monitoring system logic and indication.

3.2 Verify hydrogen monitoring system response to sample hydrogen concentrations.

3.3 Verify that the hydrogen monitoring system operates over the design range using actual or simulated signals.

3.4 Verify that the hydrogen monitoring system responds as designed to actual or simulated limiting malfunctions or failures.

3.5 Verify that the hydrogen monitoring system response meets the accident analysis assumptions, such as time response, and accuracy.

3.6 Verify redundancy and electrical independence of the hydrogen monitoring system design.

3.7 Check electrical independence and redundancy of power supplies ~~for safety-related functions~~ by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

4.1 Response to hydrogen samples.

5.0 ACCEPTANCE CRITERIA

5.1 The low range HMS consists of hydrogen sensors arranged in the following containment areas: upper dome, upper pressurizer compartment, upper steam generator compartments 1/2 and 3/4, annular rooms.

5.2 The low range HMS signal processing units are~~is~~ located in Safeguard Buildings 1 and 4, and ~~is~~ are powered from the Class 1E electrical power supplies~~y~~.

5.3 Deleted.~~Verify that safety-related components meet electrical independence and redundancy requirements.~~

5.4 The HMS functions as described in Section 6.2.5.