ArevaEPRDCPEm Resource

From: WILLIFORD Dennis (AREVA) [Dennis.Williford@areva.com]
Sent: Thursday, August 11, 2011 12:21 PM
To: Tesfaye, Getachew
Cc: BENNETT Kathy (AREVA); DELANO Karen (AREVA); ROMINE Judy (AREVA); RYAN Tom (AREVA); KOWALSKI David (AREVA); PATTON Jeff (AREVA); BALLARD Bob (AREVA)
Subject: DRAFT Response to U.S. EPR Design Certification Application RAI No. 430, FSARCh. 10, NEW PHASE 4 RAI, Question 10.02-10
Attachments: RAI 430 Response Q.10.02-10 US EPR DC - DRAFT.pdf

Getachew,
Attached is a draft response to RAI 430, Question 10.02-10. Earlier today, AREVA submitted Supplement 11 that provided a revised date for the final response to this question of August 31, 2011.

Let me know if the staff has any questions or if we can submit this response as final.

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, August 11, 2011 12:01 PM
To: Getachew.Tesfaye@nrc.gov
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); KOWALSKI David (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 430, FSARCh. 10, NEW PHASE 4 RAI, Supplement 11

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the three questions in RAI No. 430 on October 14, 2010. Supplement 1 response to RAI No. 430 was sent on November 17, 2010 to provide a revised schedule for Question 10.02-8. Supplement 2 response to RAI No. 430 was sent on December 10, 2010 to provide a revised schedule for Questions 10.02-9 and 10.02-10. Supplement 3, Supplement 4, Supplement 5, Supplement 6 and Supplement 7 responses to RAI No. 430 were sent on December 20, 2010, February 23, 2011, March 24, 2011, April 26, 2011 and May 27, 2011, respectively, to provide a revised schedule for the three questions. Supplement 8 response to RAI No. 430 was sent on June 9, 2011 to provide a technically correct and complete FINAL response to Question 10.02-8. Supplement 9 response to RAI No. 430 was sent on June 30, 2011 to provide a revised schedule for Questions 10.02-9 and 10.02-10. Supplement 10 response to RAI No. 430 was sent on July 28, 2011 to provide a revised schedule for Question 10.02-9.

The schedule for a technically correct and complete response to Question 10.02-10 has changed as indicated in bold below. The schedule for a technically correct and complete response to Question 10.02-9 has not changed. The schedule for the remaining questions is provided below.

Question #	Response Date
RAI 430 — 10.02-9	August 31, 2011

RAI 430 — 10.02-10	**August 31, 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: WELLS Russell (RS/NB)
Sent: Thursday, July 28, 2011 10:25 AM
To: Tesfaye, Getachew
Cc: WILLIFORD Dennis (RS/NB); ROMINE Judy (RS/NB); KOWALSKI David (RS/NB); BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 430, FSARCh. 10, NEW PHASE 4 RAI, Supplement 10

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the three questions in RAI No. 430 on October 14, 2010. Supplement 1 response to RAI No. 430 was sent on November 17, 2010 to provide a revised schedule for Question 10.02-8. Supplement 2 response to RAI No. 430 was sent on December 10, 2010 to provide a revised schedule for Questions 10.02-9 and 10.02-10. Supplement 3, Supplement 4, Supplement 5, Supplement 6 and Supplement 7 responses to RAI No. 430 were sent on December 20, 2010, February 23, 2011, March 24, 2011, April 26, 2011 and May 27, 2011, respectively, to provide a revised schedule for the three questions. Supplement 8 response to RAI No. 430 was sent on June 9, 2011 to provide a technically correct and complete FINAL response to Question 10.02-8. Supplement 9 response to RAI No. 430 was sent on June 30, 2011 to provide a revised schedule for Questions 10.02-9 and 10.02-10.

The schedule for a technically correct and complete response to Question 10.02-9 has changed and is provided below; the schedule for a technically correct and complete response to Question 10.02-10 has not changed and is also provided below:

Question #	Response Date
RAI 430 — 10.02-9	August 31, 2011
RAI 430 — 10.02-10	August 11, 2011

Sincerely,

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

From: WILLIFORD Dennis (RS/NB)
Sent: Thursday, June 30, 2011 8:31 AM
To: Tesfaye, Getachew
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); KOWALSKI David (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 430, FSARCh. 10, NEW PHASE 4 RAI, Supplement 9

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the three questions in RAI No. 430 on October 14, 2010. Supplement 1 response to RAI No. 430 was sent on November 17, 2010 to provide a revised schedule for Question 10.02-8. Supplement 2 response to RAI No. 430 was sent on December 10, 2010 to provide a revised schedule for Questions 10.02-9 and 10.02-10. Supplement 3, Supplement 4, Supplement 5, Supplement 6 and Supplement 7 responses to RAI No. 430 were sent on December 20, 2010, February 23, 2011, March 24, 2011, April 26, 2011 and May 27, 2011, respectively, to provide a revised schedule for the three questions. Supplement 8 response to RAI No. 430 was sent on June 9, 2011 to provide a technically correct and complete final response to Question 10.02-8.

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

Question #	Response Date
RAI 430 — 10.02-9	**July 28, 2011**
RAI 430 — 10.02-10	**August 11, 2011**

Sincerely,

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

From: WILLIFORD Dennis (RS/NB)
Sent: Thursday, June 09, 2011 8:45 AM
To: 'Tesfaye, Getachew'
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); KOWALSKI David (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 430, FSARCh. 10, NEW PHASE 4 RAI, Supplement 8

Getachew,

AREVA NP Inc. provided a schedule for a technically correct and complete response to the three questions in RAI No. 430 on October 14, 2010. Supplement 1 response to RAI No. 430 was sent on November 17, 2010 to provide a revised schedule for Question 10.02-8. Supplement 2 response to RAI No. 430 was sent on December 10, 2010 to provide a revised schedule for Questions 10.02-9 and 10.02-10. Supplement 3, Supplement 4, Supplement 5, Supplement 6 and Supplement 7 responses to RAI No. 430 were sent on December 20, 2010, February 23, 2011, March 24, 2011, April 26, 2011 and May 27, 2011, respectively, to provide a revised schedule for the three questions.

The attached file, “RAI 430 Supplement 8 Response US EPR DC.pdf” provides a technically correct and complete FINAL response to Question 10.02-8.

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 430 Question 10.02-8.

The following table indicates the respective pages in the response document, “RAI 430 Supplement 8 Response US EPR DC.pdf,” that contain AREVA NP’s response to the subject question.

Question #	Start Page	End Page
RAI 430 — 10.02-8	2	3

The schedule for technically correct and complete responses to the remaining two questions has not changed and is provided below:

Question #	Response Date
RAI 430 — 10.02-9	June 30, 2011
RAI 430 — 10.02-10	June 30, 2011

Sincerely,

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

From: WILLIFORD Dennis (RS/NB)
Sent: Friday, May 27, 2011 11:46 AM
To: 'Tesfaye, Getachew'
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); KOWALSKI David (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 430, FSARCh. 10, NEW PHASE 4 RAI, Supplement 7

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the three questions in RAI No. 430 on October 14, 2010. Supplement 1 response to RAI No. 430 was sent on November 17, 2010 to provide a revised schedule for Question 10.02-8. Supplement 2 response to RAI No. 430 was sent on December 10, 2010 to provide a revised schedule for Questions 10.02-9 and 10.02-10. Supplement 3, Supplement 4, Supplement 5 and Supplement 6 responses to RAI No. 430 were sent on December 20, 2010, February 23, 2011, March 24, 2011 and April 26, 2011, respectively, to provide a revised schedule for the three questions.

The schedule for technically correct and complete responses to the three questions has been changed and is provided below.

Question #	Response Date
RAI 430 — 10.02-8	June 10, 2011

RAI 430 — 10.02-9	June 30, 2011
RAI 430 — 10.02-10	June 30, 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: WELLS Russell (RS/NB)
Sent: Tuesday, April 26, 2011 5:49 PM
To: 'Tesfaye, Getachew'
Cc: KOWALSKI David (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. 430, FSARCh. 10, NEW PHASE 4 RAI, Supplement 6

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the three questions in RAI No. 430 on October 14, 2010. Supplement 1 response to RAI No. 430 was sent on November 17, 2010 to provide a revised schedule for Question 10.02-8. Supplement 2 response to RAI No. 430 was sent on December 10, 2010 to provide a revised schedule for Questions 10.02-9 and 10.02-10. Supplement 3, Supplement 4 and Supplement 5 responses to RAI No. 430 were sent on December 20, 2010, February 23, 2011 and March 24, 2011, respectively, to provide a revised schedule for the three questions.

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

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

Question #	Response Date
RAI 430 — 10.02-8	May 27, 2011
RAI 430 — 10.02-9	May 27, 2011
RAI 430 — 10.02-10	May 27, 2011

Sincerely,

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

Russell.Wells@Areva.com

From: WELLS Russell (RS/NB)
Sent: Thursday, March 24, 2011 1:41 PM
To: 'Tesfaye, Getachew'
Cc: KOWALSKI David (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. 430, FSARCh. 10, NEW PHASE 4 RAI, Supplement 5

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the three questions in RAI No. 430 on October 14, 2010. Supplement 1 response to RAI No. 430 was sent on November 17, 2010 to provide a revised schedule for Question 10.02-8. Supplement 2 response to RAI No. 430 was sent on December 10, 2010 to provide a revised schedule for Questions 10.02-9 and 10.02-10. Supplement 3 and Supplement 4 responses to RAI No. 430 were sent on December 20, 2010 and February 23, 2011, respectively, to provide a revised schedule for the three questions.

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

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

Question #	Response Date
RAI 430 — 10.02-8	April 28, 2011
RAI 430 — 10.02-9	April 28, 2011
RAI 430 — 10.02-10	April 28, 2011

Sincerely,

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

From: WELLS Russell (RS/NB)
Sent: Wednesday, February 23, 2011 4:35 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); BRYAN Martin (External RS/NB); KOWALSKI David (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 430, FSARCh. 10, NEW PHASE 4 RAI, Supplement 4

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the three questions in RAI No. 430 on October 14, 2010. Supplement 1 response to RAI No. 430 was sent on November 17, 2010 to provide a revised schedule for Question 10.02-8. Supplement 2 response to RAI No. 430 was sent on December 10, 2010 to provide a revised schedule for Questions 10.02-9 and 10.02-10. Supplement 3 response to RAI No. 430 was sent on December 20, 2010 to provide a revised schedule for the three questions.

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

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

Question #	Response Date
RAI 430 — 10.02-8	March 25, 2011
RAI 430 — 10.02-9	March 25, 2011
RAI 430 — 10.02-10	March 25, 2011

Sincerely,

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

From: BRYAN Martin (External RS/NB)
Sent: Monday, December 20, 2010 12:16 PM
To: Tesfaye, Getachew
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); KOWALSKI David (RS/NB); Carneal, Jason
Subject: Response to U.S. EPR Design Certification Application RAI No. 430, FSARCh. 10, NEW PHASE 4 RAI, Supplement 3

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the three questions in RAI No. 430 on October 14, 2010. Supplement 1 response to RAI No. 430 was sent on November 17, 2010 to provide a revised schedule for Question 10.02-8. Supplement 2 response to RAI No. 430 was sent on December 10, 2010 to provide a revised schedule.

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

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

Question #	Response Date
RAI 430 — 10.02-8	February 24, 2011
RAI 430 — 10.02-9	February 24, 2011

RAI 430 — 10.02-10	February 24, 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, December 10, 2010 1:24 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); KOWALSKI David (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 430, FSARCh. 10, NEW PHASE 4 RAI, Supplement 2

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the three questions in RAI No. 430 on October 14, 2010. Supplement 1 response to RAI No. 430 was sent on November 17, 2010 to provide a revised schedule for Question 10.02-8.

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

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

Question #	Response Date
RAI 430 — 10.02-8	February 24, 2011
RAI 430 — 10.02-9	December 21, 2010
RAI 430 — 10.02-10	December 21, 2010

Sincerely,

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

From: BRYAN Martin (External RS/NB)
Sent: Wednesday, November 17, 2010 1:55 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); KOWALSKI David (RS/NB); 'Miernicki, Michael'
Subject: Response to U.S. EPR Design Certification Application RAI No. 430, FSARCh. 10, NEW PHASE 4 RAI, Supplement 1

Getachew,

AREVA NP Inc. provided a schedule for technically correct and complete responses to the three questions in RAI No. 430 on October 14, 2010.

Since a response to Question 10.02-8 remains in process, a revised schedule is provided in this email.

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

Question #	Response Date
RAI 430 — 10.02-8	December 10, 2010
RAI 430 — 10.02-9	December 21, 2010
RAI 430 — 10.02-10	December 21, 2010

Sincerely,

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

From: BRYAN Martin (External RS/NB)
Sent: Thursday, October 14, 2010 2:52 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); KOWALSKI David (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 430, FSARCh. 10, NEW PHASE 4 RAI

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 430 Response US EPR DC," provides a schedule since technically correct and complete responses to the three questions are not provided.

The following table indicates the respective pages in the response document, "RAI 430 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 430 — 10.02-8	2	2
RAI 430 — 10.02-9	3	4
RAI 430 — 10.02-10	5	7

The schedule for technically correct and complete responses to these questions is provided below.

Question #	Response Date
RAI 430 — 10.02-8	November 17, 2010
RAI 430 — 10.02-9	December 21, 2010
RAI 430 — 10.02-10	December 21, 2010

Sincerely,

Martin (Marty) C. Bryan

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

From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Tuesday, September 14, 2010 1:37 PM
To: ZZ-DL-A-USEPR-DL
Cc: Reddy, Devender; Lee, Samuel; Segala, John; Hearn, Peter; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 430 (4801), FSARCh. 10, NEW PHASE 4 RAI

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on August 5, 2010, and on September 14, 2010, you informed us that the RAI is clear and no further clarification is needed. As a result, no change is made to the draft RAI. 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: 3324

Mail Envelope Properties (2FBE1051AEB2E748A0F98DF9EEE5A5D482D6CD)

Subject: DRAFT Response to U.S. EPR Design Certification Application RAI No. 430, FSARCh. 10, NEW PHASE 4 RAI, Question 10.02-10
Sent Date: 8/11/2011 12:21:24 PM
Received Date: 8/11/2011 12:22:38 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
"KOWALSKI David (AREVA)" <David.Kowalski@areva.com>
Tracking Status: None
"PATTON Jeff (AREVA)" <Jeff.Patton@areva.com>
Tracking Status: None
"BALLARD Bob (AREVA)" <Robert.Ballard@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	21439	8/11/2011 12:22:38 PM
RAI 430 Response Q.10.02-10 US EPR DC - DRAFT.pdf	1695889	

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

Response to

Request for Additional Information No. 430(4801), DRAFT

Question 10.02-10

9/14/2010

U.S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 10.02 - Turbine Generator
Application Section: 10.2

QUESTIONS for Balance of Plant Branch 1 (SBPA)

Question 10.02-10:

OPEN ITEM
New Phase 4 RAI

SRP Section 10.2, Subsection III, specifies review considerations that pertain to turbine-generator systems. Sufficient information needs to be provided to enable the reviewer to evaluate the turbine-generator system, including subsystems and components, that are considered essential for the safe integrated operation of the facility. Additionally, operating experience insights need to be addressed in accordance with 10 CFR 52.47(a)(22) requirements. The responses that were provided to RAI Numbers 10.2-1 through 10.2-7 and related FSAR markups provided additional information and clarification concerning the design of the turbine generator control and overspeed protection systems. However, the information in the FSAR continues to be incomplete and confusing in some respects. Consequently, additional information is needed and the description in the FSAR needs to be revised accordingly to address the following considerations:

1) Typically, extraction steam non-return isolation valves (NRVs) must be credited to prevent the turbine from exceeding the design overspeed limit of 120 percent of rated speed following a loss of load event (given a single failure and no credit for normal speed control). However, the description does not address this consideration and identify those NRVs that must be credited in this regard, including when they are needed (including locations when two valves are necessary to address single failure considerations) and valve types that are used; the valves interface with the turbine overspeed protection systems; closure times that are necessary (including basis); and the program for these valves to inspect, perform maintenance, and test to ensure adequate performance over the life of the plant. Also, while the closure times are provided for the turbine steam admission valves, the bases for these times are not explained. This information needs to be included in the FSAR.

2) The FSAR needs to explain the confirmation and maintenance of the valve closure times and seat leakage over time for the turbine steam isolation valves (for both the high pressure and intermediate pressure turbines) and for the extraction steam NRVs.

3) The FSAR needs to include a description of the local (at the turbine) and remote (in the control room) manual turbine overspeed trip circuits, including how they interface with the turbine overspeed protection systems and testing that is performed to assure functional capability over the life of the plant.

4) The response to RAI 10.2-6 indicates that the normal turbine generator speed control governor is independent of the turbine overspeed protection systems, but the design is not adequately described in the FSAR. The FSAR needs to include a description of the normal speed control system for the turbine generator, including major components that are included in the design and the system functioning and interfacing with other systems to prevent a turbine trip following a load rejection during full power operation.

5) The response to RAI 10.2-6 establishes COL Information Item 10.2-4 for COL applicants to provide schematic and logic diagrams for the turbine control system. This item was established because the original design included an optional turbine that could be selected by the COL applicants. Because the optional turbine has been eliminated from

the design and the response to RAI 10.2-7 included the necessary figures in a markup of the FSAR, the proposed COL item is no longer necessary and should be eliminated.

6) The response to RAI 10.2-7 included Tier 2 Figures 10.2-2 and 10.2-3 in proposed FSAR markups. However, these figures are incomplete in that they don't indicate if they represent the tripped configuration or the normal operating configuration, and the designations of "E" and "S" on Figure 10.2-3 are not defined. Also, the hydraulic interface with the trip block seems to be a single flow path in some areas which does not satisfy design considerations with respect to independence and redundancy, and small hydraulic flow passages could be subject to flow blockage. Furthermore, the response to RAI 10.2-6 indicates that the trip block dumps hydraulic fluid to a hydraulic tank which causes a low pressure signal to be sent to a safety relay for each turbine steam admission valve actuator. These safety relays cause hydraulic fluid to be dumped from the valve actuators for the turbine steam admission valves resulting in valve closure. From the figure and related description in the FSAR, it is not clear that this is accomplished and in particular, that independence and redundancy is provided by the design in this regard. The FSAR and figures need to be revised to provide a more clear description. Similarly, this sort of information needs to be provided for the extraction steam NRVs that are relied on for preventing turbine overspeed.

7) The orientation of the turbine with respect to safety-related SSCs is discussed in Tier 2 Section 3.5.1.3. However, the orientation of the turbine with respect to SSCs that are important to safety also needs to be described in the FSAR and evaluated by the staff. In particular, the FSAR needs to address the orientation of the turbine with respect to those SSCs identified in the appendix to Regulatory Guide 1.117, "Tornado Design Classification," consistent with the guidance in SRP Section 3.5.1.3 and Regulatory Guide 1.115. Also, to the extent that SSCs important to safety are located within the low-trajectory turbine missile strike zone, justification is needed for considering the turbine to be favorably oriented.

8) The FSAR indicates that the steam admission valves for the high pressure and intermediate pressure turbines and the extraction non-return valves are exercised monthly. However, the review guidance specified in SRP Section 3.5.1.3, Revision 3, under the SRP acceptance criteria listed in Paragraph II, Item 5.C.ii (page 3.5.1.3-8), specifies that this test should be performed weekly and additional information is needed to justify the extended frequency that is proposed for performing this test.

9) The FSAR indicates that the turbine generator primary and backup trip systems are automatically tested on a daily basis while the turbine is operating. A more detailed description is needed to identify the information that is encompassed by the testing that is performed, the status of the overspeed trip systems during the period when testing is being completed, and the requirement that occurs when abnormalities exist and/or are identified. A summary discussion of any diagnostic routines that are routinely performed to assess the status of the turbine generator control and overspeed protection systems also need to be included, along with the frequency of performance and outputs that are generated (this relates to common cause and common mode failure considerations as discussed in RAI 10.2-9).

10) A summary discussion in the FSAR is needed of indication and annunciation that are provided for monitoring the status of the turbine generator and to alert operators to abnormal conditions.

11) A description is needed in the FSAR of the failure modes and effects associated with the turbine overspeed protection systems. For example, Tier 2 Section 10.2.2.10 indicates that a loss of speed signals will result in a turbine trip. However, the FSAR does not discuss the number of speed signals that need to be lost on each trip system before a turbine trip occurs and that the design satisfies single failure considerations in this regard. The description in the FSAR needs to be sufficient to demonstrate that single failure considerations are satisfied and that the design is fail safe.

12) SRP Section 10.2, Revision 3, provides guidance for NRC staff evaluation of turbine generators. Item 3 of the acceptance criteria listed under paragraph II (page 10.2-5) indicates that a failure of the connection joints between the low-pressure turbine exhaust and the main condenser should not adversely impact safety-related equipment. Additional information is needed to address this SRP consideration, and the FSAR needs to be revised accordingly to reflect this information.

Response to Question 10.02-10:

Item (1):

There is an air-assisted steam extraction non-return valve on the extraction lines to high pressure feedwater heater 7, the extraction line to high pressure feedwater heater 6, the extraction lines to low pressure feedwater heater 4 and the extraction line to low pressure feedwater heater 3. There is a non-actuated swing check valve on the extraction line to the deaerating feedwater heater. The steam to the deaerator is from the high pressure turbine exhaust. The reheat stop and intercept valves downstream of each moisture separator reheater preclude an uncontrolled overspeed as a result of steam backflow in this line. The non-actuated check valve in the extraction line to the deaerator prevents water induction to the turbine during startup and shutdown when the deaerator pressure is above the high pressure turbine exhaust pressure. U.S. EPR FSAR Tier 2, Section 10.2.2.1.1 was revised in U.S. EPR FSAR, Revision 3 to include this information.

The valves in the steam extraction lines credited for reduction of speed during a loss of generator load or turbine trip (TT) are air-assisted swing check valves. See the Response to Question 10.02-9, Item (1), for additional details on the air-assisted check valves.

Following a loss of load event, the governor system is designed to limit the turbine speed to 108 percent of nominal speed. The maximum expected overspeed following a full load rejection at valves wide open and assuming governor system failure and an overspeed protection system trip is approximately 117 percent. The air-assisted extraction non-return valves are credited to prevent the turbine from exceeding the design overspeed limit of 120 percent of rated speed.

The extraction non-return valves provide protection of the turbine against steam and water backflow primarily to protect against turbine overspeed. Protection against water backflow also prevents water ingress to the turbine to avoid rapid cooling of the turbine casings. The locations of the extraction non-return valves are in accordance with the requirements of ANSI/ASME TDP-1-1998, Recommended Practices for the Prevention of Water Damage to Steam Turbines.

U.S. EPR FSAR Tier 2, Sections 10.2.2.1.1 and 10.2.5 will be revised to include this information.

U.S. EPR FSAR Tier 2, Section 10.2.2.9 was revised in U.S. EPR FSAR, Revision 3 to include the extraction non-return valves as valves closed in response to an overspeed trip signal.

The steam extraction non-return valves do not directly interface with the turbine overspeed protection systems. The extraction non-return valves receive a signal either directly from the turbine protection system for TT signals, or directly from the non-safety plant control system for non-turbine related issues such as high feedwater heater level.

Closure time for the extraction non-return valves is within one second after a trip signal is received by the air supply solenoid valve. The response time and location of the valves consider the residual steam in the extraction piping between the valve and the turbine. U.S. EPR FSAR Tier 2, Section 10.2.2.1.1 was revised in U.S. EPR FSAR, Revision 3 to include valve closure time.

The main steam stop and control valves, reheat stop and intercept valves, and extraction non-return valves are exercised weekly as described in U.S. EPR FSAR Tier 2, Section 10.2.2.12.

Typical inservice inspections and exercise requirements for the main steam stop and control valves, reheat stop and intercept valves, extraction non-return valves, and the overspeed protection systems are as follows:

At each refueling:

- Test the seat leakage of the main steam stop valves.
- Check the behavior of the valve and actuator assembly of the main steam stop and control valves, and reheat stop and intercept valves: travel time, stroke and stem thrust.
- Perform a functional test of the hydraulic protection circuit.

At intervals of approximately three and one-third years during refueling, one valve of each type is inspected as follows:

- Visual and surface examination of main steam valve seats, stems and internal parts.
- Visual and surface examinations of reheat valve bearings and seals.

During operation:

- Primary and backup overspeed protection systems and hydraulic trip block are tested daily.
- The main steam stop and control valves, reheat stop and control valves and extraction non-return valves are exercised on a weekly basis.

U.S. EPR FSAR Tier 2, Section 10.2.2.12 was revised in U.S. EPR FSAR, Revision 3 to include the above requirements.

The closing times for the main steam stop and control valves, and the reheat stop and intercept valves are based on preventing turbine overspeed following loss of full load. The closing time of

the valves is defined as the time from the signal received by the actuator trigger to the valve closed position indication. Based on fast closing tests results, this time is less than 300 milliseconds, and it includes a 100 millisecond stable period resulting from hydro-mechanical reaction time, before the closing slope is performed in less than 200 milliseconds. Full load rejection simulation, based on conservative assumptions, including a maximum of 300 millisecond closing time for the valves, show that the turbine remains less than 108 percent rated speed.

Item (2):

The rate of seat leakage of the main steam stop valves is tested at each refueling. The valve closure time of the main steam stop and control valves, and the reheat stop and intercept valves are tested at each refueling. U.S. EPR FSAR Tier 2, Section 10.2.2.12 was revised in U.S. EPR FSAR, Revision 3 to include this requirement.

Because the main steam valves are the high pressure valves, they are more prone to erosion of the seats. These valves will also have a higher differential pressure across the valve disc when closed, which makes them more likely to leak when closed. Since the reheat stop valves are subjected to a much lower differential pressure (1089 psia versus 154 psia) across the valve disc, they are less likely to leak. The pressure in the reheat line should rapidly decrease once the main steam to the turbine and moisture separator reheater are isolated, so leakage through the reheat valves will not cause overspeeding the turbine.

The valve closure time of the extraction non-return valves will be tested at the manufacturer's facility. Testing the valve requires a test loop; after installation, it will only close after flow stops or reverses. The actuator is sized in such a way that it can not fully close the valve with normal flow in the extraction line. Periodically exercising the valve will confirm that the valve disc is not stuck in place and will close upon flow reversal. The actual closure time does not depend on the actuator but on the speed that the flow stops and reverses direction.

The extraction non-return valves will be designed to achieve repeated closures without sustaining permanent deformation that would prevent shutoff of steam on reverse flow.

Metal seated check valves that will be used in extraction non-return valve applications are not inherently leak tight. Leakage rates are dependent on the differential pressure across the valve disc and seating surface. Typical leak rates are 10 cubic centimeters of water per hour per inch of valve size. The condition of the valve seats will be checked periodically during outages in accordance with the valve manufacturer's recommendations and lapped, if necessary.

These check valves are characteristically required to stop flow for approximately 30 to 45 seconds, which is the expected time it will take for the motor-operated isolation valve, upstream of the check valve, to close. Seat leakage for the extraction non-return valves is insufficient to cause a turbine overspeed.

Item (3):

There is a hard-wired manual trip button in the main control room (MCR) and a hard-wired manual trip button local to the turbine. The local trip is located close to the front end bearing. The three contacts are directly connected to the trip block channels.

The local and remote manual TT circuits are totally independent of the overspeed protection systems. Figure 10.02-10-1 shows that the local and remote TT circuits do not act on the overspeed protection system channels, but directly on the trip channels.

The manual trip systems will be tested prior to startup after an outage, or if maintenance has been performed on either system.

U.S. EPR FSAR Tier 2, Section 10.2.2.10 was revised in U.S. EPR FSAR, Revision 3 to include additional information on the manual trips and U.S. EPR FSAR Tier 2, Section 10.2.2.12 was revised in U.S. EPR FSAR, Revision 3 to include manual trip test requirements.

In U.S. EPR FSAR, Revision 3, U.S. EPR FSAR Tier 2, Figure 10.2-2 was replaced by Figure 10.02-10-1 shown in this response.

Item (4):

The architecture of the control system is shown in Figure 10.02-10-2. There are two sets of three overspeed protection sensors, one set of three control speed sensors, and one spare speed sensor which is not shown. The two sets of overspeed protection sensors are connected to two separate electronic overspeed protection systems, with no common or shared components and powered by two separate power sources. Each overspeed protection system processes the sensors analog signals in three logic signals for the command of three relays on the three trip channels. These three logic signals are also sent to the triple redundant protection system, which will also order a TT in case of a turbine overspeed.

The three control speed sensors are independent of the overspeed protection systems. The analog signals from these sensors are sent to the two redundant speed governors, located in the turbine generator controls cubicle, and processed to give main steam and reheat control valve position commands. The two-speed governors provide on-line redundancy in a hot standby arrangement.

The redundancy of the speed governors allow for safe valve control. If one speed governor fails, the second speed governor still measures speed and controls the valve position. If both speed governors fail, the triple redundant protection system will order a TT, providing an overall control system that is fail-safe.

The second bullet in U.S. EPR FSAR Tier 2, Section 10.2.2.7 was revised in U.S. EPR FSAR, Revision 3 to state:

> “Automatic controls to rematch the TG loads following a momentary (7 Hz or less) mismatch between generator load and generator power, without the loss of synchronization during load mismatch transients, up to full power.”

The term “fast valving” is vendor specific. Requiring that “automatic controls” perform this function is the FSAR requirement.

U.S. EPR FSAR Tier 2, Section 10.2.2.5 was revised in U.S. EPR FSAR, Revision 3 to include additional information on the turbine normal speed control system. Additionally, requirements for the speed governor system are provided in U.S. EPR FSAR Tier 2, Sections 10.2.2.5, 10.2.2.6 and 10.2.2.7.

Item (5):

Existing COL information item 10.2-4 was deleted in U.S. EPR FSAR, Revision 3. U.S. EPR FSAR Tier 2, Table 1.8-2–U.S. EPR Combined License Information Items and Section 10.2.2.12 were revised in U.S. EPR FSAR, Revision 3 to reflect the deletion of this COL information item.

Item (6):

Figure 10.02-10-3 and U.S. EPR FSAR Tier 2, Figure 10.2-3 both show a “tripped condition.” Normal operation is with all the switches in the closed position. In Figure 10.2-3, “E” represents inlet and “S” represents outlet.

As noted in the Response to Question 10.2-10, Item (3), U.S. EPR FSAR Tier 2, Figure 10.2-2 was replaced by Figure 10.02-10-1 in this response. This schematic also shows the tripped position.

Figure 10.02-10-3 shows a more detailed schematic of the trip block. In U.S. EPR FSAR, Revision 3, U.S. EPR FSAR Tier 2, Figure 10.2-3 was replaced by Figure 10.02-10-3 shown in this response. The solenoid valves are shown in the tripped condition and the plate valves are shown in the normal operating condition. The connection letters in the figure represent the following:

Y = Fluid drain to the control fluid tank from the solenoid valves.

P = Fluid to the trip block from the control fluid pump discharge header.

T1 = Fluid drain to the control fluid tank from the plate valves.

S1 = Fluid to the main steam and reheat valve actuators.

As shown in Figure 10.02-10-3, there are three separate flow channels between the solenoid valves and plate valves. There is a common inlet header and common outlet header. See the Response to Question 10.02-9, Item (1) and Item (4). The design of the control fluid system with respect to materials of construction, fluid filters and fluid conditioning will minimize any plugging of the system flow channels. The solenoid valves and plate valves are tested daily, which also provides an indication of problems with the valves or plugging of the flow channels.

When the trip block dumps the hydraulic fluid to the control fluid tank, low pressure occurs in the control fluid supply line to the main steam and reheat valves. Low pressure in the fluid supply line causes the exhaust valve on each actuator to trip and exhaust the fluid from the operating piston chamber of the actuator to the fluid drain line manifold and to the control fluid tank. Pressure in the operating piston chamber rapidly reduces to atmospheric and the valves close by spring action.

See the Response to Question 10.2-9, Item (1). The trip solenoid valve on each extraction non-return valve actuator receives a trip signal from either the turbine control system or the plant non-safety control system. This causes the trip solenoid to move to the exhaust position and stop the supply of instrument air to the valve actuator. Loss of pressure in the supply line causes the quick exhaust valve to open and rapidly exhaust air from the operating piston

chamber of the actuator, which causes the valve actuator to move to the closed position by spring action. The check valve and the trip solenoid valve are exercised periodically in accordance with the turbine manufacturer's and valve manufacturer's requirements. Movement of the check valve shaft during these tests will show the valve disc is not stuck in the open position.

The trip solenoid valves will send the valve actuator to the closed position on loss of power. The non-return valve will close upon reversal of extraction steam flow.

U.S. EPR FSAR Tier 2, Sections 10.2.2.1.1 and 10.2.2.9 were revised in U.S. EPR FSAR, Revision 3 to reflect this information.

Item (7):

The orientation of the turbine is discussed in U.S. EPR FSAR Tier 2, Section 3.5.1.3. This section identifies any structures, systems and components located inside the turbine low-trajectory zone, as defined by RG 1.115, and provides justification for the favorable orientation. U.S. EPR FSAR Tier 2, Table 3.2.2-1–Classification Summary provides the seismic and other design classifications for the applicable components.

U.S. EPR FSAR Tier 2, Section 3.5.2 states that structures used to protect safety-related structures, systems and components meet the requirements of RG 1.115 (turbine-generated) and RG 1.117 (tornado-generated) for externally generated missiles.

Item (8):

Acceptance criteria for SRP Section 3.5.1.3 specify that the main steam control and stop valves, reheat intercept and stop valves, and steam extraction non-return valves should be exercised weekly. Acceptance criteria Item 2.B of SRP, Section 10.2 specifies that main steam stop and control valves should be exercised at a frequency recommended by the turbine vendor or valve manufacturer.

U.S. EPR FSAR Tier 2, Section 10.2.2.12 was revised in U.S. EPR FSAR, Revision 3 to change the requirement for testing of the valves from monthly to weekly. A COL applicant may propose a frequency based on the selected turbine vendor's recommendations, consistent with the guidance in SRP 10.2.

Item (9):

The detailed test procedures performed on the turbine protection system and turbine governing system will be identified by the site specific turbine manufacturer selected by the COL applicant.

The three overspeed protection channels are tested individually on a daily basis. The two remaining channels are operational for turbine overspeed protection during the daily test. A trip signal from one of the operational protection channels during a channel test will cause the turbine to trip.

During the test of a protection channel the following occurs:

- The channel overspeed card artificially increases the channel turbine speed.

- An alarm is displayed that states the channel is tripped.
- The solenoid valve is de-energized, which opens the plate valves.

If the solenoid valve or plate valves do not function correctly, an alarm is generated. The procedure is then repeated for the remaining two channels.

Periodic tests performed on the turbine protection system and turbine governing system are shown in Table 10.02-10-1. System configuration is that turbine protection system and turbine governing system are fully operational.

Development of test procedures for testing the TG governor and overspeed protection systems are the responsibility of the COL applicant as indicated in U.S. EPR FSAR Tier 2, Section 13.5 and U.S. EPR FSAR Tier 2, Table 1.8-2, COL Information Item Number 13.5-1.

Item (10):

Measurements important to the protection and proper operation of the TG are monitored and displayed as an alarm in the MCR when the first threshold is passed (such as high or low level). If the second threshold is passed (such as high-high or low-low level), it leads to a TT. Measurement single failures (one out of three measurement disturbance or drifting) are communicated to the operator through an alarm sheet (control fluid pressure, lube oil supply pressure, drain tank levels, condenser vacuum, and overspeed). If two out of three measurements fail, it leads to a TT. The operator is informed of any anomaly and has access to the corresponding alarm sheet in order to identify the failure location.

Measurements not important to the protection and proper operation of the TG are also monitored. A measurement single failure will be displayed in the information display. If two out of three measurements fail, the last valid value is kept and failure traced by the alarm sheet. The operator is informed of any anomaly and has access to the corresponding alarm sheet in order to identify the failure location.

U.S. EPR FSAR Tier 2, Section 10.2.2.10 was revised in U.S. EPR FSAR, Revision 3 to include this information.

Item (11):

The trip matrix with quantity of failed components necessary for trip activation is shown in Table 10.02-10-2. This matrix shows the consequences of the loss of speed signals and demonstrates that the system is single-failure fault tolerant (no one out of two or one out of three will cause a TT).

See the Response to Question 10.02-9, Item (1). The primary and backup overspeed protection systems are separate redundant systems, with no common components or software. The trip block is three channels with three solenoid valves and six plate valves. Design of the control fluid system includes filters, fluid regeneration, a desiccant dryer and stainless steel components and piping to minimize the chance of plugging of the piping. The overspeed protection system will trip the turbine upon loss of hydraulic fluid or power.

See the Response to Question 10.02-10, Item (6). The trip solenoid valve supplying instrument air to the extraction non-return valve actuator will move the valve actuator to the closed position upon loss of instrument air or power.

Each overspeed protection system and the trip block are tested daily. The solenoid valves on the main steam stop and control valves, the reheat stop and control valves, and the non-return extraction valves are tested when the main valves are stroked periodically in accordance with the turbine manufacturer's recommendations.

U.S. EPR FSAR Tier 2, Sections 10.2.2.5 and 10.2.2.10 were revised in U.S. EPR FSAR, Revision 3 to add information on the number of speed sensors and number of speed signals that need to be lost before the turbine is tripped.

Item (12):

U.S. EPR FSAR Tier 2, Section 10.2.2.1.1 states that the condenser is welded to each low pressure turbine outer casing. U.S. EPR FSAR Tier 2, Section 10.4.1.3 states that the condenser is in the turbine building and there is no safety-related equipment located in the turbine building. A failure of the welded connection between the turbine and the condenser will not adversely impact the performance of any safety-related system or component.

FSAR Impact:

U.S. EPR FSAR Tier 2, Sections 10.2.2.1.1 and 10.2.5 will be revised as described in the response and indicated on the enclosed markup.

Table 10.02-10-1
Typical Tests Performed on Turbine Protection and Turbine Governing System

(2 Sheets)

Test	Purpose	Criteria	Periodicity
Tightness Test	To check the tightness of the main steam stop valves.	The turbine speed has to be lower than 5% nominal speed 30 min after the main steam control valves and the reheat control valves are all full open.	Fuel cycle.
Valve Tests	To check the correct operation of the main steam stop and control valves, reheat stop and control valves and steam extraction non-return valves, while the turbine is on-load operation.	Each turbine admission steam chest test has to be “successful.”	Weekly.
Real Overspeed Test	To check that the turbine and the three turbine protection channels trip when the turbine speed is 110%.	The turbine and the three turbine protection channels have tripped at 110% nominal speed.	Fuel cycle.
Overspeed Safety Test	To check that the turbine protection channel 1 trips when the channel 1 overspeed card artificially increases the channel 1 turbine speed. The same test is carried out on the turbine protection channels 2 and 3 in turn.	Each channel test has to be “successful.”	Daily.
Turbine Safety Channels Test	To check that the turbine protection channel 1 trips when the channel 1 turbine generator controls trip logic is activated. The same test is carried out on the turbine protection channels 2 and 3 in turn.	Each channel test has to be “successful.”	Weekly.
Other Protection Test	This test is carried out during turbine operation. The frequency is specified in U.S. EPR FSAR Chapter 16 Technical Specifications. It allows transmission of the TT signals between the reactor protection system and the turbine control system. Each of the four channels of the reactor protection system is tested.	Each channel test has to be “successful.”	24 months.

Table 10.02-10-1
Typical Tests Performed on Turbine Protection and Turbine Governing System

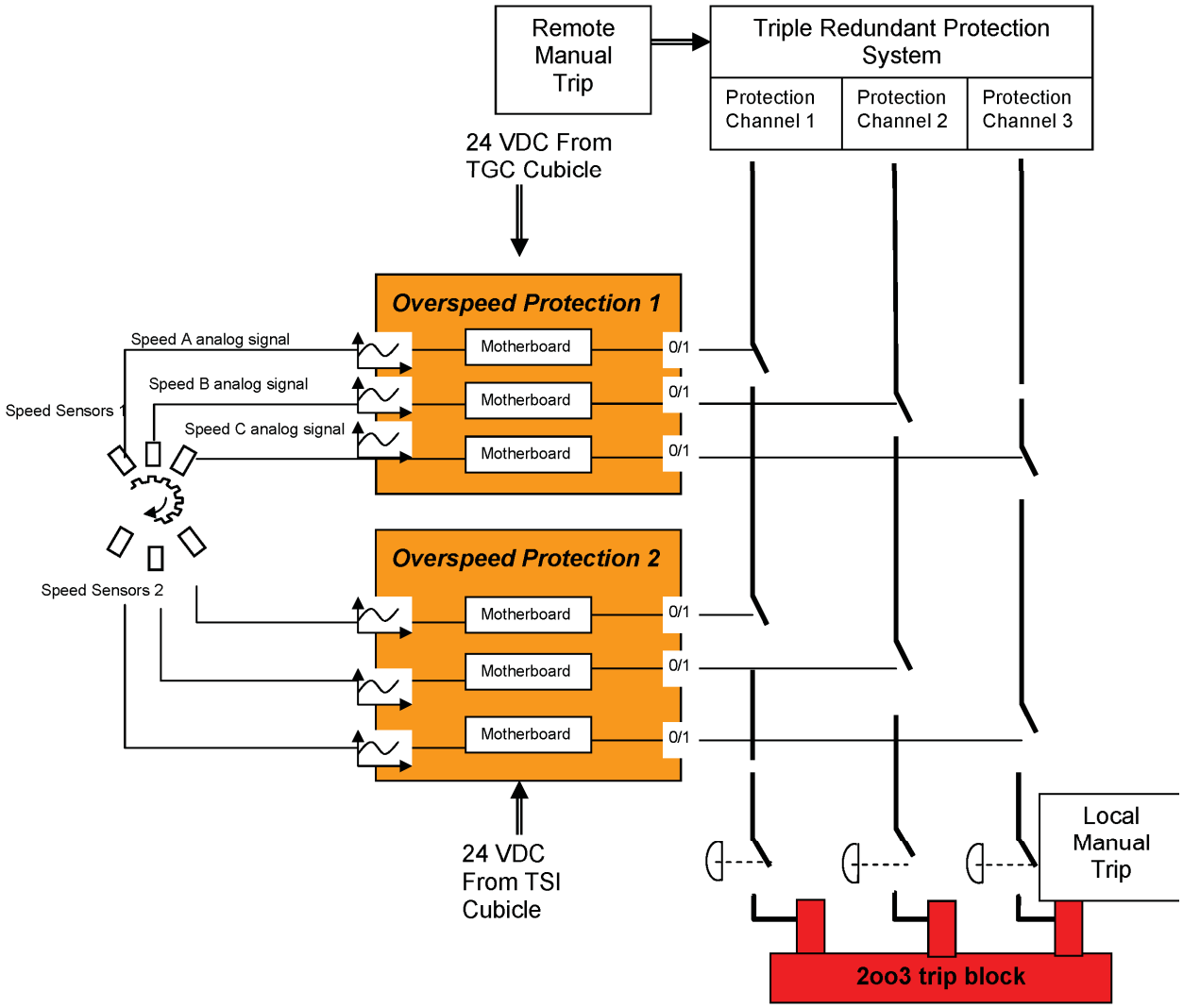
(2 Sheets)

Test	Purpose	Criteria	Periodicity
Trip Pushbuttons Test	To check that the turbine protection channels 1, 2 and 3 trip when the local or backup emergency control panel trip pushbutton has been triggered manually.	The turbine and the three turbine protection channels have tripped when the local or remote trip pushbutton has been triggered manually.	Fuel cycle.
DCS Trains A&B Trip Test	To check that the turbine protection signals from the non-safety plant control system (Train A and Train B) to the turbine control system. This test is carried out once a week during turbine operation.	Each test has to be successful.	Weekly.

Table 10.02-10-2—Trip Matrix

System	Alarm	Trip
Control Speed Sensors	One out of three or two out of three	Three out of three
Overspeed Sensors	One out of three	Two out of three or three out of three
Speed Governor	One out of two	Two out of two
Trip Channel	One out of three	Two out of three

Figure 10.02-10-1—Overspeed Protection System Schematic



Shown in the tripped condition.

Figure 10.02-10-2
Control System Architecture and Interface Chart

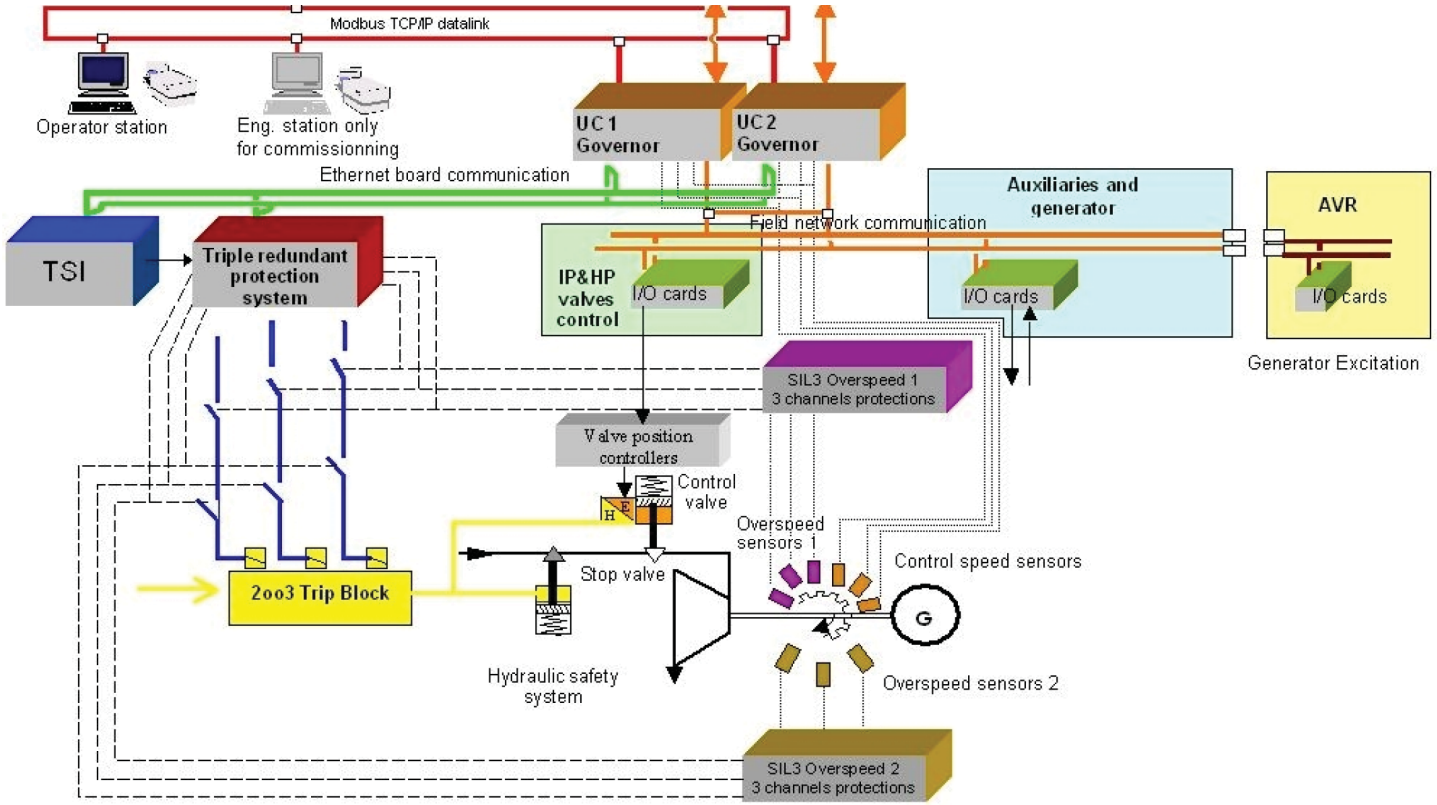
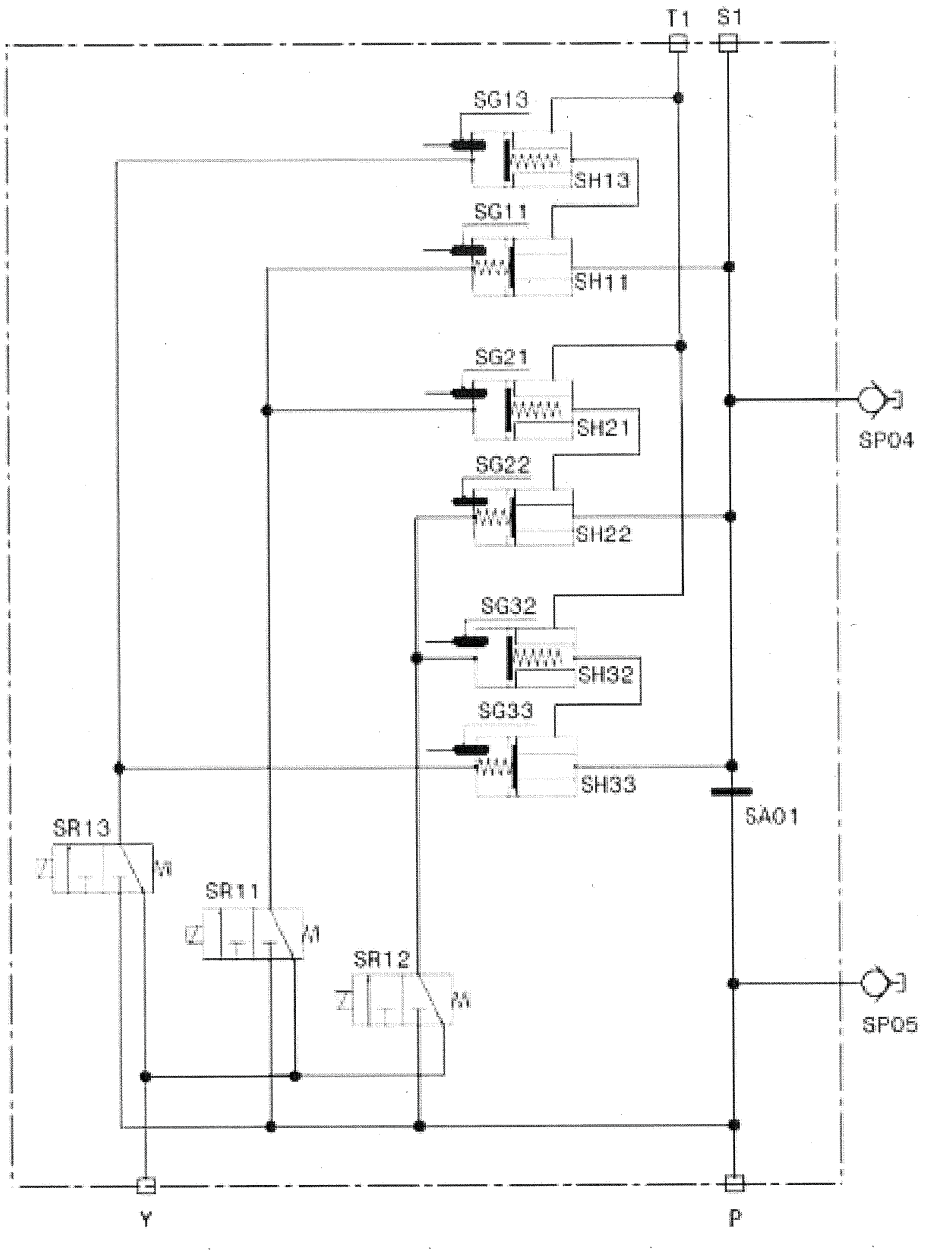


Figure 10.02-10-3
Turbine Trip Block Schematic



Solenoid valves are shown in the tripped condition. Plate valves are shown in the normal operating position.

Y = Fluid drain to the control fluid tank from the solenoid valves.

P = Fluid to the trip block from the control fluid pump discharge header.

T1 = Fluid drain to the control fluid tank from the plate valves.

S1 = Fluid to the main steam and reheat valve actuators.

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- Control fluid reservoir includes an inlet breather desiccant filter to minimize the amount of moisture entering the reservoir.

RAI 430, Question 10.02-10

Extraction Non-Return Valves

Non-return valves are used in selected turbine steam extraction lines to minimize the potential for turbine overspeed and prevent water induction into the turbine. The number of valves, type of valve, and maximum steam volume allowable between the valve and turbine extraction nozzle will be in accordance with the turbine manufacturer's requirements and the requirements of ANSI/ASME TDP-1-1998 (Reference 12).

Two types of non-return valves are provided:

- Air-assisted swing check valve with piston actuator, air-to-open, spring-to-close type are used on the high pressure extraction lines to feedwater heaters 6 and 7, and on the intermediate extraction lines to feedwater heaters 3 and 4 to prevent turbine overspeed .

- Swing check valve without actuator type is used on the extraction line to the deaerating feedwater heater to prevent water induction into the turbine.

Non-return valves are not required for the extraction steam lines to feedwater heaters 1 and 2 because of the low pressure in these heaters.

The air-assisted check valves are held open with instrument air and the valve can operate as a non-actuated swing check valve. The actuator will return to the closed position when a trip signal is received by the solenoid valve used to supply air to the actuator. The solenoid valve shifts to the exhaust position causing a loss of inlet pressure on the quick exhaust valve. Loss of inlet pressure causes the quick exhaust valve to rapidly vent the actuator piston chamber allowing the actuator spring to rotate the valve shaft and push the valve disc into the flow stream. Closure time of the non-return valve is within one second after the solenoid valve receives a trip signal. A test switch on the solenoid valve allows both the check valve and the solenoid valve to be periodically exercised. Loss of air supply or power to the extraction non-return valve actuator will cause the actuator to move to the close position under spring force.

Generator

The generator is a four-pole machine directly driven by the turbine and supplies the step-up transformer with high voltage electrical output. The field winding is directly cooled by hydrogen gas. The stator winding is directly cooled by an internal circulation of de-ionized water (stator cooling water). The generator static excitation system is controlled by an automatic voltage regulator. The generator rotor is made from a solid alloy steel forging with high tensile strength. The slots for the field coils are milled in the central body of the rotor.

- Manual trip button located in the main control room and manual trip button local to the turbine.

A protective trip system is provided to quickly close the main steam stop and control valves, the reheat stop and intercept valves, and the steam extraction non-return valves in the event of an unsafe condition or to provide overspeed protection. The system is designed to minimize false and spurious trips during normal operation and allow testing of the trip system during operation. A power load imbalance function is provided, which compares turbine and generator load and initiates an appropriate momentary control valve closure when the turbine load exceeds the generator load by a specified amount.

The steam turbine has two redundant and diverse electrical overspeed systems that meet the single failure criterion. The two overspeed protection systems are redundant from the speed probes to the turbine trip relays. Both overspeed protection systems have three independent speed probes and processing modules acting on one of three electronic tripping channels. Each independent electrical overspeed trip system is designed and manufactured by a different vendor. Each vendor directly manufactures their system components (e.g., motherboards, sensors) and develops diverse software to transform the analog speed sensor signal into a digital signal. Software between the two overspeed protection systems will be different in parameters, dynamics, or logic. There are no components, process inputs, or process outputs shared between the two systems. Each system will be installed in a separate cubicle with separate power sources. Figure 10.2-2—Overspeed Protection System Schematic shows the separate source of power supply to each system and how the sensors are treated by independent motherboards.

The two overspeed protection systems each have three separate electronic boards for signal conversion, processing and activation of an overspeed trip. Digital trip output signals for the overspeed trip will interrupt the power of separate relays as shown in Figure 10.2-2. The trip signals from the two overspeed protection systems are isolated from and independent of each other.

The electrical system has a minimum Safety Integrity Level rating of 3, in accordance with IEC 61508-1, "Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems~~,~~" (Reference 13).

RAI 430, Question 10.02-10

The trip block provides an interface between the electrical and hydraulic systems and consists of three trip solenoid valves. The three independent electronic channels energize three fail safe solenoid valves (trip by loss of power). Each solenoid valve acts on two hydraulic relays of the trip block in order to perform the hydraulic two-out-of-three trip voting. The turbine will be tripped when a least two solenoid valves are de-energized. An interruption and discharge of the fluid supply by the trip block will cause the high pressure and intermediate pressure valves to close by spring action.

6. F. J. Witt and T. R. Mager, "Procedure for Determining Bounding Values on Fracture Toughness K_{Ic} at any Temperature," ORNL-TM-3894, Oak Ridge National Laboratory, 1972.

7. ASME Boiler and Pressure Vessel Code, Section III: "Rules for Construction of Nuclear Facility Components," The American Society of Mechanical Engineers, 2004.

8. ASME Boiler and Pressure Vessel Code, Section V: "Nondestructive Examination," The American Society of Mechanical Engineers, 2004.

9. ASTM A370-05, "Standard Test Methods and Definition for Mechanical Testing of Steel Products," American Society for Testing and Materials, 2005.

10. ASME Boiler and Pressure Vessel Code, Section III: "Rules for Construction of Nuclear Facility Components," Subsection NB-5300 Acceptance Standards, The American Society of Mechanical Engineers, 2004.

11. ASTM A470-05, "Standard Specification for Vacuum-Treated Carbon and Alloy Steel Forgings for Turbine Rotors and Shafts," American Society for Testing and Materials, 2005.

12. ANSI/ASME TDP-1-1998, "Recommended Practices for the Prevention of Water Damage to Steam Turbines Used for Electric Power Generation," American National Standards Institute/ The American Society of Mechanical Engineers (1998).

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