ArevaEPRDCPEm Resource

From: WELLS Russell (AREVA) [Russell.Wells@areva.com]
Sent: Thursday, April 14, 2011 12:32 PM
To: Tesfaye, Getachew
Cc: HUDSON Greg (AREVA); BUDZIK Dennis (AREVA); BENNETT Kathy (AREVA); DELANO Karen (AREVA); HALLINGER Pat (EXTERNAL AREVA); ROMINE Judy (AREVA); RYAN Tom (AREVA); WILLIFORD Dennis (AREVA)
Subject: DRAFT Response to U.S. EPR Design Certification Application RAI No. 442, FSAR Ch. 7, Question 7.1-30
Attachments: RAI 442 Question 07.01-30 Response US EPR DC - (DRAFT).pdf

Getachew,

Attached is an updated draft response for RAI No. 442, FSAR Ch. 7, Question 7.1.30 as shown below in advance of the April 28, 2011 final date. Proposed changes to the instrumentation and controls (I&C) architecture were communicated to the NRC staff in the February 15, 2011 public meeting. U.S. EPR FSAR Tier 2, Section 14.2 attached to this response incorporate the revised I&C architecture. The affected parts of this FSAR section is provided in it's entirety with this response to facilitate NRC review.

Let me know if the staff has questions or if this can be sent as a final response.

Thanks,

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

From: WELLS Russell (RS/NB)
Sent: Tuesday, April 05, 2011 10:56 AM
To: 'Getachew.Tesfaye@nrc.gov'
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 442, FSAR Ch. 7, Supplement 7

Getachew,

On November 19, 2010, AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to the questions in RAI 442. Supplement 1 response was sent on January 7, 2011 to provide a revised schedule for four of the questions. Supplement 2 response was sent on February 9, 2011 to provide a revised schedule. Supplement 3 response was sent on February 18, 2011 to provide technically correct and complete responses to four questions. Supplement 4 response was sent on February 25, 2011 to provide technically correct and complete response to one question. Supplement 5 response was sent on March 2, 2011 to provide technically correct and complete responses to three of the 12 remaining questions.

Supplement 6 response was sent on March 15, 2011 to provide technically correct and complete responses to two of the 9 remaining questions.

To provide additional time to interact with the NRC, a revised schedule is provided in this e-mail.

AREVA NP's schedule for providing a technically correct and complete response to the remaining questions in RAI 442 is provided below.

Question #	Response Date
RAI 442 — 7.1-26	**April 28, 2011**
RAI 442 — 7.1-27	**April 28, 2011**
RAI 442 — 7.1-28	**April 28, 2011**
RAI 442 — 7.1-30	April 28, 2011
RAI 442 — 7.1-31	**April 28, 2011**
RAI 442 — 7.3-32	**April 28, 2011**
RAI 442 — 7.9-64	April 28, 2011

Sincerely,

Russ Wells
U.S. EPR Design Certification Licensing Manager
AREVA NP, Inc.
3315 Old Forest Road, P.O. Box 10935
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Lynchburg, VA 24506-0935
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Russell.Wells@Areva.com

From: WELLS Russell (RS/NB)
Sent: Tuesday, March 15, 2011 12:51 PM
To: 'Tesfaye, Getachew'
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 442, FSAR Ch. 7, Supplement 6

Getachew,

On November 19, 2010, AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to the questions in RAI 442. Supplement 1 response was sent on January 7, 2011 to provide a revised schedule for four of the questions. Supplement 2 response was sent on February 9, 2011 to provide a revised schedule. Supplement 3 response was sent on February 18, 2011 to provide technically correct and complete responses to four questions. Supplement 4 response was sent on February 25, 2011 to provide technically correct and complete response to one question. Supplement 5 response was sent on March 2, 2011 to provide technically correct and complete responses to three of the 12 remaining questions. Based on discussions with NRC, the attached file, “RAI 442 Supplement 6 Response US EPR DC.pdf” provides technically correct and complete responses to two of the 9 questions, as committed.

The following table indicates the respective pages in the response document, “RAI 442 Supplement 6 Response US EPR DC.pdf,” that contain AREVA NP’s response to the subject questions.

Question #	Start Page	End Page
RAI 442 07.01-32	2	3
RAI 442 07.09-67	4	5

AREVA NP's schedule for providing a technically correct and complete response to the remaining questions in RAI 442 remains unchanged and is provided below.

Question #	Response Date
RAI 442 — 7.1-26	April 21, 2011
RAI 442 — 7.1-27	April 14, 2011
RAI 442 — 7.1-28	April 7, 2011
RAI 442 — 7.1-30	April 28, 2011
RAI 442 — 7.1-31	April 7, 2011
RAI 442 — 7.3-32	April 14, 2011
RAI 442 — 7.9-64	April 28, 2011

Sincerely,

Russ Wells
U.S. EPR Design Certification Licensing Manager
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Fax: 434-382-3884
Russell.Wells@Areva.com

From: WELLS Russell (RS/NB)
Sent: Wednesday, March 02, 2011 4:52 PM
To: Tesfaye, Getachew
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 442, FSAR Ch. 7, Supplement 5

Getachew,

On November 19, 2010, AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to the questions in RAI 442. Supplement 1 response was sent on January 7, 2011 to provide a revised schedule for four of the questions. Supplement 2 response was sent on February 9, 2011 to provide a revised schedule. Supplement 3 response was sent on February 18, 2011 to provide technically correct and complete responses to four questions. Supplement 4 response was sent on February 25, 2011 to provide technically correct and complete response to one question. Based on discussions with NRC, the attached file, "RAI 442 Supplement 5 Response US EPR DC.pdf" provides technically correct and complete responses to three of the 12 questions, as committed.

The following table indicates the respective pages in the response document, “RAI 442 Supplement 5 Response US EPR DC.pdf,” that contain AREVA NP’s response to the subject question.

Question #	Start Page	End Page
RAI 442 07.03-33	2	2
RAI 442 07.03-34	3	4
RAI 442 07.09-61	5	8

AREVA NP's schedule for providing a technically correct and complete response to all questions in RAI 442 remains unchanged and is provided below.

Question #	Response Date
RAI 442 — 7.1-26	April 21, 2011
RAI 442 — 7.1-27	April 14, 2011
RAI 442 — 7.1-28	April 7, 2011
RAI 442 — 7.1-30	April 28, 2011
RAI 442 — 7.1-31	April 7, 2011
RAI 442 — 7.1-32	April 7, 2011
RAI 442 — 7.3-32	April 14, 2011
RAI 442 — 7.9-64	April 28, 2011
RAI 442 — 7.9-67	April 7, 2011

Sincerely,

Russ Wells
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Fax: 434-382-3884
Russell.Wells@Areva.com

From: WELLS Russell (RS/NB)
Sent: Friday, February 25, 2011 8:07 AM
To: Tesfaye, Getachew
Cc: BRYAN Martin (External RS/NB); BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 442, FSAR Ch. 7, Supplement 4

Getachew,

On November 19, 2010, AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to the questions in RAI 442. Supplement 1 response was sent on January 7, 2011 to provide a revised schedule for four of the questions. Supplement 2 response was sent on February 9, 2011 to provide a revised schedule. Supplement 3 response was sent on February 18, 2011 to provide technically correct and complete responses to four questions. Based on discussions with NRC, the attached file, "RAI 442 Supplement 4 Response US EPR DC.pdf" provides technically correct and complete responses to one of the 13 questions, as committed.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report and Technical Report ANP-10309P, in redline-strikeout format which support the response to RAI 442 Question 07.09-63.

The following table indicates the respective pages in the response document, "RAI 442 Supplement 4 Response US EPR DC.pdf," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 442 07.09-63	2	2

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

AREVA NP's schedule for providing a technically correct and complete response to all questions in RAI 442 is provided below.

Question #	Response Date
RAI 442 — 7.1-26	April 21, 2011
RAI 442 — 7.1-27	April 14, 2011
RAI 442 — 7.1-28	April 7, 2011
RAI 442 — 7.1-30	April 28, 2011
RAI 442 — 7.1-31	April 7, 2011
RAI 442 — 7.1-32	April 7, 2011
RAI 442 — 7.3-32	April 14, 2011
RAI 442 — 7.3-33	April 7, 2011
RAI 442 — 7.3-34	April 7, 2011
RAI 442 — 7.9-61	April 7, 2011
RAI 442 — 7.9-64	April 28, 2011
RAI 442 — 7.9-67	April 7, 2011

Sincerely,

Russ Wells
U.S. EPR Design Certification Licensing Manager
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434-942-6375 (cell)
Fax: 434-382-3884
Russell.Wells@Areva.com

From: BRYAN Martin (External RS/NB)
Sent: Friday, February 18, 2011 12:21 PM
To: Tesfaye, Getachew
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 442, FSAR Ch. 7, Supplement 3

Getachew,

On November 19, 2010, AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to the questions in RAI 442. Supplement 1 response was sent on January 7, 2011 to provide a revised schedule for four of the questions. Supplement 2 response was sent on February 9, 2011 to provide a revised schedule. Based on discussions with NRC, the attached file, “RAI 442 Supplement 3 Response US EPR DC.pdf” provides technically correct and complete responses to four of the 17 questions, as committed.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report and Technical Report ANP-10281P, in redline-strikeout format which support the response to RAI 442 Question 07.01-29.

The following table indicates the respective pages in the response document, “RAI 442 Supplement 3 Response US EPR DC.pdf,” that contain AREVA NP’s response to the subject questions.

Question #	Start Page	End Page
RAI 442 07.01-29	2	2
RAI 413 07.09-62	3	4
RAI 413 07.09-65	5	5
RAI 413 07.09-66	6	6

The schedule for technically correct and complete responses to the remaining 13 questions is unchanged and provided below:

AREVA NP's schedule for providing a technically correct and complete response to all questions in RAI 442 is provided below.

Question #	Response Date
RAI 442 — 7.1-26	March 15, 2011
RAI 442 — 7.1-27	March 15, 2011
RAI 442 — 7.1-28	March 15, 2011
RAI 442 — 7.1-30	March 15, 2011
RAI 442 — 7.1-31	March 15, 2011
RAI 442 — 7.1-32	March 15, 2011
RAI 442 — 7.3-32	March 15, 2011
RAI 442 — 7.3-33	March 15, 2011
RAI 442 — 7.3-34	March 15, 2011
RAI 442 — 7.9-61	March 15, 2011
RAI 442 — 7.9-63	March 15, 2011
RAI 442 — 7.9-64	March 15, 2011
RAI 442 — 7.9-67	March 15, 2011

Sincerely,

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

From: BRYAN Martin (External RS/NB)
Sent: Wednesday, February 09, 2011 5:07 PM
To: Tesfaye, Getachew
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 442, FSAR Ch. 7, Supplement 2

Getachew,

On November 19, 2010, AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to the questions in RAI 442. Supplement 1 response was sent on January 7, 2011 to provide a revised schedule for four of the questions. To allow additional time to interact with the staff and to process the responses a revised schedule is provided below. It should be noted that the dates below may need to be adjusted following the February 15, 2011 public meeting between AREVA and the NRC on digital instrumentation and controls.

AREVA NP's schedule for providing a technically correct and complete response to all questions in RAI 442 is provided below.

Question #	Response Date
RAI 442 — 7.1-26	March 15, 2011
RAI 442 — 7.1-27	March 15, 2011
RAI 442 — 7.1-28	March 15, 2011
RAI 442 — 7.1-29	March 15, 2011
RAI 442 — 7.1-30	March 15, 2011
RAI 442 — 7.1-31	March 15, 2011
RAI 442 — 7.1-32	March 15, 2011
RAI 442 — 7.3-32	March 15, 2011
RAI 442 — 7.3-33	March 15, 2011
RAI 442 — 7.3-34	March 15, 2011
RAI 442 — 7.9-61	March 15, 2011
RAI 442 — 7.9-62	March 15, 2011
RAI 442 — 7.9-63	March 15, 2011
RAI 442 — 7.9-64	March 15, 2011
RAI 442 — 7.9-65	March 15, 2011
RAI 442 — 7.9-66	March 15, 2011
RAI 442 — 7.9-67	March 15, 2011

Sincerely,

Martin (Marty) C. Bryan

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

From: BRYAN Martin (External RS/NB)
Sent: Friday, January 07, 2011 11:15 AM
To: Tesfaye, Getachew
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); RYAN Tom (RS/NB); PANNELL George (CORP/QP)
Subject: Response to U.S. EPR Design Certification Application RAI No. 442, FSAR Ch. 7, Supplement 1

Getachew,

On November 19, 2010, AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to the questions in RAI 442. To allow additional time to interact with the staff a revised schedule is provided below for questions 7.1.29, 7.1.32, 7.9-65 and 7.9-67. The schedule for the other questions remains unchanged.

AREVA NP's schedule for providing a technically correct and complete response to all questions in RAI 442 is provided below.

Question #	Response Date
RAI 442 — 7.1-26	March 15, 2011
RAI 442 — 7.1-27	March 15, 2011
RAI 442 — 7.1-28	March 15, 2011
RAI 442 — 7.1-29	**February 9, 2011**
RAI 442 — 7.1-30	February 9, 2011
RAI 442 — 7.1-31	March 15, 2011
RAI 442 — 7.1-32	**February 9, 2011**
RAI 442 — 7.3-32	February 9, 2011
RAI 442 — 7.3-33	February 9, 2011
RAI 442 — 7.3-34	March 15, 2011
RAI 442 — 7.9-61	February 9, 2011
RAI 442 — 7.9-62	February 9, 2011
RAI 442 — 7.9-63	February 9, 2011
RAI 442 — 7.9-64	March 15, 2011
RAI 442 — 7.9-65	**March 15, 2011**
RAI 442 — 7.9-66	February 9, 2011
RAI 442 — 7.9-67	**February 9, 2011**

Sincerely,

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

From: BRYAN Martin (External RS/NB)
Sent: Friday, November 19, 2010 5:12 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); PANNELL George (CORP/QP)
Subject: Response to U.S. EPR Design Certification Application RAI No. 442, FSAR Ch. 7

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 442 Response US EPR DC.pdf" provides a schedule since a technically correct and complete response to the 17 question (s) is not provided.

The following table indicates the respective pages in the response document, "RAI 442 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 442 — 7.1-26	2	2
RAI 442 — 7.1-27	3	3
RAI 442 — 7.1-28	4	4
RAI 442 — 7.1-29	5	5
RAI 442 — 7.1-30	6	6
RAI 442 — 7.1-31	7	8
RAI 442 — 7.1-32	9	9
RAI 442 — 7.3-32	10	10
RAI 442 — 7.3-33	11	11
RAI 442 — 7.3-34	12	12
RAI 442 — 7.9-61	13	13
RAI 442 — 7.9-62	14	14
RAI 442 — 7.9-63	15	15
RAI 442 — 7.9-64	16	16
RAI 442 — 7.9-65	17	17
RAI 442 — 7.9-66	18	18
RAI 442 — 7.9-67	19	19

A complete answer is not provided for the 17 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 442 — 7.1-26	March 15, 2011
RAI 442 — 7.1-27	March 15, 2011
RAI 442 — 7.1-28	March 15, 2011
RAI 442 — 7.1-29	January 7, 2011
RAI 442 — 7.1-30	February 9, 2011
RAI 442 — 7.1-31	March 15, 2011
RAI 442 — 7.1-32	January 7, 2011
RAI 442 — 7.3-32	February 9, 2011
RAI 442 — 7.3-33	February 9, 2011
RAI 442 — 7.3-34	March 15, 2011
RAI 442 — 7.9-61	February 9, 2011
RAI 442 — 7.9-62	February 9, 2011

RAI 442 — 7.9-63	February 9, 2011
RAI 442 — 7.9-64	March 15, 2011
RAI 442 — 7.9-65	January 7, 2011
RAI 442 — 7.9-66	February 9, 2011
RAI 442 — 7.9-67	January 7, 2011

Sincerely,

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

From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Wednesday, October 20, 2010 8:09 AM
To: ZZ-DL-A-USEPR-DL
Cc: Zhao, Jack; Morton, Wendell; Mott, Kenneth; Spaulding, Deirdre; Truong, Tung; Zhang, Deanna; Jackson, Terry; Canova, Michael; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 442(4295,5076,5068,5067), FSAR Ch. 7

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on September 10, 2010, and discussed with your staff on October 13, 2010. Drat RAI Questions 07.01-26 and 07.03-33 were modified as a result of that discussion. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

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

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 2846

Mail Envelope Properties (1F1CC1BBDC66B842A46CAC03D6B1CD41043A7E66)

Subject: DRAFT Response to U.S. EPR Design Certification Application RAI No. 442, FSAR Ch. 7, Question 7.1-30
Sent Date: 4/14/2011 12:31:30 PM
Received Date: 4/14/2011 12:31:36 PM
From: WELLS Russell (AREVA)

Created By: Russell.Wells@areva.com

Recipients:
"HUDSON Greg (AREVA)" <Greg.Hudson@areva.com>
Tracking Status: None
"BUDZIK Dennis (AREVA)" <Dennis.Budzik@areva.com>
Tracking Status: None
"BENNETT Kathy (AREVA)" <Kathy.Bennett@areva.com>
Tracking Status: None
"DELANO Karen (AREVA)" <Karen.Delano@areva.com>
Tracking Status: None
"HALLINGER Pat (EXTERNAL AREVA)" <Pat.Hallinger.ext@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
"WILLIFORD Dennis (AREVA)" <Dennis.Williford@areva.com>
Tracking Status: None
"Tesfaye, Getachew" <Getachew.Tesfaye@nrc.gov>
Tracking Status: None

Post Office: AUSLYNCMX02.adom.ad.corp

Files	**Size**	**Date & Time**
MESSAGE	20587	4/14/2011 12:31:36 PM
RAI 442 Question 07.01-30 Response US EPR DC - (DRAFT).pdf	665691	

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

Response to

**Request for Additional Information No. 442(4295, 5076, 5068, 5067), Revision 1,
Question 07.01-30**

9/10/2010

**U.S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 07.01 - Instrumentation and Controls - Introduction
SRP Section: 07.03 - Engineered Safety Features Systems
SRP Section: 07.09 - Data Communication Systems**

Application Section: FSAR Ch 7

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

Question 07.01-30:

Provide details on how the U.S. EPR design will verify functionality of the self testing features based on guidance from BTP 7-17.

For the U.S. EPR design, the applicant has committed to meeting BTP 7-17, "Guidance on Self-Test and Surveillance Test Provisions." BTP 7-17 (which cites GDC 21 and 10 CFR 50.55a(h) as a regulatory bases) states that: “(a) Self-test functions should be verified during periodic functional tests, and (b) If automatic test features are credited with performing surveillance test functions, provisions should be made to confirm the execution of the automatic test during plant operation. The capability to periodically test and calibrate the automatic test equipment should also be provided. The balance of surveillance and test functions that are not performed by the automatic test feature should be performed manually to meet the intent of Regulatory Guide 1.118. In addition, the automatic test feature function should conform to the same requirements and considerations (e.g., test interval) as the manual function."

a) The staff requests that the applicant provide details on the method by which the U.S. EPR Protection System self testing features will be periodically verified and how the operation will be confirmed during plant operation.

b) How does the applicant propose to meet item (b), as quoted above?

Response to Question 07.01-30:

Item a:

Technical Report ANP-10315P, Revision 0, “U.S. EPR Protection System Surveillance Testing and TELEPERM XS Self-Monitoring” describes the U.S. EPR protection system (PS) self-test features.

Technical Report ANP-10315P, Revision 0, Section 3.6 addresses compliance with BTP 7-17 and Section 3.5 addresses compliance with RG 1.118.

Item b:

Technical Report ANP-10315P, Revision 0, Section 3.6 states that there are no automatic test features that use the automatic test equipment credited to perform surveillance testing in the U.S. EPR PS design.

Technical Report ANP-10315P, Revision 0, “U.S. EPR Protection System Surveillance Testing and TELEPERM XS Self-Monitoring” has been provided by separate letter.

Proposed changes to the instrumentation and controls (I&C) architecture were communicated to the NRC staff in the public meeting on February 15, 2011. The affected sections of U.S. EPR FSAR Tier 2, Section 14.2 will be revised to incorporate modifications to I&C architecture. These conforming changes to U.S. EPR FSAR Tier 2, Section 14.2 are provided with this response to facilitate NRC review.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 14.2 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

3.3 Verify that operation of the inverters, manual transfer switches, frequency synchronization and blocking diodes of the NUPS meets design requirements.

3.4 Verify operation of the NUPS inverters as follows:

a. Verify operation of each NUPS inverter with the respective NUPS battery charger removed from service.

b. Verify each NUPS inverter static bypass switch forward and reverse transfer operation.

3.5 Place each battery charger in equalize mode and verify battery charger, battery, and inverter performance meets design requirements.

3.6 Verify that operation of protective devices, controls, interlocks, alarms, computer inputs, and ground detection meets design requirements.

3.7 Verify operation of the AC/DC and DC/DC converter output to the I&C cabinets by alternately removing power and verifying continued power to the I&C cabinet from the converter remaining in operation.

4.0 DATA REQUIRED

4.1 Charger float voltage and current.

4.2 Test discharge recording of battery terminal voltage, current, temperature, capacity in ampere hours, and individual cell voltages.

4.3 Inverter voltage, frequency, and current.

4.4 Value at which alarms, interlocks, and controls occur.

4.5 Capacity ~~estimates~~ of the NUPS batteries.

5.0 ACCEPTANCE CRITERIA

5.1 The NUPS system supplies the loads as designed (refer to Section 8.3.2).

07.01-30

14.2.12.10.5 Communication System (Test #130)

1.0 OBJECTIVE

1.1 To demonstrate the adequacy of the intra-plant communication system to provide communications between vital plant areas.

1.2 To demonstrate the offsite communication system to provide communications with exterior entities.

1.3 Verify that non-safety-related communication system functions as designed to malfunctions or failures.

1.4 To demonstrate that COMS meets design requirements.

07.01-30

2.0 PREREQUISITES

2.1 Construction activities on the intraplant communication system have been completed.

2.2 Support systems required for operation of the intraplant communication system are complete and functional.

2.3 Plant equipment that contributes to the ambient noise level shall be in operation.

3.0 TEST METHOD

3.1 Verify the intraplant portable wireless communication system functions as designed.

3.2 Verify that the intraplant (PABX) telephone system functions as designed.

3.3 Verify the intraplant sound powered telephone system functions as designed.

3.4 Verify the intraplant public address system functions as designed.

3.5 Verify the security radio system functions as designed at locations throughout the plant.

3.6 Verify the normal offsite telephone system functions as designed.

3.7 Verify the emergency telephone system (emergency notification system, health physics network) function as designed.

3.8 Verify that the communication system responds as designed to actual or simulated limiting malfunctions or failures.

3.9 Verify that the communications equipment will perform under anticipated maximum plant noise levels.

3.10 Verify the effectiveness of the exclusion zones established for protecting the safety-related I&C equipment from mis-operation due to EMI/RFI effects from the portable phones and radios of the communication system.

4.0 DATA REQUIRED

4.1 Record the results of communication attempts from each system and its locations.

5.0 ACCEPTANCE CRITERIA

5.1 The portable wireless communication system provides radio coverage throughout the plant, except in areas restricted due to potential EMI/RFI considerations.

5.2 The portable wireless communication system provides an interconnection to the public switched telephone network (PSTN) to allow offsite communications.

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5.3 The digital telephone system provides plant-wide intercom capability.

5.4 The digital telephone system provides an interconnection to the public switched telephone network (PSTN) to allow offsite communications.

5.5 The public address and alarm system operates as described in the design specification.

5.6 The sound powered system operates as described in the design specification.

5.7 The security communication system operates as described in the design specification.

5.8 The communication system provides communication with the emergency notification system and the health physics network.

5.9 The communication equipment is capable of operating under maximum noise conditions.

5.10 Safety-related I&C equipment is not adversely impacted by the portable phones and radios of the communication system.

5.11 The intraplant and offsite communication systems function as described in Section 9.5.2.

~~14.2.12.10.5 Control Rod Drive Power System (Test #112)~~

~~1.0 OBJECTIVE~~

~~1.1 To demonstrate the operation of the control rod drive power system.~~

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

~~2.0 PREREQUISITES~~

~~2.1 Construction activities on the control rod drive power system have been completed.~~

~~2.2 The control rod drive power system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.~~

~~2,3 Support systems required for operation of the control rod drive power systems are completed and functional.~~

~~2,4 Test instrumentation is available and calibrated.~~

~~2.5 Applicable equipment has been visually inspected.~~

~~3.0 TEST METHOD~~

~~3.1 Demonstrate the functionality of the control rod drive source and reactor trip breakers locally and remotely.~~

~~3,2 Demonstrate the functionality of the bus interlocks alarms and protective relays.~~

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~~3.3 Verify the operation of indication and automatic responses.~~

~~3.4 Perform energization of control rod drive power system.~~

~~3.5 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 Setpoints at which alarms, interlocks, and protective relays occur.~~

~~5.0 ACCEPTANCE CRITERIA~~

~~5.1 The control rod drive power system operates as designed (refer to Section 8.3.1).~~

~~5.2 Verify that safety-related components meet electrical independence and redundancy requirements.~~

14.2.12.10.6 Normal Lighting System (Test #113)

1.0 OBJECTIVE

1.1 To demonstrate the operation of the normal lighting system.

2.0 PREREQUISITES

2.1 Construction activities on the normal lighting system have been completed.

2.2 Normal lighting system instrumentation has been calibrated and is operating satisfactorily prior to performing the test, if applicable.

2.3 Support systems required for operation of the normal lighting system are completed and functional.

2.4 Test instrumentation is available and calibrated.

2.5 Equipment has been visually inspected.

2.6 Normal lighting system power is available.

3.0 TEST METHOD

3.1 Demonstrate the functionality of the source and feeder circuit breakers.

3.2 Verify acceptable ~~normal~~ lighting levels for each system with other lighting systems de-energized in each room.

4.0 DATA REQUIRED

4.1 Plant area illumination levels.

3.4 Perform energization of 480 V NPSS.

4.0 DATA REQUIRED

4.1 Values at which alarms, interlocks, and protective relays occur.

5.0 ACCEPTANCE CRITERIA

5.1 The 480 V NPSS operates as designed (refer to Section 8.3.1).

~~14.2.12.10.14 Reserved (Test #121)~~

~~14.2.12.10.15 Reserved (Test #122)~~

14.2.12.10.14 12-Hour Uninterruptible Power Supply (Test #123)

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1.0 OBJECTIVE

1.1 To demonstrate the 12-hour uninterruptible power supply system (12-UPS) supply power as designed in required operating modes.

2.0 PREREQUISITES

2.1 Construction activities on the 12-UPS have been completed.

2.2 12-UPS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Support systems required for operation of the12-UPS are completed and functional.

2.4 Test instrumentation is available and calibrated.

2.5 12-UPS batteries are fully charged.

2.6 Load banks are available for discharge test.

2.7 Operation of breakers and cables has been verified.

2.8 Ventilation systems are in operation, as needed.

2.9 Megger and perform visual inspection of buses and associated components.

3.0 TEST METHOD

3.1 Demonstrate that the 12-UPS batteries and battery chargers meet design capacities by performing discharge and charging tests.

3.2 Verify that minimum bank and individual cell limits are not exceeded during battery discharge test.

3.3 Verify that operation of the inverters, manual transfer switches, and frequency synchronization meets design requirements.

3.4 Verify operation of the 12-UPS inverters as follows:

(SICS), including the requirements of Regulatory Guide 1.97 type A, B, and C variable. (This test should be performed in coordination with safe shutdown, the safety automation system, and the protection system, where applicable.)

2.0 PREREQUISITES

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2.1 The instrumentation ~~used to operate~~that provides inputs to the SICS has been calibrated and is operating satisfactorily prior to performing the following test.

2.1.1 Signal conditioning and distribution system (SCDS).

2.1.2 Diverse actuation system (DAS).

2.1.3 Protection system (PS).

2.1.4 Safety automation system (SAS).

2.1.5 Priority and actuator control system (PACS).

2.2 Programming and diagnostic testing is complete.

2.3 Support systems required for testing SICS are installed and have successfully completed initial testing.

3.0 TEST METHOD

3.1 Energize power supplies and verify operation.

3.2 Activate manual trips and monitor operation.

3.3 Activate ESF actuations and monitor operation.

3.4 Simulate safe shutdown scenarios and observe appropriate alarms and indications.

3.5 Exercise the transfer of control functions to SICS from PICS.

3.6 Exercise manual control of individual components required in the Chapter 15 analysis.

3.7 Verify the SICS control signals override lower priority signals where appropriate.

3.8 Verify permissive and interlocks can be manually controlled.

3.9 Verify monitoring and control of safety-related auxiliary support systems required to mitigate Chapter 15 events and recovery.

3.10 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing from service (i.e., loss of power conditions) SICS divisions and determining which functions are lost on the energized PS division and which overall SICS functions are lost. Repeat test for all SICS divisions.

4.0 DATA REQUIRED

4.1 Power supply voltages.

4.2 Circuit breaker and indicator operation.

4.3 Safety parameter trends during testing.

4.4 Response time for manually initiated actions.

4.5 Reactor trip and actuation path response.

5.0 ACCEPTANCE CRITERIA

5.1 The SICS has been verified to be capable of control and monitoring of critical plant functions automatically and in response to manual signals.

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5.2 The SICS ~~operates properly once control has been transferred from PICS~~commands have priority over PICS commands.

5.3 The response times meet those assumed in the safety analysis.

14.2.12.11.2 Seismic Monitoring System (Test #125)

1.0 OBJECTIVE

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

2.0 PREREQUISITES

2.1 Construction activities on the SMS have been completed.

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

2.3 Test instrumentation is available and calibrated.

2.4 Factory acceptance testing of the SMS is complete.

3.0 TEST METHOD

3.1 Verify functionality of internal calibration devices by recording calibration records on applicable sensors.

3.2 Verify system response to simulated seismic events by actuating the appropriate trigger units, recording accelerograph outputs, and playing back records for analysis.

3.3 Verify and calibrate systems alarms and indicators.

3.4 Verify that operation and installation of peak recording accelerographs meet design requirements.

3.5 Verify proper operation of alarm, control and indication functions.

3.6 Verify that the SMS system operates over the design range using actual or simulated signals.

3.7 Verify that the SMS system responds as designed to actual or simulated limiting malfunctions or failures.

5.0 ACCEPTANCE CRITERIA

5.1 The cable insulation resistance for the cables associated with the AMS are within specification.

5.2 Amplifiers associated with the AMS are operating properly.

5.3 The non-safety-related counting table and the signal processing equipment respond as designed to a test source.

5.4 The AMS nuclear signal channel cables and instrumentation function as described in Section 7.1.1.4.6.

14.2.12.11.5 Process Automation System (Test #128)

1.0 OBJECTIVE

1.1 To demonstrate the ability of the non-safety-related process automation system (PAS) to monitor and control non-safety processes.

1.1.1 Automatic primary plant limitation functions.

1.1.2 Automatic operational functions, including:

- Equipment protection~~,~~.
- Closed loop controls.

1.1.3 Manual control functions.

1.1.4 Processing of information for display, including:

- Type A-E post-accident monitoring (PAM) variables.
- Process system instrumentation~~,~~.
- Alarms.

2.0 PREREQUISITES

2.1 Construction activities on the PAS have been completed.

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2.2 ~~PAS i~~Instrumentation that provides input signals to PAS has been calibrated and is functional for performance of the following test.

2.2.1 Signal conditioning and distribution system (SCDS).

2.2.2 PAS sensors and black boxes.

2.2.3 Priority and actuator control system (PACS) devices.

2.2.4 Actuators/black boxes.

2.2.5 Turbine generator instrumentation and control (TG I&C).

2.3 Support system~~(s)~~ required for operation of the PAS ~~is~~are complete and functional.

2.3.1 SCDS.

2.3.2 PACS.

2.4 Test instrumentation is available and calibrated.

2.5 Verify that factory acceptance testing has been completed.

2.6 Verify proper operation of alarm, control, and indication functions.

3.0 TEST METHOD

3.1 Demonstrate that operation of the PAS meets design requirements.

3.2 Verify that PAS operates over the design range using actual or simulated signals.

3.3 Verify that PAS responds as designed to actual or simulated limiting malfunctions or failures.

3.4 Verify redundancy and electrical independence of the PAS design.

4.0 DATA REQUIRED

4.1 Setpoints under which alarms and interlocks occur.

4.2 PAS functional data (input data and corresponding output).

5.0 ACCEPTANCE CRITERIA

5.1 The PAS provides the following operational I&C functions.

5.1.1 Automatic primary plant limitation functions.

5.1.2 Automatic operational functions, including:

- Equipment protection.
- Closed loop controls.

5.1.3 Manual control functions, as described in ~~Sections 7.1.1.3.1~~Sections 7.1.1.6.5 and ~~7.1.2.6.29~~7.4.1.3.4.

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5.1.4 Processing of information for display, including:

- Type A-E post-accident monitoring (PAM) variables.
- Process system instrumentation.
- Alarms.

14.2.12.11.6 Process Information and Control System (Test #129)

1.0 OBJECTIVE

1.1 To demonstrate the ability of the non-safety-related process information and control system (PICS) to monitor and control plant processes.

2.0 PREREQUISITES

2.1 Construction activities on the PICS have been completed.

2.2 Support system~~(s)~~ required for operation of the PICS ~~is~~are complete and functional.

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2.2.1 Protection system (PS).

2.2.2 Safety automation system (SAS).

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2.2.3 Reactor control, surveillance and limitation system (RCSL).

2.2.4 Turbine generator instrumentation and control (TG I&C).

2.2.5 Process automation system (PAS).

2.2.6 Remote shutdown station (RSS).

2.3 Test instrumentation is available and calibrated.

2.4 Verify that factory acceptance testing has been completed.

2.5 Verify proper operation of alarm, control, and indication functions.

3.0 TEST METHOD

3.1 Demonstrate that operation of the PICS meets design requirements.

3.2 Verify that the PICS operates over the design range using actual or simulated signals.

3.3 Verify that the PICS responds as designed to actual or simulated limiting malfunctions or failures.

3.4 Verify redundancy and electrical independence of the PICS design.

3.5 Verify full capability and independence of PICS operation at the MCR and RSS.

4.0 DATA REQUIRED

4.1 Setpoints under which alarms and interlocks occur.

4.2 PICS functional data (input data and corresponding output).

5.0 ACCEPTANCE CRITERIA

5.1 Each PICS operator interface that provides monitoring and control capabilities is enabled.

5.2 Each PICS operator interface that provides monitoring only capabilities is enabled and does not allow control capabilities.

5.3 The PICS provides monitoring and control of process systems.

5.4 The PICS provides the status of the automatic reactor trip and engineered safety features.

5.5 The PICS provides the manual reset of automatic reactor trip and engineered safety features.

5.6 The PICS provides manual component control of safety-related process systems via the PAS and the PACS.

5.7 The PICS provides safety parameter display system (SPDS) functions.

5.8 The PICS displays the Type A-E post-accident monitoring (PAM) variables.

5.9 The PICS provides monitoring and control of systems required to mitigate severe accidents.

5.10 The PICS displays bypassed and inoperable status of safety systems.

5.11 The PICS provides alarm management capability.

5.12 The PICS provides the capability to archive plant and other selected data.

5.13 The PICS provides the interface to external I&C computers.

5.14 The PICS provides an interface to external computers via a unidirectional firewall.

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5.15 The PICS functions as described in Section 7.1.1.3.2.

~~14.2.12.11.7 Communication System (Test #130)~~

~~1.0 OBJECTIVE~~

~~1,1 To demonstrate the adequacy of the intra-plant communication system to provide communications between vital plant areas.~~

~~1.2 To demonstrate the offsite communication system to provide communications with exterior entities.~~

~~1.3 Verify that non-safety-related communication system functions as designed to malfunctions or failures.~~

~~1.4 To demonstrate that COMS meets design requirements.~~

~~2.0 PREREQUISITES~~

~~2.1 Construction activities on the intraplant communication system have been completed.~~

~~2.2 Support systems required for operation of the intraplant communication system are complete and functional.~~

~~2.3 Plant equipment that contributes to the ambient noise level shall be in operation.~~

~~3.0 TEST METHOD~~

~~3.1 Verify the intraplant portable wireless communication system functions as designed.~~

~~3.2 Verify that the intraplant (PABX) telephone system functions as designed.~~

~~3.3 Verify the intraplant sound powered telephone system functions as designed.~~

~~3.4 Verify the intraplant public address system functions as designed.~~

~~3.5 Verify the security radio system functions as designed at locations throughout the plant.~~

~~3.6 Verify the normal offsite telephone system functions as designed.~~

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~~3.7 Verify the emergency telephone system (emergency notification system, health physics network) function as designed.~~

~~3.8 Verify that the communication system responds as designed to actual or simulated limiting malfunctions or failures.~~

~~3.9 Verify that the communications equipment will perform under anticipated maximum plant noise levels.~~

~~3.10 Verify the effectiveness of the exclusion zones established for protecting the safety-related I&C equipment from mis-operation due to EMI/RFI effects from the portable phones and radios of the communication system.~~

~~4.0 DATA REQUIRED~~

~~4.1 Record the results of communication attempts from each system and its locations.~~

~~5.0 ACCEPTANCE CRITERIA~~

~~5.1 The portable wireless communication system provides radio coverage throughout the plant, except in areas restricted due to potential EMI/RFI considerations.~~

~~5.2 The portable wireless communication system provides an interconnection to the public switched telephone network (PSTN) to allow offsite communications.~~

~~5.3 The digital telephone system provides plant-wide intercom capability.~~

~~5.4 The digital telephone system provides an interconnection to the public switched telephone network (PSTN) to allow offsite communications.~~

~~5.5 The public address and alarm system operates as described in the design specification.~~

~~5.6 The sound powered system operates as described in the design specification.~~

~~5.7 The security communication system operates as described in the design specification.~~

~~5.8 The communication system provides communication with the emergency notification system and the health physics network.~~

~~5.9 The communication equipment is capable of operating under maximum noise conditions.~~

~~5.10 Safety-related I&C equipment is not adversely impacted by the portable phones and radios of the communication system.~~

~~5.11 The intraplant and offsite communication systems function as described in Section 9.5.2.~~

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14.2.12.11.7 Control Rod Drive Control System (Test #112)

1.0 OBJECTIVE

1.1 To demonstrate the operation of the control rod drive control system (CRDCS).

1.2 To demonstrate electrical independence and redundancy of power supplies.

1.3 Verify operation of CRDCS to signals generated by the reactor control, surveillance and limitation (RCSL) system.

2.0 PREREQUISITES

2.1 Construction activities on the CRDCS have been completed.

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

2.3 Support systems required for operation of the CRDCS are completed and functional.

2.3.1 Protection system (PS).

2.3.2 Diverse actuation system (DAS).

2.3.3 RCSL system.

2.4 Test instrumentation is available and calibrated.

2.5 Applicable equipment has been visually inspected.

3.0 TEST METHOD

3.1 Demonstrate the functionality of the CRDCS trip contactors and control transistors.

3.2 Demonstrate the functionality of the bus interlocks alarms and protective features.

3.3 Verify the operation of indication and automatic responses.

3.4 Perform energization of CRDCS.

3.5 Check electrical independence and redundancy of power supplies for functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

4.1 Setpoints at which alarms, interlocks, and protective relays occur.

5.0 ACCEPTANCE CRITERIA

5.1 The CRDCS operates as designed (refer to Section 7.7).

5.2 Verify that components meet electrical independence and redundancy requirements.

2.4 Required test equipment is functional.

2.5 Verify that factory acceptance testing has been completed.

2.6 Verify proper operation of alarm, control, and indication functions.

3.0 TEST METHOD

3.1 Verify the response of the loose parts monitoring channels with a mechanical impulse type device.

3.2 Verify alarm functions using simulated signals.

3.3 Establish baseline monitoring data for a cold subcritical plant.

3.4 Establish the alarm level for loose parts monitoring channels in a cold subcritical plant.

3.5 Verify that the LPMS operates over the design range using actual or simulated signals.

3.6 Verify that the LPMS responds as designed to actual or simulated limiting malfunctions or failures.

Note: This alarm level shall apply to the preoperational test phase, to startup and, to power operations unless it is found to be unsuitable by subsequent equipment operation.

4.0 DATA REQUIRED

4.1 Baseline loose parts data.

4.2 Alarm levels applicable to detectable loose parts.

5.0 ACCEPTANCE CRITERIA

5.1 The accelerometers of the LPMS are operating properly.

5.2 The signal conditioning equipment of the LPMS is operating properly.

5.3 The equipment of the LPMS that provides data recording, data analysis, and alarming is operating properly.

5.4 The LPMS setpoints have been adjusted for initial power operation.

5.5 The LPMS functions as described in Section 7.1.1.5.9.

14.2.12.11.11 Turbine–Generator Instrumentation and Control System (Test #134)

1.0 OBJECTIVE

1.1 To verify the proper installation and operation of the non-safety-related turbine-generator instrumentation and control system (TG I&C).

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2.0 PREREQUISITES

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2.1 Construction activities on the ~~turbine-generator instrumentation and control~~TG I&C system are essentially complete and the applicable systems and components are ready for testing.

2.1.1 Process information and control system (PICS).

2.1.2 Protection system (PS).

2.1.3 Diverse actuation system (DAS).

2.2 Applicable operating manuals are available for developing detailed procedures.

2.3 ~~Turbine-generator instrumentation and control software is installed and i~~Instrumentation that provide inputs to TG I&C has been calibrated and ~~is~~ operating satisfactorily prior to performing the following test.

2.3.1 Reactor control, surveillance and limitation system (RCSL).

2.3.2 Process automation system (PAS).

2.4 ~~Test equipment and instrumentation is available and calibrated and is operating satisfactorily prior to performing the following test~~TG I&C software is installed.

2.5 Plant systems required to support testing are functional to the extent necessary to perform the testing or suitable simulations are used.

2.6 Verify that factory acceptance testing has been completed.

2.7 Verify proper operation of alarm, control, and indication functions.

3.0 TEST METHOD

3.1 Verify input data and control paths from systems associated with the turbine-generator instrumentation and control system.

3.2 Simulate inputs and verify system responses and demand settings.

3.3 ~~Verify the functions of the turbine-generator instrumentation and control system. Using simulated signals, v~~Verify that the operator interface allows turbine control~~, as designed~~ to the following simulated signals as designed.

3.3.1 Manual operation.

3.3.2 Increasing load.

3.3.3 Decreasing load.

3.3.4 Latching turbine turning gear.

3.3.5 Unlatching turbine turning gear.

3.4 Verify that turbine-generator instrumentation responds as designed to the following simulated signals:

3.4.1 Turbine rpm.

3.4.2 Reactor trip.

14.2.12.11.15 Safety Automation System (Test #139)

1.0 OBJECTIVE

1.1 To demonstrate the ability of the safety-related ~~S~~safety ~~A~~automation ~~S~~system (SAS) to perform the following automatic and selected manual control functions on safety-related processes: ~~during normal operations, abnormal operational occurrences, postulated accidents, and post accidents.~~

1.1.1 During normal operations.

1.1.2 During abnormal operational occurrences.

1.1.3 Postulated design basis accident mitigation.

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1.1.4 Postulated design basis post-accident mitigation operations.

2.0 PREREQUISITES

2.1 Construction activities on the SAS have been completed.

2.2 ~~SAS~~Signal conditioning and distribution system (SCDS) instrumentation has been calibrated and is functional for performance of this test.

2.3 Support system~~(s)~~ required for operation of the SAS ~~is~~are complete and functional.

2.3.1 SCDS.

2.3.2 PACS.

2.4 Test instrumentation is available and calibrated.

2.5 Verify that factory acceptance testing has been completed.

2.6 Verify proper operation of alarm, control, and indication functions are available or performing this test..

3.0 TEST METHOD

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3.1 ~~Demonstrate the operation of the SAS meets design requirements~~Simulate SCDS sensor inputs over the instrument range and verify that SAS receives SCDS inputs.

3.2 Verify that SAS ~~operates~~responds as designed over the design range using ~~actual or~~ simulated signals from SCDS.

3.3 Verify that SAS responds as designed to actual or simulated limiting malfunctions or failures.

3.4 Verify redundancy and electrical independence of the SAS design.

3.5 Verify the functionality of the SAS self-test features by simulating SAS component failures and observing through man-machine interfaces that the self-test features identified the failure.

4.0 DATA REQUIRED

4.1 Setpoints under which alarms and interlocks occur.

4.2 SAS functional data (input data and corresponding output).

5.0 ACCEPTANCE CRITERIA

5.1 Monitoring and control of safety related automatic and manual functions after initiation through the Protection System.

5.2 Monitoring and control of essential auxiliary support systems.

5.3 Processing Type A-C PAM variables for display on the SICS.

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5.4 ~~Certain i~~Interlock functions respond as described in Section 7.8.

5.5 The self-test features of the SAS are operating properly.

14.2.12.11.16 Remote Shutdown Station (Test #140)

1.0 OBJECTIVE

1.1 To verify proper operation of the remote shutdown station (RSS).

1.2 To determine transfer of control occurs and that the plant can be controlled and cooled down from the RSS.

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

2.0 PREREQUISITES

2.1 All construction activities on the RSS have been completed.

2.2 The RSS instrumentation has been calibrated and is functional for performing the following test.

2.3 The communication systems between the MCR and RSS location have been demonstrated to be functional.

2.4 Verify that factory acceptance testing has been completed.

2.5 Verify proper operation of alarm, control, and indication functions.

3.0 TEST METHOD

3.1 Simulate signals to verify that operation of RSS instrumentation meets design requirements.

3.2 Perform a full transfer of control from the MCR during the performance of the HFT.

3.3 Perform a controlled cooldown from the remote shutdown panel during the performance of the HFT.

3.4 Verify that the RSS operates over the design range using actual or simulated signals.

3.0 TEST METHOD

3.1 Verify the operation of the radiation monitor using a check source and external test equipment, as applicable.

3.2 Check the self-testing feature of the radiation monitor, as applicable.

3.3 Compare local and remote indications.

3.4 Verify as-designed local and remote alarm actuations, as applicable.

3.5 Initiate a high radiation signal to the MCR air intake, main steam line, and containment high range radiation monitors to verify that control actuations meet design requirements. The source of initiation of the signal, listed in order of preference, should be one of the following:

3.5.1 Internal check source (verify that check source strength is capable of generating desired control actuations).

3.5.2 Radiation calibration check source (verify that check source does not generate a personnel hazard during the test).

3.5.3 Simulated high radiation signal at the radiation detector.

3.6 Verify that the radiation monitoring system operates over the design range using actual or simulated signals.

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

3.8 Verify that the radiation monitoring system response meets the accident analysis assumptions, such as time response, accuracy, and control stability.

3.9 Verify redundancy and electrical independence of the radiation monitoring system design.

4.0 DATA REQUIRED

4.1 Radiation monitor response to a check source, as applicable.

4.2 Technical data associated with the source.

4.3 Local and remote responses to test signals, as applicable.

4.4 Signals levels necessary to cause alarm actuation.

5.0 ACCEPTANCE CRITERIA

5.1 The radiation monitoring system (MCR air intake duct activity) generates a Main Control Room air intake activity measurement signal as input to the protection system

5.2 The radiation monitoring system (containment high range activity)
07.01-30 generates a containment isolation signal as an input to the ~~protection system~~PS, as designed.

14.2.12.11.22 Protection System (Test #146)

1.0 OBJECTIVE

1.1 To demonstrate the proper operation of the safety-related protection system (PS).

1.2 To verify the PS response times.

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

1.4 Verify operation of PS interlocks.

1.5 Verify that upon loss and restoration of electrical power to each PS division, the PS outputs attain a predefined state.

1.6 Verify the receipt of plant signals (sensors/black boxes) from the signal conditioning and distribution system (SCDS).

1.7 Verify the output of PS signals to the following:

1.7.1 Reactor trip circuit breakers (RTCB).

1.7.2 Control rod drive control system (CRDCS) trip contactors.

1.7.3 Turbine generator instrumentation and control (TG I&C).

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1.7.4 Priority and actuator control system (PACS).

2.0 PREREQUISITES

2.1 ~~Construction activities on the reactor trip breakers, reactor trip contactors, and PS have been completed~~Construction activities on the following are complete:~~.~~

2.1.1 Reactor trip breakers.

2.1.2 Reactor trip contactors.

2.1.3 Safety conditioning and distribution system (SCDS).

2.1.4 Priority and actuator control system (PACS).

2.2 ~~PS~~ SCDS ~~system~~ instrumentation ~~has~~(sensors and black boxes) have been calibrated and ~~is~~are operating satisfactorily prior to performing the following test.

2.3 External test instrumentation is available and calibrated.

2.4 Factory acceptance testing has been completed.

2.5 Support systems required for PS operation are functional and the plant is configured so that equipment damage or personnel injury will not occur. For example, pump breakers racked to test to prevent inadvertent pump start, or pump motors uncoupled~~.~~:

2.5.1 Reactor trip circuit breakers.

2.5.2 Reactor trip contactors.

2.5.3 Manual reactor trip (RT) controls on SICS.

2.5.4 Engineered Safety Features systems components are energized and positioned in a manner to respond to a PS actuation signal to the PACS modules.

2.5.5 The TG I&C system is capable of responding to a PS signal.

2.5.6 The CRDCS trip contactors are capable of responding to a PS signal.

2.5.7 The PS is receiving signals from the SCDS.

3.0 TEST METHOD

07.01-30

3.1 Energize power supplies and verify power supply output voltage.

3.2 Simulate combinations of the actuation voting trip logic for each of the actuation signals and observe actuation and associated alarms.

3.3 Simulate PS inputs from SCDS described in Section 7.2 that would generate a reactor trip signal and trip each reactor trip breaker. Observe reactor trip breaker operation.

3.4 Simulate PS inputs described in Section 7.2 that would generate a reactor trip signal and trip each reactor trip contactor. Observe reactor trip contactor operation.

3.5 Initiate a manual reactor trip from SICS and observe the following:

3.5.1 Reactor trip breaker operation.

3.5.2 Reactor trip contactor operation.

3.5.3 CRDM operating coil transistor discharge in response to PS signal to the CRDCS.

3.5.4 TG I&C response to reactor trip.

3.6 Simulate ~~PS~~SCDS inputs described in Section 7.3 that would generate an ESF actuation output. Observe ESF actuators response.

3.7 Initiate each manual ESF actuation from SICS while observing ESF actuator ~~system~~ response.

3.8 Check the operation of bypass features including, where applicable, observation that operating bypasses are cancelled automatically.

3.9 Inject signals into appropriate sensors or sensor terminals and measure the elapsed time to achieve actuation of the field device (e.g., breaker, contactor). Trip or actuation paths may be tested in several segments.

3.10 Observe protection system operation over the design range using actual or simulated input signals to the SCDS. 07.01-30

3.11 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing from service (i.e., loss of power condition) PS divisions and determining which functions are lost on the energized PS division and which overall PS functions are lost. Repeat test for all PS divisions.

3.12 Verify operation of PS interlocks described in Section 7.6 using actual or simulated inputs and verify corresponding interlock function.

07.01-30

5.7 The PS provides status information to the ~~non-safety-related control systems~~following~~.~~:

5.7.1 PAS.

5.7.2 SAS.

5.7.3 PACS.

5.7.4 TG I&C.

5.7.5 CRDCS.

5.7.6 Reactor trip circuit breakers.

5.8 The total response time of each PS trip or actuation path is verified to be conservative with respect to the times used in the safety analysis.

5.9 Electrical independence and redundancy requirements are met.

5.10 The PS functions as described in Sections 7.1.1.4.1, 7.2, 7.3, and 7.6.

5.11 The PS outputs attain a predefined state upon loss and restoration of electrical power.

5.12 The self-test features of the PS are operating properly.

14.2.12.11.23 Reactor Control, Surveillance and Limitation System (Test #147)

1.0 OBJECTIVE

1.1 To demonstrate the proper operation of the non-safety-related reactor control, surveillance and limitation system (RCSL).

1.2 To demonstrate electrical independence and redundancy of power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the RCSL have been completed.

07.01-30

2.2 RCSL software is installed and instrumentation that provides RCSL input and control signals has been calibrated and is operating satisfactorily prior to performing the following test.

2.2.1 Signal conditioning and distribution system (SCDS).

2.2.2 Control rod drive control system (CRDCS).

2.2.3 Turbine generator instrumentation and control (TG I&C).

2.2.4 Process information and control system (PICS).

2.3 External test equipment has been calibrated and is functional.

2.4 Support systems required for operation of the RCSL are functional.

2.5 Cabling has been completed between the RCSL and interface equipment.

2.6 Verify that factory acceptance testing has been completed.

2.7 Verify proper operation of alarm, control and indication functions.

3.0 TEST METHOD

3.1 Simulate inputs to the RCSL; observe receipt of these signals at the RCSL and system response.

3.2 Verify that the RCSL operates over the design range using actual or simulated signals.

3.3 Verify that the RCSL responds as designed to actual or simulated limiting malfunctions or failures.

3.4 Verify that the RCSL response meets design bases assumptions.

3.5 Verify redundancy and electrical independence of the non-safety RCSL design.

4.0 DATA REQUIRED

4.1 Input signal values.

4.2 RCSL output.

5.0 ACCEPTANCE CRITERIA

5.1 Verify that preliminary control setpoints have been established for the following:

5.1.1 RCCA withdrawal limits.

5.1.2 Full power target axial offset (AO).

5.1.3 Positive and negative AO bands about the target AO.

5.1.4 Power ramp rate limits.

5.1.5 Limits with respect to approaching heat flux control limits.

5.2 The RCSL responds as designed to simulated inputs (AO, SPNDs, reactor power, etc.).

5.3 The RCSL functions as described in Section 7.1.1.4.5.

14.2.12.11.24 Diverse Actuation System (Test #157)

1.0 OBJECTIVE

07.01-30

1.1 To demonstrate the ability of the non-safety-related diverse actuation system (DAS) to monitor and control non-safety processes using sensor and black box inputs from the signal conditioning and distribution system (SCDS).

1.1.1 Automatic risk reduction functions, including:

- Mitigation of ATWS,
- Mitigation of SBO,
- Mitigation of other risk significant events.

1.2 To demonstrate that DAS generated reactor trip signals to reactor trip circuit breakers (RTCB) function as designed.

07.01-30

1.3 To demonstrate that ~~R~~risk mitigation DAS functions to the following function as designed.

1.3.1 Control rod drive control system (CRDCS).

1.3.2 Turbine generator instrumentation and controls (TG I&C).

1.3.3 Priority and actuator control system (PACS).

2.0 PREREQUISITES

2.1 Construction activities on the DAS have been completed.

2.2 ~~DAS~~SCDS instrumentation has been calibrated and is functional for performance of the following test.

2.3 Support system(s) required for operation of the DAS is complete and functional.

2.4 Test instrumentation is available and calibrated.

2.5 Verify that factory acceptance testing has been completed.

2.6 Verify proper operation of alarm, control, and indication functions.

3.0 TEST METHOD

3.1 Demonstrate that operation of the DAS meets design requirements.

3.2 Verify that DAS operates over the design range using actual or simulated signals from the SCDS. 07.01-30

3.3 Verify that DAS responds as designed to actual or simulated limiting malfunctions or failures.

3.4 Verify redundancy and electrical independence of the DAS design.

3.5 Verify that DAS meets design requirements for diverse reactor trip system (without Protection system inputs or outputs).

4.0 DATA REQUIRED

4.1 Setpoints under which alarms and interlocks occur.

4.2 DAS functional data (input data and corresponding output).

5.0 ACCEPTANCE CRITERIA

5.1 The DAS provides the following operational I&C functions.

5.1.1 Automatic risk reduction functions, including:

- Mitigation of ATWS and software common cause failure, as described in Sections 7.1.2.6.27 and 7.8.2.1.3.
- Mitigation of SBO, as described in Section 7.4.1.4.
- Mitigation of other risk significant events, as described in 07.01-30 ~~Sections 7.1.1.6.1 and~~ Section 7.4.2.2.1.

07.01-30

5.2 DAS generates signals for the following automatic actuation of the functions described in the software design specification~~.~~:

5.2.1 RTCB.

5.2.2 CRDCS.

5.2.3 TG I&C.

5.2.4 PACS.

5.3 The DAS generates independent reactor trip signals in response to simulated inputs.

5.4 The DAS functions as described in Section 7.8.1.2.1.

14.2.12.11.25 Reserved (Test #158)

14.2.12.11.26 Process Radiation Monitor (Test #159)

1.0 OBJECTIVE

1.1 To demonstrate proper operation of the process radiation monitor of the process sampling system.

2.0 PREREQUISITES

2.1 The process radiation monitor has been installed, interconnections have been completed and the sample chamber has been filled with reactor makeup water.

2.2 The process radiation monitor has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 A check source is available.

2.4 Support systems required for operation of the process radiation monitor are complete and functional.

2.5 Verify that factory acceptance testing has been completed.

2.6 Verify proper operation of alarm, control and indication functions.

3.0 TEST METHOD

3.1 Observe process monitor indications, outputs to interface equipment and alarm operation, utilizing the built-in test features.

3.2 Verify calibration of the process monitor, utilizing the check source.

4.0 DATA REQUIRED

4.1 Check source data.

4.2 Process monitor operating data.

4.3 Process monitor response to the check source.

4.4 Value of parameters required to actuate alarms.

5.1.1 Offsite.

5.1.2 Clean areas onsite.

5.2 The personnel radiation monitors checkout and calibration procedures meet design requirements.

07.01-30

14.2.12.11.28 Signal Conditioning and Distribution System (Test #121)

1.0 OBJECTIVE

1.1 To demonstrate the ability of the safety-related signal conditioning and distribution system (SCDS) to acquire inputs from the following sources:

1.1.1 Safety-related sensors.

1.1.2 Black boxes.

1.2 To demonstrate the ability of the SCDS to distribute acquired inputs to the following I&C platforms:

1.2.1 Safety information and control system (SICS).

1.2.2 Diverse actuation system (DAS).

1.2.3 Protection system (PS).

1.2.4 Safety automation system (SAS).

1.2.5 Reactor control, surveillance and limitation (RCSL) system.

1.2.6 Process automation system (PAS).

2.0 PREREQUISITES

2.1 Construction activities on the SCDS have been completed.

2.2 Support system(s) required for operation of the SCDS is complete and functional.

2.3 Test instrumentation is available and calibrated.

2.4 Verify that factory acceptance testing has been completed.

2.5 Verify proper operation of alarm, control, and indication functions.

3.0 TEST METHOD

3.1 Demonstrate that operation of the SCDS meets design requirements such as:

3.1.1 Data processing rates.

3.1.2 Data quality.

3.2 Verify that the SCDS operates over the design range using actual or simulated signals for the following:

3.2.1 Sensor inputs.

3.2.2 Black box inputs.

3.2.3 Sensor outputs.

3.2.4 Black box outputs.

3.3 Verify that the SCDS responds as designed to actual or simulated limiting malfunctions or failures.

3.4 Verify redundancy and electrical independence of the SCDS design.

4.0 DATA REQUIRED

4.1 Setpoints under which alarms and interlocks occur.

4.2 SCDS functional data (input data and corresponding output).

5.0 ACCEPTANCE CRITERIA

5.1 Each SCDS operator interfaces that provide monitoring and control capabilities is enabled.

5.2 Each SCDS operator interface that provides monitoring only capabilities is enabled and does not allow control capabilities.

5.3 The SCDS functional status is displayed as designed.

5.4 The SCDS provides alarm management capability.

5.5 The SCDS provides the interface to the following via an unidirectional firewall with qualified isolation devices:

5.5.1 DAS.

5.5.2 RCSL.

5.5.3 PAS.

5.6 The SCDS provides an interface to the following via an unidirectional firewall:

5.6.1 SICS.

5.6.2 PS.

5.6.3 SAS.

5.7 The SCDS functions as described in Section 7.1.1.4.8.

14.2.12.11.29 Priority and Actuator Control System (Test #122)

1.0 OBJECTIVE

1.1 To demonstrate the ability of the priority and actuator control system (PACS) to prioritize outputs from the following sources:

1.1.1 Protection system (PS).

1.1.2 Safety information and control system (SICS).

1.1.3 Safety automation system (SAS).

1.1.4 Diverse actuation system (DAS).

1.1.5 Process automation system (PAS).

1.2 To demonstrate the ability of the PACS to acquire inputs from the following I&C components:

07.01-30

1.2.1 Safety-related actuators.

1.2.2 Safety-related black boxes.

1.2.3 Non-safety related actuators.

1.2.4 Non-safety related black boxes.

1.3 To demonstrate the ability of the PACS to communicate with the following:

1.3.1 SICS.

1.3.2 SAS.

2.0 PREREQUISITES

2.1 Construction activities on the PACS have been completed.

2.2 Support systems required for operation of the PACS are complete and functional.

2.3 Test instrumentation is available and calibrated.

2.4 Verify that factory acceptance testing has been completed.

2.5 Verify proper operation of alarm, control, and indication functions.

3.0 TEST METHOD

3.1 Demonstrate that operation of the PACS meets design requirements such as:

3.1.1 Data processing rates.

3.1.2 Prioritization.

3.2 Verify that the PACS operates using actual or simulated signals to each component:

3.3 Verify that the PACS responds as designed to actual or simulated limiting malfunctions or failures.

3.4 Verify redundancy and electrical independence of the PACS design.

4.0 DATA REQUIRED

4.1 Setpoints under which alarms and interlocks occur.

4.2 PACS functional data (input data and corresponding output).

4.3 Verify that each PACS module responds to a signal produced at the originating platform:

4.3.1 PS.

4.3.2 SICS.

4.3.3 SAS.

4.3.4 PAS.

4.3.5 DAS.

5.0 ACCEPTANCE CRITERIA

07.01-30

5.1 Each PACS operator interfaces that provide monitoring and control capabilities is enabled.

5.2 Each PACS operator interface that provides monitoring only capabilities is enabled and does not allow control capabilities.

5.3 The PACS functional status is displayed as designed.

5.4 The PACS provides alarm management capability.

5.5 The PACS provides the interface to the following via an unidirectional firewall with qualified isolation devices:

5.5.1 PAS.

5.5.2 DAS.

5.6 The PACS provides an interface to the following via an unidirectional firewall:

5.6.1 SICS.

5.6.2 PS.

5.6.3 SAS.

5.7 The PACS functions as described in Section 7.1.1.4.3.

14.2.12.12 I&C Functions

14.2.12.12.1 Accident Monitoring (Test # 138)

Note: The Accident Monitoring is not a separate system but is a collection of functions provided by other systems.

1.0 OBJECTIVE

1.1 To verify proper operation of the postaccident and severe accident systems, which comprise the accident monitoring system. The systems that are used for accident monitoring consist of radiation monitoring, reactor vessel water level indicating system, and selected instrumentation.

1.2 To verify that the accident monitoring system monitors the established parameters.

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

2.0 PREREQUISITES

2.1 Construction activities on the systems that provide the accident monitoring functions are complete.

2.2 Required special test equipment is available and functional.

2.3 Verify that factory acceptance testing has been completed.

Table 14.2-1—List of Initial Tests for the U.S. EPR
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Test #	Test Name	FSAR or COLA Test	Applicable Section of RG 1.68, Revision 3	Other RG	ITAAC
104	Emergency Diesel Generator Mechanical	FSAR	Appendix A, 1.g.(3)	RG 1.9	
105	Emergency Diesel Generator Electrical	FSAR	Appendix A, 1.g.(3)	RG 1.9	
106	Emergency Diesel Generator Auxiliaries	FSAR	Appendix A, 1.g.(3)	RG 1.9	
107	Auxiliary Steam Generating System	FSAR	Appendix A, 1.n.		
108	Switchyard and Preferred Power System	FSAR	Appendix A, 1.g.(1)		
109	Main Generator	FSAR	Appendix A, 1.g.(1)		
110	Class 1E Uninterruptible Power Supply	FSAR	Appendix A, 1.g.(3)		
111	Non-Class 1E Uninterruptible Power Supply	FSAR	Appendix A, 1.g.(1)		
112	Control Rod Drive ~~Power~~Control System	FSAR	Appendix A, ~~1.g.(1)~~1.b.(1)		
113	Normal Lighting System	FSAR	Appendix A, 1.g.(1)		
114	Heat Tracing	FSAR	Appendix, A, 1.n.(1b)		
115	Emergency Lighting System	FSAR	Appendix A, 1.g.(1)		
116	6.9 kV Emergency Power Supply	FSAR	Appendix A, 1.g.(2)		
117	480 V Emergency Power Supply	FSAR	Appendix A, 1.g.(2)		
118	13.8 kV Normal Power Supply	FSAR	Appendix A, 1.g.(1)		
119	6.9 kV Normal Power Supply	FSAR	Appendix A, 1.g.(1)		
120	480 V Normal Power Supply	FSAR	Appendix A, 1.g.(1)		
121	~~Reserved~~Signal Conditioning and Distribution System	FSAR	Appendix A 1.j		

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Test #	Test Name	FSAR or COLA Test	Applicable Section of RG 1.68, Revision 3	Other RG	ITAAC
122	~~Reserved~~Priority Actuation Control System	FSAR	Appendix A 1.j		
123	12-Hour Uninterruptible Power Supply	FSAR	Appendix A, 1.g.(1)		
124	Safety Information and Control System	FSAR	Appendix A, 1.c.		
125	Seismic Monitoring System	FSAR	Appendix A, 1.j.(10)		
126	Boron Concentration Measurement System	FSAR	Appendix A, 1.n.(6)		
127	Aeroball Measurement System	FSAR	Appendix A, 1.j.(11)		
128	Process Automation System	FSAR	Appendix A, 1.j.(8)		
129	Process Information and Control System	FSAR	Appendix A, 1.j.(8)		
130	Communication System	FSAR	Appendix A, 1.n.(13)		
131	Vibration Monitoring System	FSAR	Appendix A, 1.j.(2)		
132	Plant Fire Alarm System	FSAR	Appendix A, 1.n.(7)		
133	Loose Parts Monitoring System	FSAR	Appendix A, 1.j.(6)		
134	Turbine-~~g~~Generator Instrumentation and Control System	FSAR	Appendix A, 1.j.(8) & (15)		
135	Reactor Pressure Vessel Level Measurement System	FSAR	Appendix A, 1.j.(22) & 5.y		
136	Fatigue Monitoring System	FSAR	Appendix A, 1.j.(8)		
137	Leak Detection Systems	FSAR	Appendix A, 1.j.(20) & 5.o		
138	Accident Monitoring	FSAR	Appendix A, 1.j.(22)		
139	Safety Automation System	FSAR	Appendix A, 1.c.		