ArevaEPRDCPEm Resource

From:	WELLS Russell (AREVA) [Russell.Wells@areva.com]
Sent:	Wednesday, May 18, 2011 3:13 PM
To:	Tesfaye, Getachew
Cc:	GUCWA Len (EXTERNAL AREVA); WILLIFORD Dennis (AREVA); BENNETT Kathy (AREVA); DELANO Karen (AREVA); ROMINE Judy (AREVA); RYAN Tom (AREVA)
Subject:	Response to U.S. EPR Design Certification Application RAI No. 221, FSAR Ch 6, Supplement 15
Attachments:	RAI 221 Supplement 15 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 3 of the 32 questions of RAI 221 on June 17, 2009. Supplement 1 response to RAI 221 was sent on July 31, 2009 to address 4 of the remaining 29 questions. Supplement 2 response to RAI 221 was sent on August 27, 2009 to address 8 of the remaining 25 questions. Supplement 3 response to RAI 221 was sent on September 30, 2009 to address 3 of the remaining 17 questions. Supplement 4 response to RAI 221 was sent on December 18, 2009 to address 10 of the remaining 14 questions. AREVA NP submitted Supplement 5 response to RAI 221 on February 25, 2010, to address 1 of the remaining 4 questions. AREVA NP submitted Supplement 6 and Supplement 7 on May 25, 2010 and July 7, 2010, respectively, to provide revised response schedules. AREVA NP submitted Supplement 8 response to RAI 221 on July 20, 2010 to address 2 of the 3 remaining questions. AREVA NP submitted Supplements 9, 10 and 11 on August 16, 2010, October 6, 2010 and November 2, 2010, respectively, to provide a revised response schedule for Question 06.02.01-24. Supplement 12 response to RAI 221 was submitted on November 23, 2010 to provide a revised response schedule for Question 06.02.01-24. Supplement 13 and Supplement 14 responses to RAI 221 were submitted on March 16, 2011 and April 13, 2011, respectively, to provide a revised response for Question 06.02.01-16 and Question 06.02.01-24.

The attached file, “RAI 221 Supplement 15 Response US EPR DC.pdf,” provides a technically correct and complete response to the 2 remaining questions. Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 221 Questions 06.02.01-16 and 06.02.01-24.

The following table indicates the respective pages in the response document “RAI 221 Supplement 15 Response US EPR DC.pdf,” that contain AREVA NP’s response to the subject questions.

Question #	Start Page	End Page
RAI 221 — 06.02.01-16	2	2
RAI 221 — 06.02.01-24	3	3

This concludes the formal AREVA NP response to RAI 221, and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

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

From: WELLS Russell (RS/NB)
Sent: Wednesday, April 13, 2011 5:09 PM
To: 'Tesfaye, Getachew'
Cc: GUCWA Len (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. 221, FSAR Ch 6, Supplement 14

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 3 of the 32 questions of RAI 221 on June 17, 2009. Supplement 1 response to RAI 221 was sent on July 31, 2009 to address 4 of the remaining 29 questions. Supplement 2 response to RAI 221 was sent on August 27, 2009 to address 8 of the remaining 25 questions. Supplement 3 response to RAI 221 was sent on September 30, 2009 to address 3 of the remaining 17 questions. Supplement 4 response to RAI 221 was sent on December 18, 2009 to address 10 of the remaining 14 questions. AREVA NP submitted Supplement 5 response to RAI 221 on February 25, 2010, to address 1 of the remaining 4 questions. AREVA NP submitted Supplement 6 and Supplement 7 on May 25, 2010 and July 7, 2010, respectively, to provide revised response schedules. AREVA NP submitted Supplement 8 response to RAI 221 on July 20, 2010 to address 2 of the 3 remaining questions. AREVA NP submitted Supplements 9, 10 and 11 on August 16, 2010, October 6, 2010 and November 2, 2010, respectively, to provide a revised response schedule for Question 06.02.01-24. Supplement 12 response to RAI 221 was submitted on November 23, 2010 to provide a revised response schedule for Question 06.02.01-24. Supplement 13 response to RAI 221 was submitted on March 16, 2011 to provide a revised response to Question 06.02.01-16 and Question 06.02.01-24.

To provide an opportunity to interact with the NRC staff on the responses to Question 06.02.01-16 and Question 06.02.01-24, the schedule for technically correct and complete responses is changed and is also provided below.

Question #	Response Date
RAI 221 — 06.02.01-16	May 18, 2011
RAI 221 — 06.02.01-24	May 18, 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, March 16, 2011 4:00 PM
To: 'Tesfaye, Getachew'
Cc: GUCWA Len (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. 221, FSAR Ch 6, Supplement 13

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 3 of the 32 questions of RAI 221 on June 17, 2009. Supplement 1 response to RAI 221 was sent on July 31, 2009 to address 4 of the remaining 29 questions. Supplement 2 response to RAI 221 was sent on August 27, 2009 to address 8 of the remaining 25 questions. Supplement 3 response to RAI 221 was sent on September 30, 2009 to address 3 of the remaining 17 questions. Supplement 4 response to RAI 221 was sent on December 18, 2009 to address 10 of the remaining 14 questions. AREVA NP submitted Supplement 5 response to RAI 221 on February 25, 2010, to address 1 of the remaining 4 questions. AREVA NP submitted Supplement 6 and Supplement 7 on May 25, 2010 and July 7, 2010, respectively, to provide revised response schedules. AREVA NP submitted Supplement 8 response to RAI 221 on July 20, 2010 to address 2 of the 3 remaining questions. AREVA NP submitted Supplements 9, 10 and 11 on August 16, 2010, October 6, 2010 and November 2, 2010, respectively, to provide a revised response schedule for Question 06.02.01-24. Supplement 12 response to RAI 221 was submitted on November 23, 2010 to provide a revised response schedule for Question 06.02.01-24.

As discussed during a recent audit, the response to Question 06.02.01-16 is being changed and a schedule for providing a revised response if provided below. In addition, to provide an opportunity to interact with the NRC staff on the response to Question 06.02.01-24, the schedule for a technically correct and complete response to that question is changed and is also provided below.

Question #	Response Date
RAI 221 — 06.02.01-16	April 14, 2011
RAI 221 — 06.02.01-24	April 14, 2011

Sincerely,

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

From: BRYAN Martin (External RS/NB)
Sent: Tuesday, November 23, 2010 12:13 PM
To: Tesfaye, Getachew
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); GUCWA Len (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 221, FSAR Ch 6, Supplement 12

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 3 of the 32 questions of RAI 221 on June 17, 2009. Supplement 1 response to RAI 221 was sent on July 31, 2009 to address 4 of the remaining 29 questions. Supplement 2 response to RAI 221 was sent on August 27, 2009 to address 8 of the remaining 25 questions. Supplement 3 response to RAI 221 was sent on September 30, 2009 to address 3 of the remaining 17 questions. Supplement 4 response to RAI 221 was sent on December 18, 2009 to address 10 of the

remaining 14 questions. AREVA NP submitted Supplement 5 response to RAI 221 on February 25, 2010, to address 1 of the remaining 4 questions. AREVA NP submitted Supplement 6 and Supplement 7 on May 25, 2010 and July 7, 2010, respectively, to provide revised response schedules. AREVA NP submitted Supplement 8 response to RAI 221 on July 20, 2010 to address 2 of the 3 remaining questions. AREVA NP submitted Supplements 9, 10 and 11 on August 16, 2010, October 6, 2010 and November 2, 2010, respectively, to provide a revised response schedule for Question 06.02.01-24.

To provide an opportunity to interact with the NRC staff on the response, the schedule for a technically correct and complete response to the remaining RAI 221 question is changed and is provided below.

Question #	Response Date
RAI 221 — 06.02.01-24	March 16, 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: Tuesday, November 02, 2010 10:13 AM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); GUCWA Len (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 221, FSAR Ch 6, Supplement 11

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 3 of the 32 questions of RAI 221 on June 17, 2009. Supplement 1 response to RAI 221 was sent on July 31, 2009 to address 4 of the remaining 29 questions. Supplement 2 response to RAI 221 was sent on August 27, 2009 to address 8 of the remaining 25 questions. Supplement 3 response to RAI 221 was sent on September 30, 2009 to address 3 of the remaining 17 questions. Supplement 4 response to RAI 221 was sent on December 18, 2009 to address 10 of the remaining 14 questions. AREVA NP submitted Supplement 5 response to RAI 221 on February 25, 2010, to address 1 of the remaining 4 questions. AREVA NP submitted Supplement 6 and Supplement 7 on May 25, 2010 and July 7, 2010, respectively, to provide revised response schedules. AREVA NP submitted Supplement 8 response to RAI 221 on July 20, 2010 to address 2 of the 3 remaining questions. AREVA NP submitted Supplement 9 on August 16, 2010 and Supplement 10 on October 6, 2010 to provide a revised response schedule for Question 06.02.01-24.

To provide an opportunity to interact with the NRC staff on the response, the schedule for a technically correct and complete response to the remaining RAI 221 question is changed and is provided below.

Question #	Response Date
RAI 221 — 06.02.01-24	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: BRYAN Martin (External RS/NB)
Sent: Wednesday, October 06, 2010 8:45 AM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); GUCWA Len (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 221, FSAR Ch 6, Supplement 10

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 3 of the 32 questions of RAI 221 on June 17, 2009. Supplement 1 response to RAI 221 was sent on July 31, 2009 to address 4 of the remaining 29 questions. Supplement 2 response to RAI 221 was sent on August 27, 2009 to address 8 of the remaining 25 questions. Supplement 3 response to RAI 221 was sent on September 30, 2009 to address 3 of the remaining 17 questions. Supplement 4 response to RAI 221 was sent on December 18, 2009 to address 10 of the remaining 14 questions. AREVA NP submitted Supplement 5 response to RAI 221 on February 25, 2010, to address 1 of the remaining 4 questions. AREVA NP submitted Supplement 6 and Supplement 7 on May 25, 2010 and July 7, 2010, respectively, to provide revised response schedules. AREVA NP submitted Supplement 8 response to RAI 221 on July 20, 2010 to address 2 of the 3 remaining questions. AREVA NP submitted Supplement 9 on August 16, 2010 to provide a revised response schedule for Question 06.02.01-24.

To provide an opportunity to interact with the NRC staff on the response, the schedule for a technically correct and complete response to the remaining RAI 221 question is changed and is provided below.

Question #	Response Date
RAI 221 — 06.02.01-24	November 3, 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: Monday, August 16, 2010 2:47 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); GUCWA Len (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 221, FSAR Ch 6, Supplement 9

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 3 of the 32 questions of RAI No. 221 on June 17, 2009. Supplement 1 response to RAI No. 221 was sent on July 31, 2009 to address 4 of the remaining 29 questions.

Supplement 2 response to RAI No. 221 was sent on August 27, 2009 to address 8 of the remaining 25 questions. Supplement 3 response to RAI No. 221 was sent on September 30, 2009 to address 3 of the remaining 17 questions. Supplement 4 response to RAI No. 221 was sent on December 18, 2009 to address 10 of the remaining 14 questions. AREVA NP submitted Supplement 5 to the response on February 25, 2010, to address 1 of the remaining 4 questions. AREVA NP submitted Supplement 6 on May 25, 2010, to provide a revised response schedule. To provide an opportunity to interact with the NRC staff on the response, on July 7, 2010, AREVA NP provided a revised response date for Questions 06.02.01-22 and 06.02.01-23. On July 20, 2010, AREVA NP provided a technically correct and complete response to these 2 questions.

The schedule for a technically correct and complete response to the remaining RAI 221 question is changed and is provided below.

Question #	Response Date
RAI 221 — 06.02.01-24	October 07, 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 (EXT)
Sent: Tuesday, July 20, 2010 3:51 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); GUCWA Len T (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 221, FSAR Ch 6, Supplement 8

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 3 of the 32 questions of RAI No. 221 on June 17, 2009. Supplement 1 response to RAI No. 221 was sent on July 31, 2009 to address 4 of the remaining 29 questions. Supplement 2 response to RAI No. 221 was sent on August 27, 2009 to address 8 of the remaining 25 questions. Supplement 3 response to RAI No. 221 was sent on September 30, 2009 to address 3 of the remaining 17 questions. Supplement 4 response to RAI No. 221 was sent on December 18, 2009 to address 10 of the remaining 14 questions. AREVA NP submitted Supplement 5 to the response on February 25, 2010, to address 1 of the remaining 4 questions. AREVA NP submitted Supplement 6 on May 25, 2010, to provide a revised response schedule. To provide an opportunity to interact with the NRC staff on the response, on July 7, 2010, AREVA NP provided a revised response date for Questions 06.02.01-22 and 06.02.01-23.

The attached file, "RAI 221 Supplement 8 Response US EPR DC.pdf," provides a technically correct and complete response to 2 of the 3 remaining questions. The following table indicates the respective pages in the response document "RAI 221 Supplement 8 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 221 — 06.02.01-22	2	2
RAI 221 — 06.02.01-23	3	4

The schedule for a technically correct and complete response to the remaining RAI 221 question is unchanged and is provided below.

Question #	Response Date
RAI 221 — 06.02.01-24	August 18, 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 (EXT)
Sent: Wednesday, July 07, 2010 5:37 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); GUCWA Len T (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 221, FSAR Ch 6, Supplement 7

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 3 of the 32 questions of RAI No. 221 on June 17, 2009. Supplement 1 response to RAI No. 221 was sent on July 31, 2009 to address 4 of the remaining 29 questions. Supplement 2 response to RAI No. 221 was sent on August 27, 2009 to address 8 of the remaining 25 questions. Supplement 3 response to RAI No. 221 was sent on September 30, 2009 to address 3 of the remaining 17 questions. Supplement 4 response to RAI No. 221 was sent on December 18, 2009 to address 10 of the remaining 14 questions. AREVA NP submitted Supplement 5 to the response on February 25, 2010 and supplement 6 on May 25, 2010 to provide a revised response schedule. To provide an opportunity to interact with the NRC on the response, a revised date is provided below for questions 06.02.01-22 and 23.

Question #	Response Date
RAI 221 — 06.02.01-22	August 11, 2010
RAI 221 — 06.02.01-23	August 11, 2010
RAI 221 — 06.02.01-24	August 18, 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 (EXT)
Sent: Tuesday, May 25, 2010 3:36 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); GUCWA Len T (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 221, FSAR Ch 6, Supplement 6

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 3 of the 32 questions of RAI No. 221 on June 17, 2009. Supplement 1 response to RAI No. 221 was sent on July 31, 2009 to address 4 of the remaining 29 questions. Supplement 2 response to RAI No. 221 was sent on August 27, 2009 to address 8 of the remaining 25 questions. Supplement 3 response to RAI No. 221 was sent on September 30, 2009 to address 3 of the remaining 17 questions. Supplement 4 response to RAI No. 221 was sent on December 18, 2009 to address 10 of the remaining 14 questions. AREVA NP submitted Supplement 5 to the response on February 25, 2010 to provide a revised response schedule.

The responses to the 3 remaining RAI 221 questions are primarily dependent upon ongoing containment pressure analyses and component evaluations. Because of these ongoing activities, AREVA NP is not providing a response to the 3 remaining questions at this time. The revised schedule for technically correct and complete responses is provided below. The bases for the schedule change were discussed with NRC staff during a telecon held on May 24, 2010.

Question #	Response Date
RAI 221 — 06.02.01-22	July 7, 2010
RAI 221 — 06.02.01-23	July 7, 2010
RAI 221 — 06.02.01-24	August 18, 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: DUNCAN Leslie E (AREVA NP INC)
Sent: Thursday, February 25, 2010 10:36 AM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); ROMINE Judy (AREVA NP INC); BRYAN Martin (EXT); GUCWA Len T (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 221, FSAR Ch 6, Supplement 5

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 3 of the 32 questions of RAI No. 221 on June 17, 2009. Supplement 1 response to RAI No. 221 was sent on July 31, 2009 to address 4 of the remaining 29 questions. Supplement 2 response to RAI No. 221 was sent on August 27, 2009 to address 8 of the remaining 25 questions. Supplement 3 response to RAI No. 221 was sent on September 30, 2009 to address 3 of the remaining 17 questions. Supplement 4 response to RAI No. 221 was sent on December 18, 2009 to address 10 of the remaining 14 questions. The attached file, “RAI 221 Supplement 5 Response US EPR DC.pdf,” provides a technically correct and complete response to 1 of the 4 remaining questions, as committed.

The following table indicates the respective pages in the response document, “RAI 221 Supplement 5 Response US EPR DC.pdf,” that contain AREVA NP’s response to the subject question.

Question #	Start Page	End Page
RAI 221 — 06.02.01-35	2	5

The schedule for technically correct and complete responses to the remaining RAI No. 221 questions is unchanged and is provided below:

Question #	Response Date
RAI 221 — 06.02.01-22	May 28, 2010
RAI 221 — 06.02.01-23	May 28, 2010
RAI 221 — 06.02.01-24	May 28, 2010

Sincerely,

Les Duncan
Licensing Engineer
AREVA NP Inc.
An AREVA and Siemens Company
Tel: (434) 832-2849
Leslie.Duncan@areva.com

From: Pederson Ronda M (AREVA NP INC)
Sent: Friday, December 18, 2009 11:41 AM
To: 'Tesfaye, Getachew'
Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); BEELMAN Ronald J (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 221, FSAR Ch 6, Supplement 4

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 3 of the 32 questions of RAI No. 221 on June 17, 2009. Supplement 1 response to RAI No. 221 was sent on July 31, 2009 to address 4 of the remaining 29 questions. Supplement 2 response to RAI No. 221 was sent on August 27, 2009 to address 8 of the remaining 25 questions. Supplement 3 response to RAI No. 221 was sent on September 30, 2009 to address 3 of the remaining 17 questions. The attached file, “RAI 221 Supplement 4 Response US EPR DC_PUBLIC.pdf,” provides technically correct and complete responses to 10 of the 14 remaining questions.

Since the response contains security-related sensitive information that should be withheld from public disclosure in accordance with 10 CFR 2.390, the attached file is a public version with the security-related sensitive information redacted. This email does not contain any security-related information. The unredacted SUNSI version is provided under separate email.

The following table indicates the respective pages in the response document, “RAI 221 Supplement 4 Response US EPR DC_PUBLIC.pdf,” that contain AREVA NP’s response to the subject questions.

Question #	Start Page	End Page
RAI 221 — 06.02.01-15	2	6
RAI 221 — 06.02.01-21	7	15
RAI 221 — 06.02.01-26	16	20
RAI 221 — 06.02.01-28	21	23
RAI 221 — 06.02.01-30	24	31

RAI 221 — 06.02.01-32	32	32
RAI 221 — 06.02.01-33	33	34
RAI 221 — 06.02.01-34	35	38
RAI 221 — 06.02.01-42	39	40
RAI 221 — 06.02.01-44	41	41

A response to four questions cannot be provided at this time. The schedule for technically correct and complete responses to the remaining RAI No. 221 questions has been changed and is provided below:

Question #	Response Date
RAI 221 — 06.02.01-22	May 28, 2010
RAI 221 — 06.02.01-23	May 28, 2010
RAI 221 — 06.02.01-24	May 28, 2010
RAI 221 — 06.02.01-35	February 25, 2010

Since three of the remaining questions are regarding the safety-related doors and/or foils and dampers for which the responses depend on performance of the subcompartment analysis (OPEN ITEM), AREVA NP requests a telecon with NRC staff in January to gain clarity regarding the scope of the needed response with the goal of improving the response dates provided above.

Sincerely,

Ronda Pederson

ronda.pederson@areva.com
Licensing Manager, U.S. EPR Design Certification
AREVA NP Inc.
An AREVA and Siemens company
3315 Old Forest Road
Lynchburg, VA 24506-0935
Phone: 434-832-3694
Cell: 434-841-8788

From: Pederson Ronda M (AREVA NP INC)
Sent: Wednesday, September 30, 2009 4:19 PM
To: 'Tesfaye, Getachew'
Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); BEELMAN Ronald J (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 221, FSAR Ch 6, Supplement 3

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 3 of the 32 questions of RAI No. 221 on June 17, 2009. Supplement 1 response to RAI No. 221 was sent on July 31, 2009 to address 4 of the remaining 29 questions. Supplement 2 response to RAI No. 221 was sent on August 27, 2009 to address 8 of the remaining 25 questions. The attached file, “RAI 221 Supplement 3 Response US EPR DC.pdf,” provides technically correct and complete responses to 3 of the 17 remaining questions.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 221 Question 06.02.01-18.

The following table indicates the respective pages in the response document, “RAI 221 Supplement 3 Response US EPR DC.pdf,” that contain AREVA NP’s response to the subject questions.

Question #	Start Page	End Page

RAI 221 — 06.02.01-16	2	2
RAI 221 — 06.02.01-18	3	3
RAI 221 — 06.02.01-20	4	5

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

Question #	Response Date
RAI 221 — 06.02.01-15	December 17, 2009
RAI 221 — 06.02.01-21	December 17, 2009
RAI 221 — 06.02.01-22	December 17, 2009
RAI 221 — 06.02.01-23	December 17, 2009
RAI 221 — 06.02.01-24	December 17, 2009
RAI 221 — 06.02.01-26	December 17, 2009
RAI 221 — 06.02.01-28	December 17, 2009
RAI 221 — 06.02.01-30	December 17, 2009
RAI 221 — 06.02.01-32	December 17, 2009
RAI 221 — 06.02.01-33	December 17, 2009
RAI 221 — 06.02.01-34	December 17, 2009
RAI 221 — 06.02.01-35	December 17, 2009
RAI 221 — 06.02.01-42	December 17, 2009
RAI 221 — 06.02.01-44	December 17, 2009

Sincerely,

Ronda Pederson
ronda.pederson@areva.com
Licensing Manager, U.S. EPR Design Certification
AREVA NP Inc.
An AREVA and Siemens company
3315 Old Forest Road
Lynchburg, VA 24506-0935
Phone: 434-832-3694
Cell: 434-841-8788

From: WELLS Russell D (AREVA NP INC)
Sent: Thursday, August 27, 2009 6:19 PM
To: 'Getachew Tesfaye'
Cc: Pederson Ronda M (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); SLIVA Dana (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 221, FSAR Ch 6, Supplement 2

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 3 of the 32 questions of RAI No. 221 on June 17, 2009. Supplement 1 response to RAI No. 221 was sent on July 31, 2009 to address 4 of the remaining 29 questions. The attached file, “RAI 221 Supplement 2 Response US EPR DC.pdf,” provides technically correct and complete responses to 8 of the remaining 25 questions.

The following table indicates the respective pages in the response document, “RAI 221 Supplement 2 Response US EPR DC.pdf,” that contain AREVA NP’s response to the subject questions.

Question #	Start Page	End Page
RAI 221 — 06.02.01-27	2	5
RAI 221 — 06.02.01-29	6	7
RAI 221 — 06.02.01-38	8	13
RAI 221 — 06.02.01-39	14	14
RAI 221 — 06.02.01-40	15	15
RAI 221 — 06.02.01-41	16	18
RAI 221 — 06.02.01-43	19	20
RAI 221 — 06.02.01-46	21	22

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

Question #	Response Date
RAI 221 — 06.02.01-15	December 17, 2009
RAI 221 — 06.02.01-16	September 30, 2009
RAI 221 — 06.02.01-18	September 30, 2009
RAI 221 — 06.02.01-20	September 30, 2009
RAI 221 — 06.02.01-21	December 17, 2009
RAI 221 — 06.02.01-22	December 17, 2009
RAI 221 — 06.02.01-23	December 17, 2009
RAI 221 — 06.02.01-24	December 17, 2009
RAI 221 — 06.02.01-26	December 17, 2009
RAI 221 — 06.02.01-28	December 17, 2009
RAI 221 — 06.02.01-30	December 17, 2009
RAI 221 — 06.02.01-32	December 17, 2009
RAI 221 — 06.02.01-33	December 17, 2009
RAI 221 — 06.02.01-34	December 17, 2009
RAI 221 — 06.02.01-35	December 17, 2009
RAI 221 — 06.02.01-42	December 17, 2009
RAI 221 — 06.02.01-44	December 17, 2009

Sincerely,

(Russ Wells on behalf of)

Ronda Pederson
ronda.pederson@areva.com
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From: Pederson Ronda M (AREVA NP INC)
Sent: Friday, July 31, 2009 2:51 PM
To: 'Tesfaye, Getachew'
Cc: BEELMAN Ronald J (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 221, FSARCh. 6 , Supplement 1

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 3 of the 32 questions of RAI No. 221 on June 17, 2009. The attached file, “RAI 221 Supplement 1 Response US EPR DC.pdf” provides technically correct and complete responses to 4 of the remaining 29 questions and a revised schedule for the one partial response (RAI 221 — 06.02.01-38c) of the remaining 29 questions.

The following table indicates the respective pages in the response document, “RAI 221 Supplement 1 Response US EPR DC.pdf,” that contain AREVA NP’s response to the subject questions.

Question #	Start Page	End Page
RAI 221 — 06.02.01-25	2	2
RAI 221 — 06.02.01-31	3	3
RAI 221 — 06.02.01-36	4	4
RAI 221 — 06.02.01-37	5	5

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

Question #	Response Date
RAI 221 — 06.02.01-15	December 17, 2009
RAI 221 — 06.02.01-16	September 30, 2009
RAI 221 — 06.02.01-18	September 30, 2009
RAI 221 — 06.02.01-20	September 30, 2009
RAI 221 — 06.02.01-21	December 17, 2009
RAI 221 — 06.02.01-22	December 17, 2009
RAI 221 — 06.02.01-23	December 17, 2009
RAI 221 — 06.02.01-24	December 17, 2009
RAI 221 — 06.02.01-26	December 17, 2009
RAI 221 — 06.02.01-27	August 27, 2009
RAI 221 — 06.02.01-28	December 17, 2009
RAI 221 — 06.02.01-29	August 27, 2009
RAI 221 — 06.02.01-30	December 17, 2009
RAI 221 — 06.02.01-32	December 17, 2009
RAI 221 — 06.02.01-33	December 17, 2009
RAI 221 — 06.02.01-34	December 17, 2009
RAI 221 — 06.02.01-35	December 17, 2009
RAI 221 — 06.02.01-38c	August 27, 2009
RAI 221 — 06.02.01-39	August 27, 2009
RAI 221 — 06.02.01-40	August 27, 2009
RAI 221 — 06.02.01-41	August 27, 2009
RAI 221 — 06.02.01-42	December 17, 2009
RAI 221 — 06.02.01-43	August 27, 2009
RAI 221 — 06.02.01-44	December 17, 2009
RAI 221 — 06.02.01-46	August 27, 2009

Sincerely,

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From: Pederson Ronda M (AREVA NP INC)
Sent: Wednesday, June 17, 2009 5:41 PM
To: 'Getachew Tesfaye'
Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); GUCWA Len T (EXT); BEELMAN Ronald J (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 221, FSARCh. 6 (Part 2 of 2)

Getachew,
Attached is response to RAI 221 (Part 2 of 2).

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From: Pederson Ronda M (AREVA NP INC)
Sent: Wednesday, June 17, 2009 5:09 PM
To: 'Getachew Tesfaye'
Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); GUCWA Len T (EXT); BEELMAN Ronald J (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 221, FSARCh. 6 (Part 1 of 2)

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 221 Response US EPR DC.pdf" provides technically correct and complete responses to 3 of the 32 questions.

The following table indicates the respective pages in the response document, "RAI 221 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 221 — 06.02.01-15	2	2
RAI 221 — 06.02.01-16	3	3
RAI 221 — 06.02.01-17	4	4
RAI 221 — 06.02.01-18	5	5
RAI 221 — 06.02.01-19	6	6
RAI 221 — 06.02.01-20	7	7

RAI 221 — 06.02.01-21	8	8
RAI 221 — 06.02.01-22	9	9
RAI 221 — 06.02.01-23	10	10
RAI 221 — 06.02.01-24	11	11
RAI 221 — 06.02.01-25	12	12
RAI 221 — 06.02.01-26	13	13
RAI 221 — 06.02.01-27	14	14
RAI 221 — 06.02.01-28	15	15
RAI 221 — 06.02.01-29	16	16
RAI 221 — 06.02.01-30	17	17
RAI 221 — 06.02.01-31	18	18
RAI 221 — 06.02.01-32	19	19
RAI 221 — 06.02.01-33	20	20
RAI 221 — 06.02.01-34	21	21
RAI 221 — 06.02.01-35	22	22
RAI 221 — 06.02.01-36	23	23
RAI 221 — 06.02.01-37	24	24
RAI 221 — 06.02.01-38	25	25
RAI 221 — 06.02.01-39	26	26
RAI 221 — 06.02.01-40	27	27
RAI 221 — 06.02.01-41	28	28
RAI 221 — 06.02.01-42	29	29
RAI 221 — 06.02.01-43	30	30
RAI 221 — 06.02.01-44	31	31
RAI 221 — 06.02.01-45	32	34
RAI 221 — 06.02.01-46	35	35

A complete answer is not provided for 29 of the 32 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	**Response Date**
RAI 221 — 06.02.01-15	December 17, 2009
RAI 221 — 06.02.01-16	September 30, 2009
RAI 221 — 06.02.01-18	September 30, 2009
RAI 221 — 06.02.01-20	September 30, 2009
RAI 221 — 06.02.01-21	December 17, 2009
RAI 221 — 06.02.01-22	December 17, 2009
RAI 221 — 06.02.01-23	December 17, 2009
RAI 221 — 06.02.01-24	December 17, 2009
RAI 221 — 06.02.01-25	July 31, 2009
RAI 221 — 06.02.01-26	December 17, 2009
RAI 221 — 06.02.01-27	August 27, 2009
RAI 221 — 06.02.01-28	December 17, 2009
RAI 221 — 06.02.01-29	August 27, 2009
RAI 221 — 06.02.01-30	December 17, 2009
RAI 221 — 06.02.01-31	July 31, 2009
RAI 221 — 06.02.01-32	December 17, 2009
RAI 221 — 06.02.01-33	December 17, 2009
RAI 221 — 06.02.01-34	December 17, 2009
RAI 221 — 06.02.01-35	December 17, 2009
RAI 221 — 06.02.01-36	July 31, 2009

RAI 221 — 06.02.01-37	July 31, 2009
RAI 221 — 06.02.01-38c	July 31, 2009
RAI 221 — 06.02.01-39	August 27, 2009
RAI 221 — 06.02.01-40	August 27, 2009
RAI 221 — 06.02.01-41	August 27, 2009
RAI 221 — 06.02.01-42	December 17, 2009
RAI 221 — 06.02.01-43	August 27, 2009
RAI 221 — 06.02.01-44	December 17, 2009
RAI 221 — 06.02.01-46	August 27, 2009

Sincerely,

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From: Getachew Tesfaye [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Tuesday, May 19, 2009 7:30 PM
To: ZZ-DL-A-USEPR-DL
Cc: Walton Jensen; Christopher Jackson; Jason Carneal; Joseph Colaccino; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 221 (2792), FSARCh. 6

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on April 14, 2009, and on May 15, 2009, you informed us that the RAI is clear with exception of Draft RAI Question 06.02.01-15, Part 33. After further evaluation, the staff has determined that Draft RAI Question 06.02.01-15, Part 33 is unnecessary and it is deleted. Additionally, per your request, RAI 221 has been renumbered to break up the single RAI question with 32 parts into 32 separate questions, i.e. Question 06.02.01-15, Part1-32 are now Questions 06.02.01-15 - Question 06.02.01-46. 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: 2986

Mail Envelope Properties (1F1CC1BBDC66B842A46CAC03D6B1CD41046221A8)

Subject: Response to U.S. EPR Design Certification Application RAI No. 221, FSAR Ch 6, Supplement 15
Sent Date: 5/18/2011 3:12:33 PM
Received Date: 5/18/2011 3:12:53 PM
From: WELLS Russell (AREVA)

Created By: Russell.Wells@areva.com

Recipients:
"GUCWA Len (EXTERNAL AREVA)" <Len.Gucwa.ext@areva.com>
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Tracking Status: None
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Tracking Status: None
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Tracking Status: None

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Files	**Size**	**Date & Time**
MESSAGE	39593	5/18/2011 3:12:53 PM
RAI 221 Supplement 15 Response US EPR DC.pdf		895541

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

Response to

Request for Additional Information No. 221, Supplement No. 15

5/19/2009

U.S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 06.02.01 - Containment Functional Design
Application Section: 6.2.1, Technical Report ANP-10299P

QUESTIONS for Containment and Ventilation Branch 1 (AP1000/EPR Projects) (SPCV)

Question 06.02.01-16:

Section 2.2.3 of ANP-10299P describing the mixing dampers states that they open with a differential pressure of plus of minus 35 mille bar or an absolute pressure of 1.2 bar. Discuss the redundancy of these sensors and actuation logic.

Response to Question 06.02.01-16:

This response supersedes the original response to Question 06.02.01-16 that was provided on September 30, 2009, as part of RAI 221, Supplement 3.

Based on the safety classification and function of the hydrogen mixing dampers (HMD), redundancy has been designed into the associated digital instrumentation and control (I&C) logic-sensors. A total of eight logic-sensor units (two per steam generator (SG) loop) continuously monitors the differential pressure across the SG ceiling formed by the foils at the top of the SG compartments. Each sensor monitors the differential pressure that exists at that location (between the accessible and equipment rooms). This arrangement complies with failure modes and effects analysis (FMEA) requirements so that a single sensor can be out of service for maintenance and a single-failure can occur without affecting the HMD function. If high differential pressure is sensed by digital I&C logic at any two of the eight sensor unit locations, all eight HMDs receive an “OPEN” command. A design change was implemented to replace the two non-safety related absolute containment pressure sensors with four existing safety-related sensors for opening the HMDs. If high containment pressure is sensed by the digital I&C logic at two of the four containment pressure sensor unit locations, all eight HMDs receive an “OPEN” command. A signal by any two of the eight differential pressure logic-sensor units, or by either of the two containment pressure logic-sensor units, triggers the opening of all eight HMDs.

The HMDs are kept closed by a solenoid brake during normal (energized) operation and fail-safe in the “OPEN” position upon loss of power. No battery backup is provided (this would violate the fail-safe principle). In case of a loss of offsite power (LOOP), the HMDs would fail-safe open. When power is restored, the HMDs close automatically, except when a high containment pressure signal is active to prevent unwanted closing of the HMDs. Manual operator action can reset the opening signal and close the dampers. A description of HMD operation upon loss of power will be added to U.S. EPR FSAR, Tier 2, Section 6.2.5.

FSAR Impact:

The U.S. EPR FSAR, Tier 2, Section 6.2.5 will be revised as described in the response and indicated on the enclosed markup.

Question 06.02.01-24:

Provide technical specification surveillance requirements which will ensure that the foils and dampers of the CONVECT system and the safety-related doors in ANP-10299P perform their intended safety functions. The NRC staff requested that ITAACs be provided for these components in RAI 104:14-03.2.

Response to Question 06.02.01-24:

Inspections, tests, analyses, and acceptance criteria (ITAAC) for foils, dampers, and doors credited in the containment analysis described in Technical Report ANP-10299P, “Applicability of AREVA NP Containment Response Evaluation Methodology to the U.S. EPR for Large Break LOCA Analysis,” are addressed in the Response to RAI 104, Question 14.03-1.

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Sections 3.6.9 and 3.6.10 (and corresponding Bases) will be added for the rupture and convection foils, hydrogen mitigation dampers, and sub-compartment doors. U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Sections 3.3.1 (and corresponding Bases) will be revised for addition of the hydrogen mitigation dampers. Corresponding changes will be made to U.S. EPR FSAR Tier 2, Table 1.7-1, Section 6.2.4, Chapter 7, Table 15.0-7, Table 15.0-8, and Chapter 16 Bases Section 3.6.3 will be revised to reflect the addition of foils, dampers, and doors.

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Section 3.5.2 (and corresponding Bases) will be revised to add new Surveillance Requirement 3.5.2.7 regarding required low head safety injection (LHSI) flow to the hot leg. U.S. EPR FSAR Tier 2, Chapter 16, Bases Sections 3.5.4, 3.6.4, and 3.6.5 will be revised for clarity.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 1, Chapter 6, Chapter 7, Chapter 15, and Chapter 16 will be revised as described in the response and indicated on the enclosed markups.

U.S. EPR Final Safety Analysis Report Markups

Table 1.7-1—I&C Functional and Electrical One Line Diagrams
Sheet 3 of 4

FSAR Figure Number	Title
7.3-7	EFWS Actuators (Div. 3&4)
7.3-8	Partial Cooldown Actuation
7.3-9	MSRT Setpoint Formation
7.3-10	MSRT Opening (Div. 1&2)
7.3-11	MSRT Opening (Div. 3&4)
7.3-12	MSRCV Control
7.3-13	MSRT Isolation
7.3-14	MSIV Isolation (Div. 1&2)
7.3-15	MSIV Isolation (Div. 3&4)
7.3-16	MFWS Isolation - Full Load
7.3-17	MFWS Isolation - SSS
7.3-18	MFW Actuators (Div. 1&2)
7.3-19	MFW Actuators (Div. 3&4)
7.3-20	Containment Isolation
7.3-21	CVCS Charging Isolation
7.3-22	CVCS Isolation for Anti-Dilution
7.3-23	EDG Actuation
7.3-24	PSRV Opening (Brittle Fracture Protection)
7.3-25	SG Isolation (Div. 1&2)
7.3-26	SG Isolation (Div. 3&4)
7.3-27	RCP Trip
7.3-28	MCR Isolation and Filtering
7.3-29	Turbine Trip on Reactor Trip Confirmation
7.3-30	Hydrogen Mixing Dampers Opening
7.6-1	CCWS Switchover Valves Interlock
7.6-2	CCWS Containment Isolation Valves Interlock
7.6-3	Detection of RHR Connected
7.7-1	Average Coolant Temperature Control Logic
7.7-2	Rod Speed Control Program
7.7-3	RCS Pressure Setpoints
7.7-4	Pressurizer Level Setpoints
7.7-5	Steam Generator Level Setpoints
7.7-6	Signal Flow from PS through CU

06.02.01-24

The positions of the individual containment isolation valves depend on the operating mode of the plant, and on the specific fluid system's functional requirements. The positions of the containment isolation valves for each penetration under normal and accident conditions are listed in Table 6.2.4-1.

Closed system piping inside containment that serves as one of the containment isolation barriers meets containment isolation design requirements, as discussed in Section 6.2.4.3.

6.2.4.2.4 System Actuation

When required by plant conditions, the protection system (PS) sends containment isolation signals that automatically isolate the non-essential process lines. The U.S. EPR senses diverse parameters to initiate redundant, train-oriented, isolation signals. While a variety of conditions trigger valve closure, the majority of process lines are closed when they receive a containment isolation signal that is generated by one of the following initiating conditions.

06.02.01-24

- Containment Isolation Stage 1 on Containment Equipment Compartment Pressure > Max1p.
- Containment Isolation Stage 1 on Containment Service Compartment Pressure (NR) > Max2p.
- Containment Isolation Stage 1 on High Containment Activity > Max1p.
- Containment Isolation Stage 1 on SIS Actuation.
- Containment Isolation Stage 1 and 2 on Containment Service Compartment Pressure (WR) > Max~~2~~3p.

Stage 1 and Stage 2 containment isolation functions are addressed in Section 7.3.1.2.9. The pressure setpoint Max1p is set to a minimum value compatible with normal operating conditions.

The PS automatically isolates containment. Each non-essential containment penetration has two isolation barriers in series, and each of the two barriers is actuated by a different PS division. Resetting the containment isolation signal does not automatically reopen the containment isolation valves. Deliberate operator action, consisting of two independent actions, is required to reopen the valves. Redundancy and reliability of the actuation system are addressed in Section 7.3.

Isolation valves have actuation features appropriate to the valve type and required closure time. Power-operated isolation valves can be remotely actuated from the MCR. These valves have one operator with two methods of actuation, a primary and secondary mode. For power-operated isolation valves that automatically operate upon

6.2.5.5 Instrumentation Requirements

The PARs, rupture foils, and convection foils of the CGCS are passive components that do not require instrumentation or controls. The hydrogen mixing dampers (HMD) are safety-related and their operation and actuation logic is controlled by the protection system, safety automation system, and diverse actuation system. There are two sensors per steam generator loop for a total of eight, safety-related delta pressure sensors powered from their respective electrical divisions. This arrangement meets the single failure requirements such that a sensor can be out for maintenance and a single-failure can occur without affecting the HMD control. If two out of eight sensor signals exceed the delta pressure setpoint all eight HMDs receive a signal to open. The delta pressure setpoint is 0.5 psid. The delta pressure is measured across the steam generator pressure equalization ceiling and measures the difference in pressure between the accessible and equipment area. The delta pressure signal accounts for a pressure increase in either of the regions to provide an actuation signal for the HMDs.

In addition, there are a total of four safety-related absolute containment service compartment pressure sensors. Their operation and actuation logic is also controlled by the protection system and the diverse actuation system. For each steam generator loop an associated absolute pressure sensor is located in the accessible area of the containment. If two out of four of the absolute pressure sensors exceed the absolute pressure setpoint of 17.4 psia, the HMDs receive a signal to open. This arrangement and logic also meets the single failure requirements in that a sensor can be out for maintenance and a single-failure can occur without affecting the HMD control. There are no restrictions placed on plant operation if one of the absolute pressure sensors is out of service.

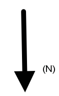
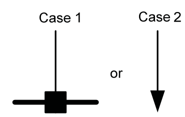
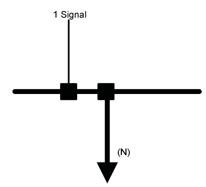
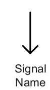
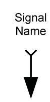
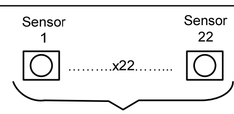
06.02.01-16

The combination of delta and absolute pressure sensors fulfills redundancy and diversity requirements. Upon loss of power, the HMDs open in a fail-safe position and remain open until power is restored. When power is restored, the HMDs will close automatically unless a high containment pressure condition exists. The plant operator can reset the instrumentation and controls (I&C) interlock function and manually operate the HMDs. Position sensors indicate the HMD position in the main control room. If an HMD opens unintentionally, it can be closed by either the actuator or the mechanical backup closing mechanism. In the unlikely case that a mixing damper remains open, the resulting leakage (cross-sectional area approximately 8 ft^2), compared to the total leakage of penetrations and doors across the in-accessible and accessible rooms, is negligible. HMDs are installed in the accessible area which provides for maintenance access to the component during normal operation. Section 7.3 provides further detail about the I&C logic and logic diagrams of the HMDs.

The redundancy of the eight hydrogen mixing dampers meets FMEA requirements so that one HMD can be out for maintenance and a single failure can occur at a second

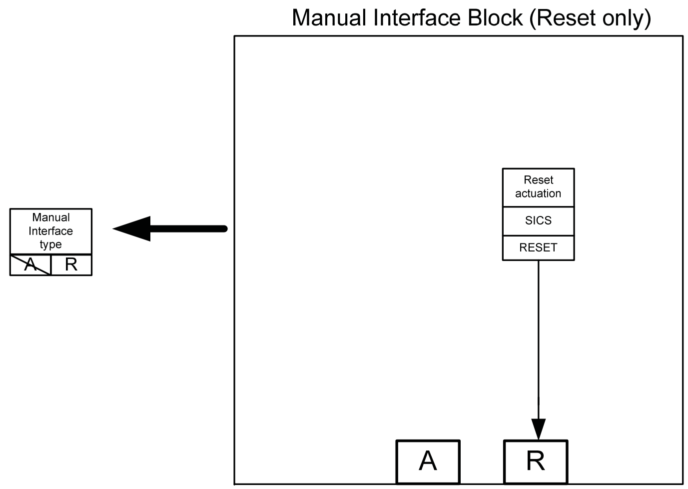
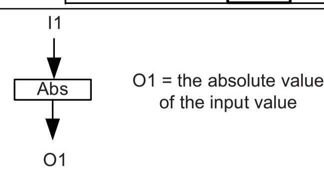
06.02.01-24

Figure 7.1-1—Chapter 7 Symbol Legend
Sheet 2 of 16

Symbols – Logic Figures	Definition
	Multiple Signals of the Same Type
	Single Signal (2 Cases)
	Signal Transfer Between Divisions
	Signal Sent Elsewhere in Figure
	Signal Received from Elsewhere in Figure
	The logic within the block is duplicated in other divisions of the system.
	Multiple instances of the same type of object. Multiple sensors are given as an example. This convention is also applied to signal arrows and calculation boxes.

REV 003
EPR3000-2 T2

**Figure 7.1-1—Chapter 7 Symbol Legend
Sheet 10 of 16**

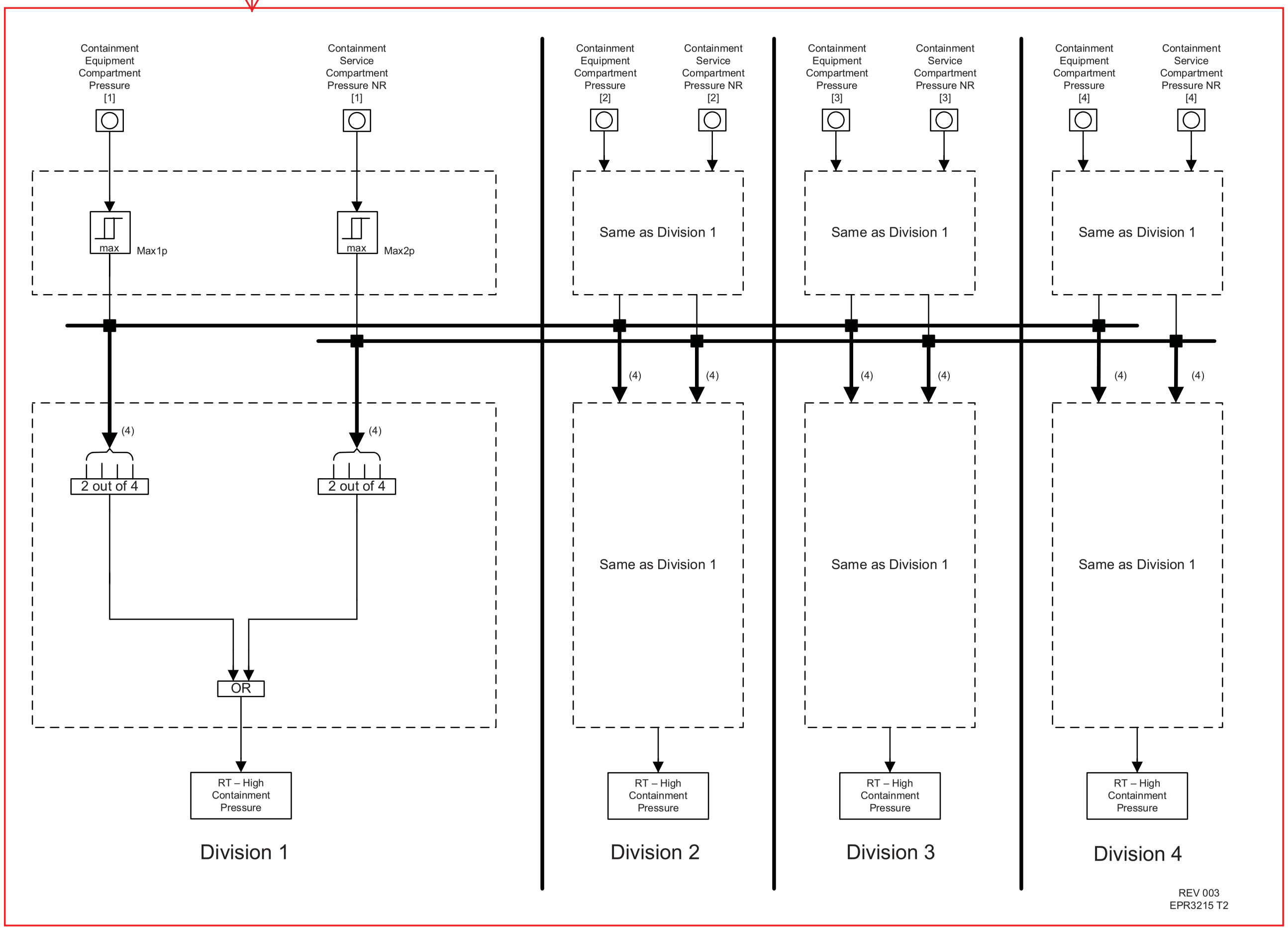
Symbols – Logic Figures	Definition
	Manual Interface Block Reset Only
	Absolute Value Function

06.02.01-24

REV 003
EPR3000-10 T2

Figure 7.2-23—High Containment Pressure

06.02.01-24



7.2.1.2.18 Reactor Trip on High Steam Generator Level

This function is provided to protect the integrity of the fuel in case of a main feedwater control malfunction that causes an increase in feedwater flow resulting in RCS overcooling and a reactivity insertion. This function also protects the turbine from moisture carryover in case of excessive feedwater addition or a rising SG water level due to a tube rupture.

The SG level variable is directly measured by four (NR) level sensors in each SG. These measurements are acquired by the PS as described in Section 7.2.1.2.17 and are compared to a fixed high setpoint (Max1p). If two measurements from any one SG are above the setpoint, RT orders are generated.

The P13 permissive condition bypasses the high SG level RT function at low temperatures as measured in the hot legs. This bypass is automatically removed as hot leg temperature increases above the P13 setpoint. Generation of the P13 permissive signal is described in Section 7.2.1.3.

The logic for the high SG level RT function is shown in Figure 7.2-21—Low SG Level.

7.2.1.2.19 Reactor Trip on High Containment Pressure

This function is provided to protect the integrity of the containment during any event leading to water or steam discharge into containment. The containment pressure variable is directly measured by two sets of four redundant pressure sensors. One set of four measures the pressure in the containment equipment compartments. The other set of four measures the pressure in the containment service compartments.

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Each division of the PS acquires one pressure measurement from each set of sensors ~~and compares them to a fixed high setpoint (Max1p)~~. The containment service compartment pressure measurements are compared to the Max2p setpoint and the containment equipment compartment pressure measurements are compared to the Max1p setpoint. If two measurements from either set of four pressure sensors are above the setpoint, RT orders are generated.

There are no operating bypasses associated with the high containment pressure RT. The logic for the high containment pressure RT function is shown in Figure 7.2-23—High Containment Pressure.

7.2.1.2.20 Reactor Trip on Safety Injection System Actuation

This function is provided to trip the reactor when the SIS is automatically actuated by the PS. In each division of the PS, when a safety injection (SI) signal is generated, an RT order is also generated in the same division.

Figure 7.3-14—MSIV Isolation (Div. 1&2)

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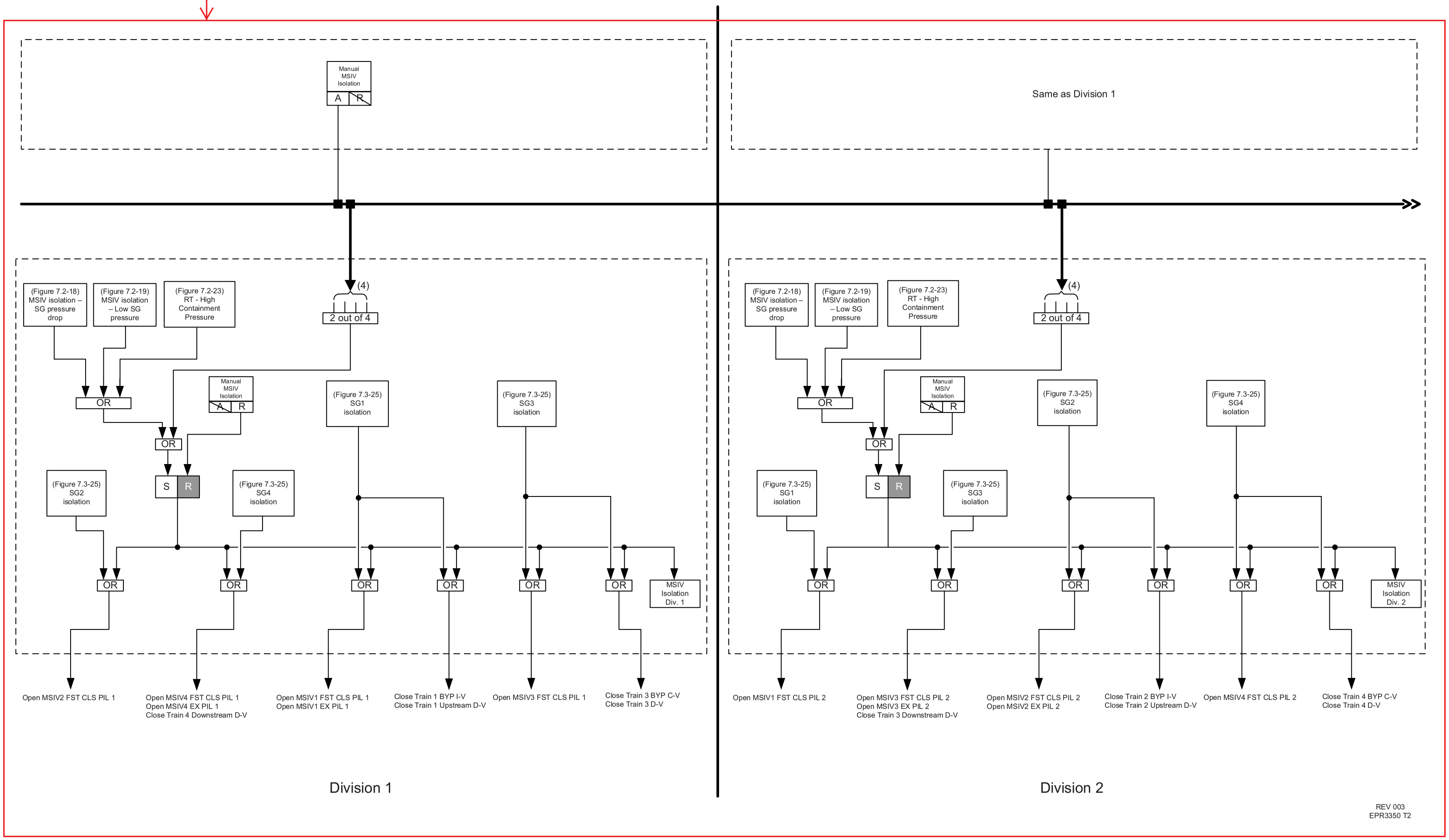

Figure 7.3-15—MSIV Isolation (Div. 3&4)

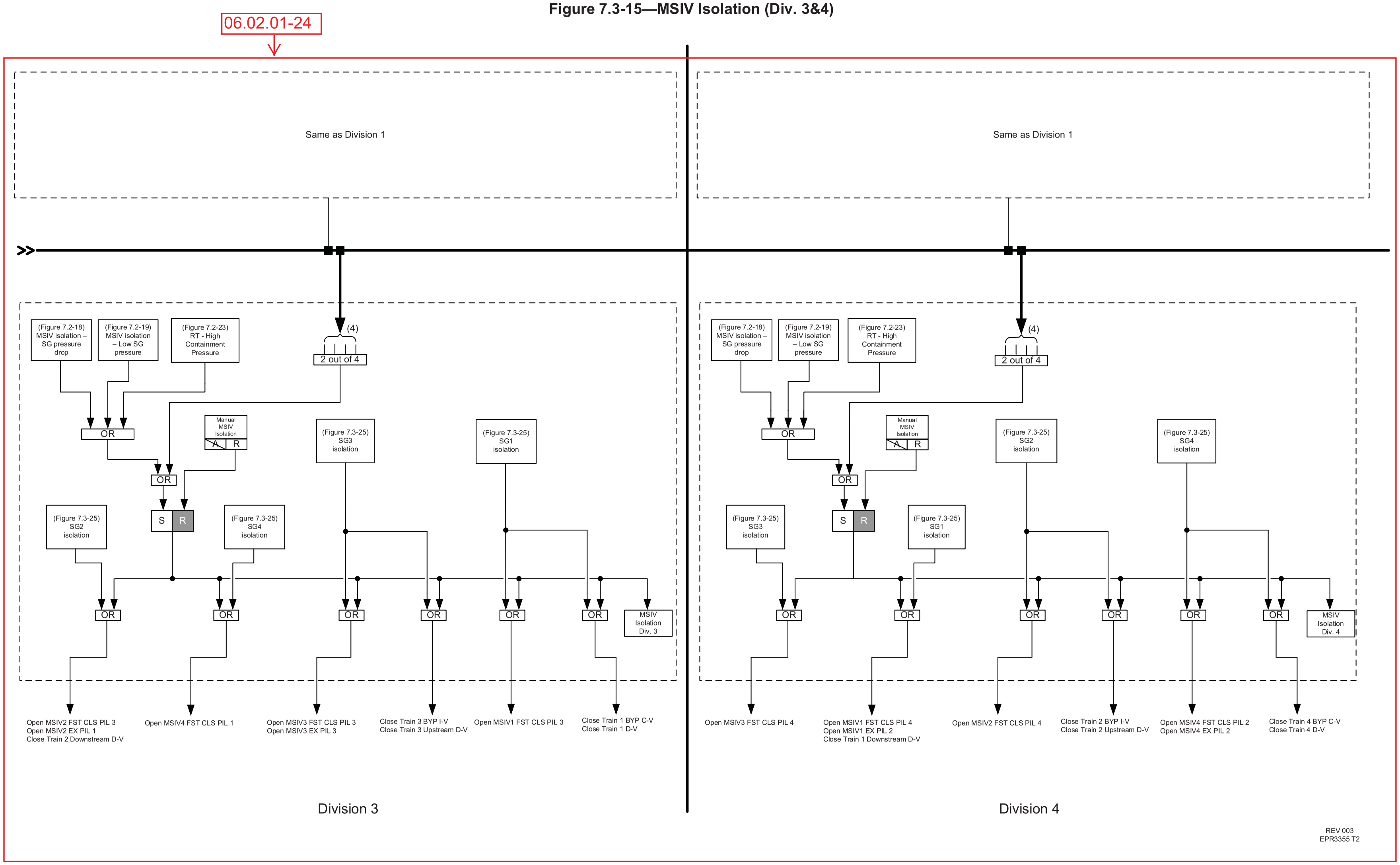

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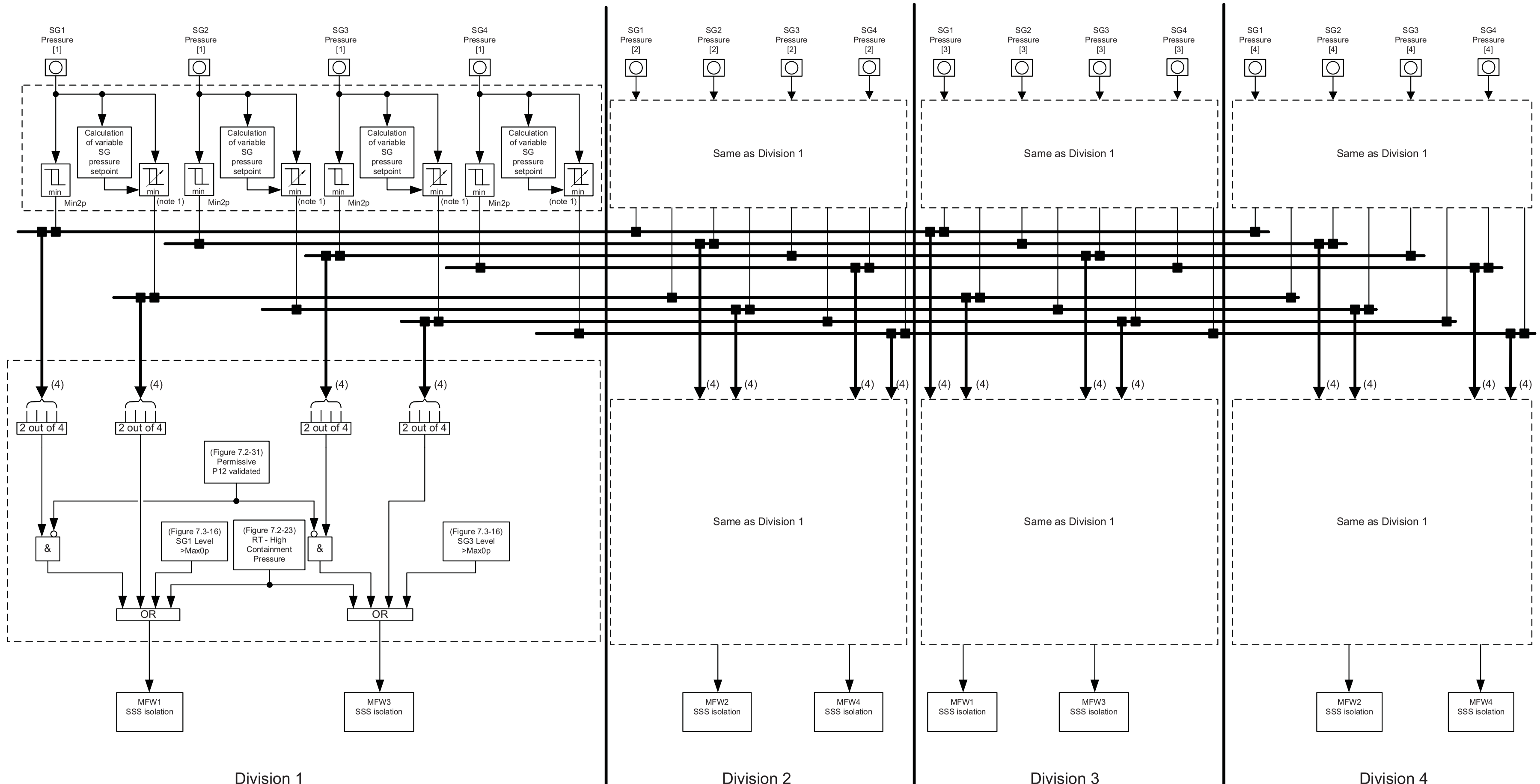
Figure 7.3-17—MFWS Isolation - SSS



Note 1: The condition to be detected is a SG pressure drop > Max 2p. This is implemented with a variable "Min" setpoint that decreases in a rate-limited manner.

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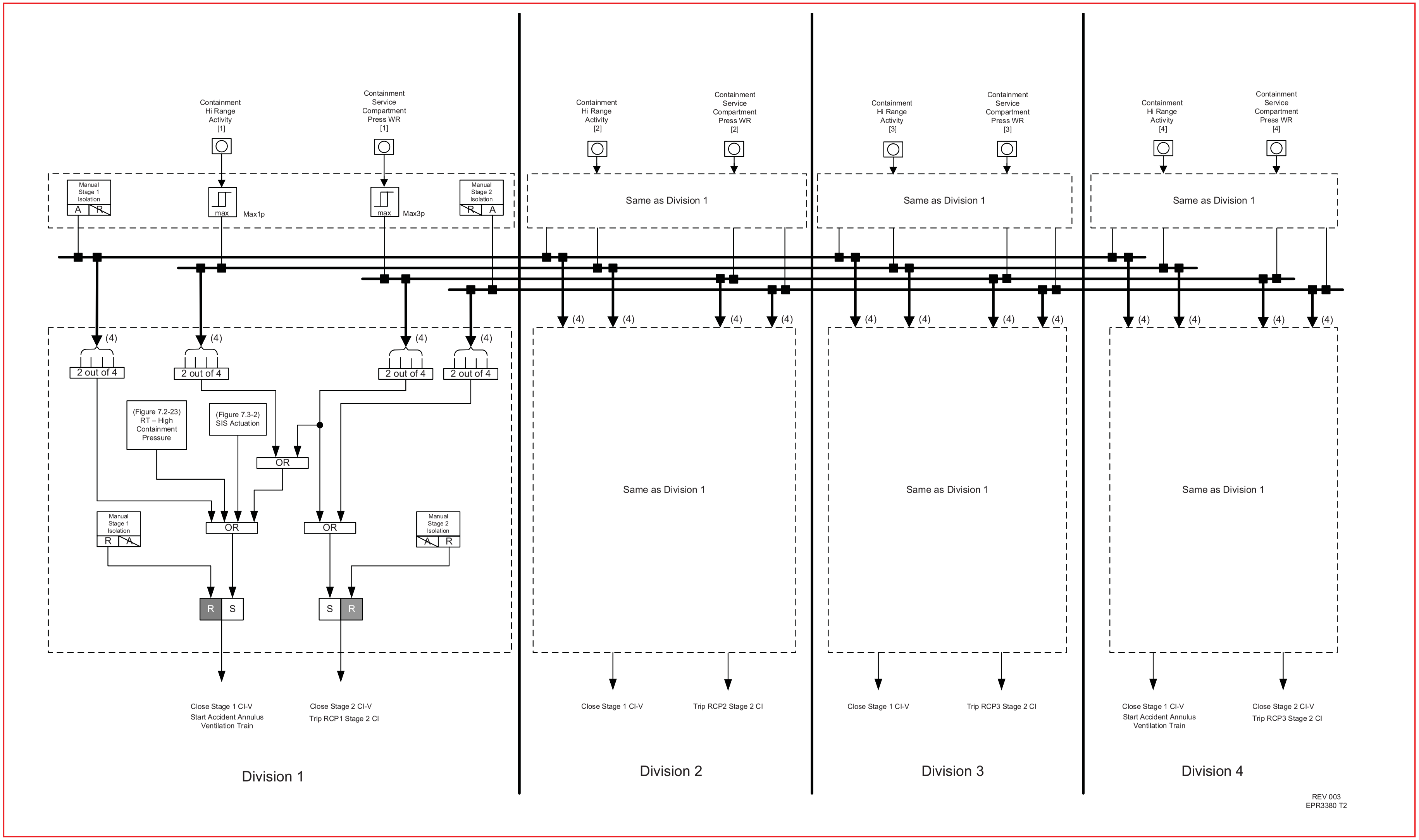

Figure 7.3-20—Containment Isolation

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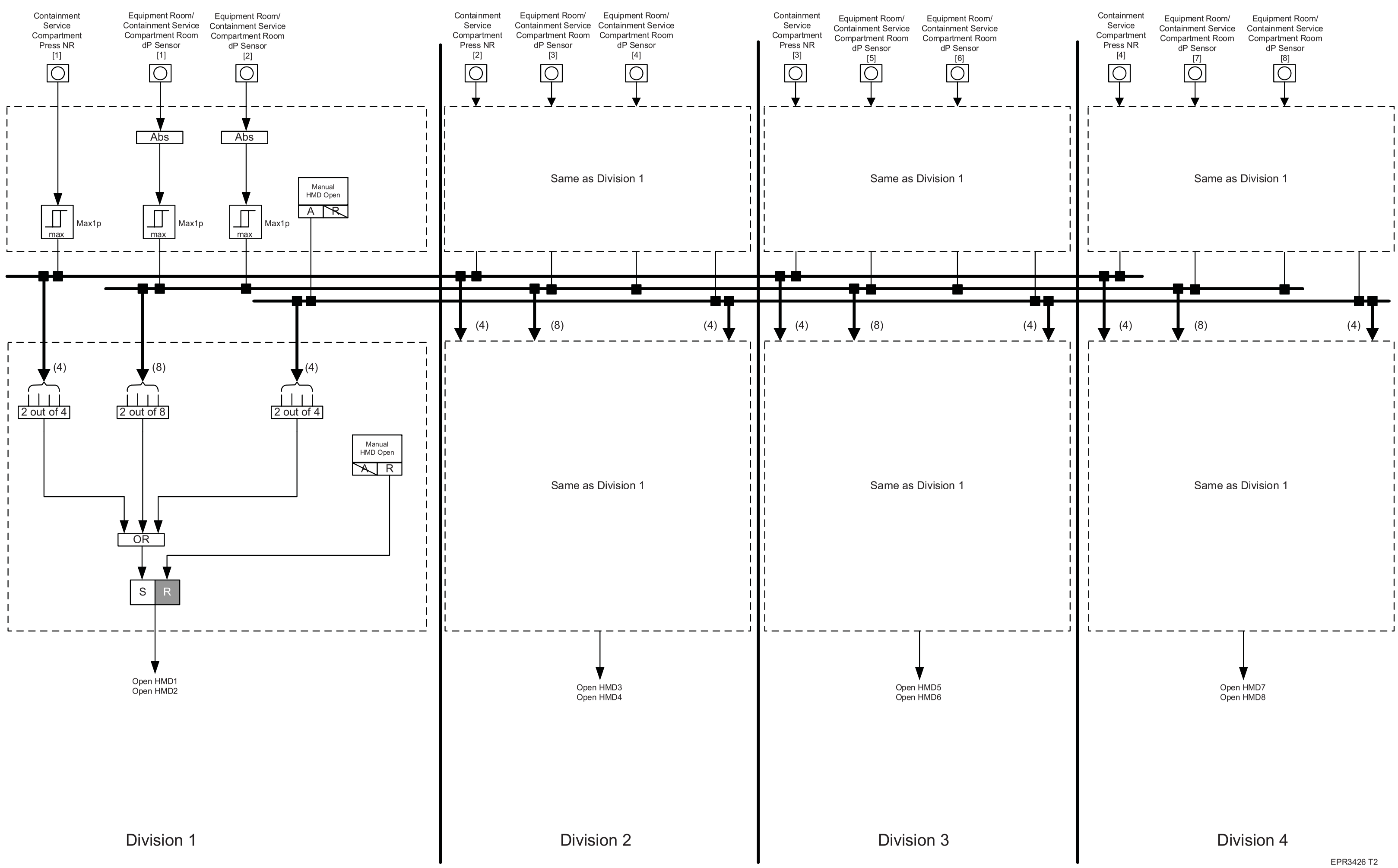
Figure 7.3-30—Hydrogen Mixing Dampers Opening.



Next File

- SG pressure drop.
- SG pressure < Min1p.
- SG isolation signal (Section 7.3.1.2.14).
- Containment equipment compartment pressure > Max1p.
- Containment service compartment pressure (NR) > Max2p.

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An actuation order is generated for main steam isolation when two-out-of-four SG pressure measurements on any one SG decrease faster than the specified allowable rate. When this condition occurs in any one SG, all four main steam trains are isolated. A SG pressure drop is detected by using a variable low setpoint equal to the actual SG pressure minus a fixed value, with a limitation placed on the rate of decrease of the setpoint. The maximum value of the setpoint is also limited in order to avoid MSIV closure during a SG pressure decrease following RT and turbine trip, which could result in a SG over-pressure condition.

There are no permissive conditions associated with main steam isolation due to SG pressure drop; this initiation parameter is used in all plant operating conditions.

An actuation order is also generated for main steam isolation when two-out-of-four SG pressure measurements on any one SG are below the fixed Min1p setpoint. When this condition occurs in any one SG, all four main steam trains are isolated. Main steam isolation due to low SG pressure is bypassed when RCS pressure is below the P12 permissive setpoint. The bypass is automatically removed above the P12 setpoint. Generation of the P12 permissive signal is discussed in Section 7.2.1.3.

An actuation order is generated for main steam isolation when two-out-of-four PS divisions detect high containment pressure. Either two-out-of-four equipment compartment pressure measurements exceeding the Max1p setpoint, or two-out-of-four NR service compartment pressure measurements exceeding the Max2p setpoint results in main steam isolation. There are no operating bypasses associated with main steam isolation on high containment pressure.

The capability for manual system-level actuation of main steam isolation is provided on the SICS in the MCR. This manual system-level initiation closes all four MSIVs. Four manual system-level initiation controls are provided, any two of which will actuate the main steam isolation.

The capability for component-level control of the MSIVs is available to the operator on both the PICS and the SICS in the MCR. For small main steam line breaks (MSLB) and FWLB, manual initiation from the SICS is credited with closing the MSIVs when operating below P12 permissive setpoint. Operator actions credited in mitigating accidents are addressed in Section 15.0.0.3.7.

The sense and command output for main steam isolation can be reset manually from both the PICS and SICS in the MCR. Reset of the sense and command output does not result in opening of the associated valves; it allows the operator to take further manual actions to open the valves.

The functional logic for automatic main steam isolation is shown in Figure 7.3-14—MSIV Isolation (Div. 1&2) and Figure 7.3-15—MSIV Isolation (Div. 3&4).

7.3.1.2.8 Main Feedwater Isolation

To protect against a loss of SG level control arising from a SGTR, pipe fault, or level control malfunction, and to prevent overcooling of the RCS following a RT, isolation of the main feedwater (MFW) system is performed. The MFW isolation is actuated in two steps, full load isolation or startup and shutdown system (SSS) isolation, depending upon the severity of the SG level deviation. The SSS isolation includes the closure of the main MFW isolation valve, which prevents flow via the full load path as well as SSS.

Operation of the MFW system is described in Section 10.4.

The U.S. EPR design uses the following initiating conditions to actuate MFW isolation:

- ConfirmationInitiation of RT (full load isolation).
- SG level NR > Max1p (full load isolation).
- SG level NR > Max0p for a period of time following RT (SSS isolation).
- SG pressure drop > Max2p (SSS isolation).
- SG pressure < Min2p (SSS isolation).
- SG isolation signal (Section 7.3.1.2.14).
- Containment equipment compartment pressure > Max1p (SSS isolation).
- Containment service compartment pressure (NR) > Max2p (SSS isolation).

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Following RT, a MFW full load isolation of all four SG is required in order to avoid RCS overcooling, which could result in a return to critical conditions with a potential power excursion. The confirmation of RT signal is generated when two out of four RT breakers are in the open position. This MFW isolation secures the full load flow path and allows for SG level control from the low load valves, in the absence of close commands for the low load valves.

Redundant to the MFW full load isolation due to RT on SG level > Max1p, a separate, SG-specific MFW full load isolation order is also generated at the Max1p setpoint to avoid SG overfill and moisture carryover. This actuation order is generated when two out of four NR SG level measurements on any one SG exceed the Max1p setpoint. Only the full load lines feeding the SG with the high water level are isolated due to this signal. The other full load lines are isolated on ~~confirmation~~initiation of RT due to the same high level measurement. The high SG level initiation is bypassed when hot leg temperature is below the P13 setpoint. The bypass is automatically removed when hot leg temperature is above the P13 setpoint. Generation of the P13 permissive signal is discussed in Section 7.2.1.3.

Following RT on high SG level, the SG level is expected to decrease initially due to the prompt reduction in steam flow and then be maintained at a normal level by the SG level control system. A persistent high SG level may be indicative of a SGTR or a failure of the SG level control system. If the SG level remains greater than the Max0p setpoint for a fixed amount of time following RT and MFW full load isolation, MFW SSS isolation is performed. This actuation order is generated when two-out-of-four NR SG level measurements remain above the Max0p setpoint, following expiration of a time delay initiated by RT ~~confirmation~~signal. The SSS isolation is performed only on a SG in which the level remains above the Max0p setpoint. This initiation signal is bypassed when hot leg temperature is below the P13 setpoint. The bypass is automatically removed when hot leg temperature is above the P13 setpoint. Generation of the P13 permissive signal is discussed in Section 7.2.1.3.

Following a main steam or feedwater system piping failure, a complete feedwater isolation of the MFW train feeding the affected SG is desirable. In this case, MFW full load isolation occurs on all four steam generators because of the reactor trip on either SG pressure drop or on SG pressure < Min1p. A MFW SSS isolation of the affected SG will occur on a more severe SG pressure drop (to mitigate fast depressurizations) or on SG pressure < Min2p (to mitigate slower depressurizations). The logic to initiate MFW isolation on SG pressure drop is the same as that described for main steam isolation on SG pressure drop described in Section 7.3.1.2.7, except that the variable low setpoint for SSS isolation is maintained below the RT and MSIV isolation setpoint. The actuation order for SSS isolation due to SG pressure < Min2p is generated when two out of four SG pressure measurements on any one SG are below the Min2p setpoint. There is no operating bypass associated with SSS isolation on SG pressure drop. SSS isolation on SG pressure < Min2p is bypassed when RCS pressure is below the P12 permissive setpoint. The bypass is automatically removed when RCS pressure is above the P12 setpoint. Generation of the P12 permissive signal is discussed in Section 7.2.1.3.

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An actuation order is generated for SSS isolation when two-out-of-four PS divisions detect high containment pressure. Either two-out-of-four equipment compartment pressure measurements exceeding the Max1p setpoint, or two-out-of-four NR service compartment pressure measurements exceeding the Max2p setpoint results in SSS isolation. There are no operating bypasses associated with SSS isolation on high containment pressure.

The capability for manual system-level isolation of MFW on a per-train basis is provided on the SICS in the MCR. This manual system-level initiation isolates both full load and SSS lines on the desired SG. Two manual system-level isolation controls are provided per MFW train. Either of the two controls isolates the MFW train.

The capability for component-level control of the MFW actuators is available to the operator on both the PICS and the SICS in the MCR.

The sense and command outputs for MFW isolation can be reset manually from ~~both~~ the ~~PICS and~~ SICS. Reset of the sense and command output does not result in opening of the associated valves; it allows the operator to take further manual actions to open the valves.

The functional logic for MFW isolation is shown in Figure 7.3-16—MFWS Isolation - Full Load, Figure 7.3-17—MFWS Isolation - SSS, Figure 7.3-18—MFW Actuators (Div. 1&2), and Figure 7.3-19—MFW Actuators (Div. 3&4).

7.3.1.2.9 Containment Isolation

During a LOCA, radioactive coolant is released into the containment. Therefore, the containment has to be isolated to prevent activity release to the environment. The U.S. EPR provides containment isolation in two stages to isolate nonessential components based on the size of the break. Containment pressure measurements and high-range activity monitors are used to initiate containment isolation and to determine which stage is actuated. Additionally, containment isolation is actuated anytime a safety injection actuation signal is generated.

The containment isolation actuators and their functionality are described in Section 6.2.4.

The U.S. EPR design uses the following initiating conditions to isolate the containment:

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- Containment equipment compartment pressure > Max1p (stage 1).
- Containment service compartment pressure (NR) > Max2p (stage 1).
- Containment activity > Max1p (stage 1).
- SIS actuation signal (stage 1).
- Containment service compartment pressure (WR) > ~~Max2p~~Max3p (stage 1 and 2).

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The functional logic for turbine trip is shown in Figure 7.3-29—Turbine Trip on Reactor Trip ConfirmationFigure 7.3-29—Turbine Trip on Reactor Trip Initiation.

7.3.1.2.18 Hydrogen Mixing Dampers Opening

This function provides convection and atmospheric mixing in the event of a design basis accident to enable atmospheric circulation within the whole containment building.

The U.S. EPR design uses the following initiating conditions to open the hydrogen mixing dampers (HMD):

- Containment service compartment pressure (NR) > Max1p.
- Containment equipment compartment/containment service compartment ΔP > Max1p.

If two-out-of-four NR service compartment pressure measurements exceed the Max1p setpoint, then orders are generated by the PS to open the HMDs. Additionally, the HMDs are opened if the differential pressure between the service compartment and equipment compartment exceeds a setpoint (Max1p). This differential pressure is detected by eight differential pressure measurements (two in each division of the PS). If two-out-of-eight equipment compartment/service compartment ΔP measurements exceed the Max1p setpoint, then orders are generated by the PS to open the HMDs.

There are no operating bypasses associated with this function.

The capability for manual system-level initiation of this function is provided on the SICS in the MCR. Four manual system-level initiation controls are provided, any two of which will open the HMDs.

The capability for component-level control for the HMD opening function is available to the operator on both the PICS and the SICS in the MCR.

Reset of the hydrogen mixing dampers opening sense and command outputs is available from the SICS in the MCR. A reset of the sense and command output does not result in a change of state of the actuators; it allows the operator to take further actions to manipulate individual components as may be necessary to follow plant operating procedures.

The functional logic for hydrogen mixing dampers opening is shown in Figure 7.3-30 - Hydrogen Mixing Dampers Opening.

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Table 7.3-1—ESF Actuation Variables

Protective Function	Variables To Be Monitored	Range of Variables
Safety Injection System Actuation	Pressurizer Pressure (NR)	1615-2515 psia
	Hot Leg Pressure (WR)	15-3015 psia
	Hot Leg Temperature (WR)	32-662°F
	RCS Loop Level	0-30.71 in.
Reactor Coolant Pump Trip	RCP differential pressure	0-120% nominal
Emergency Feedwater Actuation	SG Level (WR)	0-100% MR
Emergency Feedwater Isolation	SG Level (WR)	0-100% MR
SG Isolation	Main Steam Line Activity	$1x10^{-1} – 1x10^{4}$ counts/ sec.
	SG Level (NR)	0-100% MR
Main Steam Relief Train Actuation	SG Pressure	15-1615 psia
Main Steam Relief Train Isolation	SG Pressure	15-1615 psia
Main Steam Isolation	SG Pressure	15-1615 psia
	Cont. Equipment Compartment Pressure	-3 to +7 psig
	Cont. Service Compartment Pressure (NR)	-3 to +7 psig
Main Feedwater Isolation	SG Level (NR)	0-100% MR
06.02.01-24	SG Pressure	15-1615 psia
	RT Breaker Position	Open/Closed
	Cont. Equipment Compartment Pressure	-3 to +7 psig
	Cont. Service Compartment Pressure (NR)	-3 to +7 psig
Containment Isolation	Cont. Service Compartment Pressure (NR)	-3 to +7 psig
	Cont. Service Compartment Pressure (WR)	-5 to +220 psig
	Cont. Equipment Compartment Pressure	-3 to +7 psig
	Containment High Range Activity	$1x10^{-1} – 1x10^{7}$ Rad/hr
Emergency Diesel Generator Actuation	6.9 kV Bus Voltage	0-8.625 kV
PSRV Opening	Hot Leg Pressure (NR)	0-870 psia
CVCS Charging Isolation	Pressurizer Level (NR)	0-100% MR

Table 7.3-1—ESF Actuation Variables

Protective Function	Variables To Be Monitored	Range of Variables
CVCS Isolation for Anti-Dilution	Boron Concentration	0-5000 ppm
	Boron Temperature	32-212°F
	CVCS Charging Flow	0-320,000 lb/hr
	Cold Leg Temperature (WR)	32-662°F
MCR A/C Isolation and Filtering	MCR Air Intake Duct Activity	$1x10^{-5}$ – $1x10^{1}$ Rad/hr
Turbine Trip	RT Breaker Position	Open/Closed
HMD Opening	Cont. Service Compartment Pressure (NR)	-3 to +7 psig
	Cont. Equipment Compartment and Cont. Service Compartment Differential Pressure	-7.25 to +7.25 psi

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

The SCDS is described in Section 7.1.

7.8.1.2.1 Automatic DAS Functions

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

- RT on low SG pressure.
- RT on low SG level.
- RT on high SG level.
- RT on low RCS flow (two loops).
- RT on low-low RCS flow (one loop).
- RT on high neutron flux (power range).
- RT on low hot leg pressure.
- RT on high pressurizer pressure.
- Turbine trip on RT.
- EFWS actuation on low SG level.
- SIS actuation on low pressurizer pressure with signal to PAS to generate partial cooldown through TBS.
- Main steam isolation on low SG pressure.
- Containment isolation on high activity (also includes functions that cascade from containment isolation: Annulus ventilation and Safeguards Building HVAC reconfiguration)
- MFW isolation on low SG pressure.
- MFW isolation on high SG level.
- Opening of containment H_2hydrogen mixing dampers on high containment pressure, or high containment compartments differential pressure.
- Start SBO diesels.

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Table 15.0-7—Reactor Trip Setpoints and Delays Used in the Accident Analysis

Signal[4]	Setpoint[1] (Nominal)	Uncertainty (Normal/Degraded)	Time Delay[2] (s)
Pressurizer pressure < Min2p	2005.0 psia	25 psi/55 psi	1.3
Pressurizer pressure > Max2p	2414.7 psia	25 psi/55 psi	1.3
Pressurizer level > Max1p	75%	5.5%/8.0%	1.9
Hot leg pressure < Min1p	2005.0 psia	45 psi /(75 psi <15 sec, 110 psi > 15 sec)	1.3
SG pressure < Min1p	724.7 psia	30 psi/75 psi	1.3
SG pressure > Max1p	1384.7 psia	30 psi/75 psi	1.3
SG ΔP > Max1p	see note 7	30 psi/75 psi	1.3
SG level < Min1p	20% NR[3]	5%/19%	1.9
SG level > Max1p	69% NR	9.5%/11.5%	1.9
High Ccontainment pressure > Max1p[5]	see note 5	see note 5	see note 5
High linear power density	460 W/cm	see note 8	1.0
Low DNBR	1.95	see note 8	1.4 plus sensor delays
Low $DNBR_{Imb/Rod\ Drop}$	2.10	see note 8	1.4 plus sensor delays
Low $DNBR_{Rod\ Drop}$	3.30	see note 8	1.4 plus sensor delays
Low $DNBR_{High\ Quality}$	25%	see note 8	1.4 plus sensor delays
Low $DNBR_{High\ Quality\ Imb/Rod\ Drop}$	18%	see note 8	1.4 plus sensor delays
Low saturation margin[6]	see note 6	see note 6	see note 6
Excore high neutron flux rate of change	11% NP	2% NP	0.7
High core power level	105% NP	10.2% NP/11.7% NP	0.9 plus sensor delays
Low RCS flow rate (2 loops)	90% NF	4% NF	1.05
Low-low RCS flow rate (one loop)	54% NF	4% NF	1.05
Low RCP speed (2 loops)	93% NS	1% NS	0.75
High neutron flux (IR)	25% NP	10% NP	0.7
Low neutron flux doubling time (IR)	20 s	10 s	0.7

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Notes:

1. The value assumed in the accident analysis (i.e., the analytical limit) is the nominal setpoint (listed in this column) plus or minus the uncertainty (listed in the next

Table 15.0-8—Engineered Safety Features Actuation System (ESFAS) Functions Used in the Accident Analysis (Sheet 2 of 4)

Function	Setpoint	Uncertainty (Normal/ Degraded)	Time Delay (seconds)[4]
MSRT Actuation			
MSRT opening (MSRIV) on SG Pressure > Max1p (affected SG)	1384.7 psia	30 psi/75 psi	0.9 plus 1.8 opening time
MSRT isolation (MSRIV,MSRCV) on SG Pressure < Min3p (affected SG)	579.7 psia	30 psi/75 psi	0.9 plus 5 closing time for MSRIV and 40 for MSRCV
Main Steam Isolation			
MSIV closure on SG pressure drop > Max1p (all SGs)	See note 13	30 psi/75 psi	0.9 plus 5 for valve closure
MSIV closure on SG pressure < Min1p (all SGs)	724.7 psia	30 psi/75 psi	0.9 plus 5 for valve closure
MSIV closure on High Containment pressure	See Containment Isolation function below		
SG Isolation Signal	See SG Isolation function below		
Main Feedwater Isolation			
MFW full load ~~closure~~isolation on Reactor Trip (all SGs)	Not Applicable	Not Applicable	Following TT, 25 for isolation valve closure and 40 for control valve closure
MFW full load isolation on SG Level > Max1p (NR) (affected SG)[10]	69% NR	9.5%/11.5%	1.5 plus 25 for isolation valve closure and 40 for control valve closure
MFW SSS isolation on SG Level > Max0p (NR) for period of time (affected SG)	65% NR for 10 sec w RT	9.5%/11.5%	1.5 plus 20 for valve closure
MFW SSS isolation on SG pressure drop > Max2p (affected SG)	See note 14	30 psi/75 psi	0.9 plus 20 for valve closure
MFW SSS isolation on SG pressure < Min2p (affected SG)	579.7 psia	30 psi/75 psi	0.9 plus 20 for valve closure
MFW SSS isolation on High Containment pressure	See Containment Isolation function below		
SG Isolation Signal	See SG Isolation function below		

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Table 15.0-8—Engineered Safety Features Actuation System (ESFAS) Functions Used in the Accident Analysis (Sheet 3 of 4)

Function	Setpoint	Uncertainty (Normal/ Degraded)	Time Delay (seconds)[4]
Containment Isolation			
Containment equipment compartment pressure > Max1p (Stage 1)	~~4~~18.7 ~~psig~~psia	0.5 psi	0.9
Containment service compartment pressure (NR) > Max2p (Stage 1)	18.7 psia	0.5 psi	0.9
Containment activity > Max1p (Stage 1)	100 X background		
SIS Actuation Signal (Stage 1)	Not applicable	Not applicable	Not applicable
Containment service compartment pressure (WR) > Max~~2~~3p (Stage 2)	36.3 psia	Not applicable	0.9
CVCS Charging Isolation			
CVCS charging line isolation on pressurizer level > Max2p	80%	5.5%/8.0%	1.5 plus 40 for valve closure
CVCS Isolation for Ant-Dilution			
Anti-Dilution (power)	See note 5	See note 8	66 + 40[6]
Anti-Dilution (shutdown)	See note 5	See note 8	66 + 40[6]
Anti-Dilution (shutdown no RCPs)	927 ppm	See note 7	66 + 40[6]
Steam Generator Isolation			
MSRT Setpoint Increase on SG Level > Max2p + partial cooldown initiated (affected SG)	85% NR[11] (1435.5 psia)	9.5%/11.5% (30 psi / 75 psi)	1.5
MSRT setpoint increase on high steam line activity + partial cooldown initiated (affected SG)[2]	See note 2 (1435.5 psia)	See note 2 (30 psi/75 psi)	See note 2.
MSIV closure on SG level > Max2p (NR) + partial cooldown Initiated (affected SG)	85% NR[11]	9.5%/11.5%	1.5 plus 5 for valve closure
MSIV closure on high steam line activity + partial cooldown initiated (affected SG)[2]	See note 2.	See note 2.	See note 2.
MFW SSS Isolation on SG Level > Max2p (NR) + partial cooldown initiated (affected SG)	85% NR[11]	9.5%/11.5%	1.5 plus 20 for valve closure
MFW SSS isolation on high steam line activity + partial cooldown initiated (affected SG)[2]	See note 2	See note 2	See note 2

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Table 15.0-8—Engineered Safety Features Actuation System (ESFAS) Functions Used in the Accident Analysis (Sheet 4 of 4)

Function	Setpoint	Uncertainty (Normal/ Degraded)	Time Delay (seconds)[4]
EFWS isolation on SG Level (NR) > Max2p + partial cooldown initiated (affected SG)	85% NR[11]	9.5%/11.5%	1.5 plus 60 for valve closure
EFWS isolation on High Steam Line Activity + partial cooldown initiated (affected SG)[2]	See note 2.	See note 2.	See note 2.
Reactor Coolant Pump Trip			
RCP Trip on ΔP Over RCP < Min1p + SIS Signal	80% nominal	3%/5%	3.9[12]
MCR AC System isolation			
MCR air intake activity > Max1p	3 X background		
Turbine Trip on RT			
Confirmation of RT	Following RT	Not Applicable	1.0
EDG on LOOP or degraded voltage[17]			
EBS	Manual	Not Applicable	Not Applicable
Hydrogen Mixing Dampers Opening			
Containment service compartment pressure (NR) > Max1p	17.4 psia	±0.5 psia	18
Containment equipment compartment/ containment service compartment ΔP > Max1p	0.5 psi	±30%	18

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Notes:

1. EFWS actuation on LOOP and SIS is assumed in the SGTR to minimize the margin to overfill. It is also credited in SBLOCA. This function does not have a specific setpoint, uncertainty, or delay.

2. The accident analysis does not credit automatic actions based on MSL activity but uses MSL activity for input to operator action. This function does not have a specific setpoint, uncertainty, or delay.

3. EFWS actuation also results in SG blowdown isolation.

4. Represents the total time for completion of the function. Includes sensor delay, I&C delay (includes PS computerized portion, and PACS delays), and other delays as noted until the function is completed.

Table 3.3.1-1 (page 2 of 97)
Protection System Sensors, Manual Actuation Switches,
Signal Processors, and Actuation Devices

COMPONENT	REQUIRED NUMBER OF SENSORS, SWITCHES, SIGNAL PROCESSORS, OR ACTUATION DEVICES	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	MINIMUM REQUIRED FOR FUNCTIONAL CAPABILITY	CONDITION	SURVEILLANCE REQUIREMENTS
6. Cold Leg Temperature (Wide Range)	4	1,2(eg),3(ee),4(e)(f)	3	N,S	SR 3.3.1.5 SR 3.3.1.6(b)(c) SR 3.3.1.10
	4	4(e)	3	O,S	SR 3.3.1.5 SR 3.3.1.6(b)(c) SR 3.3.1.10
	4	5(ee)(f), 6(f),(h)	2	Q,S	SR 3.3.1.5 SR 3.3.1.6(b)(c) SR 3.3.1.10
7. Containment Equipment Compartment Pressure	4	1,2,3,4	3	N	SR 3.3.1.5 SR 3.3.1.6(b)(c) SR 3.3.1.10
8. Containment Service Compartment Pressure (Narrow Range)	4	1,2,3,4	3	N	SR 3.3.1.5 SR 3.3.1.6(b)(c) SR 3.3.1.10
9. Containment Service Compartment Pressure (Wide Range)	4	1,2,3,4	3	N	SR 3.3.1.5 SR 3.3.1.6(b)(c) SR 3.3.1.10
10. Containment Equipment Compartment/ Containment Service Compartment Delta Pressure	2 per division, 4 divisions	1,2,3,4	1 per division, 3 divisions	N	SR 3.3.1.5 SR 3.3.1.6(b)(c) SR 3.3.1.10

(b) If the as-found sensor calibration setting values are outside their predefined as-found tolerance for the calibrations settings (e.g., 0, 25, 50, 75, and 100%), then the sensor shall be evaluated to verify that it is functioning as required before returning the sensor to service.

(c) The sensor shall be calibrated such that the as-left sensor calibration setting values are within the as-left tolerance around the calibration settings at the completion of the surveillance; otherwise, the sensor shall be declared inoperable. The methodologies used to determine the as-found and the as-left CALIBRATION setting tolerances are specified in a document controlled under 10 CFR 50.59.

(ce) With P7 permissive P7 inhibited (one or more RCPs in operation).

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(eg) With P5 permissive P5 validated.

(fh) When Pressurizer Safety Relief Valve (PSRV) OPERABILITY is required by LCO 3.4.11.

Table 3.3.1-2 (page 3 of ~~7~~8)
Acquisition and Processing Unit Requirements Referenced from Table 3.3.1-1

TRIP / ACTUATION FUNCTION / PERMISSIVE	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	MINIMUM REQUIRED FOR FUNCTIONAL CAPABILITY(a)	NOMINAL ~~LIMITING~~ TRIP SETPOINT ~~/ DESIGN LIMIT~~	CONDITION
B. ENGINEERED SAFETY FEATURES ACTUATION SYSTEM (ESFAS) SIGNALS				
1. Turbine Trip on Reactor Trip (RT)	1	3 divisions	[Reactor Trip for 1 sec.]	I
2.a. Main Feedwater Full Load Isolation on Reactor Trip (All SGs)	1,2(~~k~~i),3(~~k~~i)	3 divisions	[NA]	M
2.b. Main Feedwater Full Load Isolation on High SG Level (Affected SG~~s~~)	1,2(~~k~~i),3(~~k~~i)	3 divisions	[69% Narrow Range(~~b~~)(~~c~~)]	M
2.c. Startup and Shutdown System (SSS) ~~Feedwater~~ Isolation on SG Pressure Drop (Affected SG~~s~~)	1,2(~~l~~j),3(~~l~~j)	3 divisions	[29 psi/min; 247 psi < steady state; Max 943 psia(~~b~~)(~~c~~)]	M
2.d. ~~Startup and Shutdown System~~SSS ~~Feedwater~~ Isolation on Low SG Pressure (Affected SG~~s~~)	1,2(~~l~~j),3(~~j~~h)(~~l~~j)	3 divisions	[580 psia(~~b~~)(~~c~~)]	L
2.e. ~~Startup and Shutdown System~~SSS ~~Feedwater~~ Isolation on High SG Level for Period of Time (Affected SG~~s~~)	1,2(~~l~~j),3(~~l~~j)	3 divisions	[65% Narrow Range for 10 sec.(~~b~~)(~~c~~)]	M
2.f. SSS Isolation on High Containment Pressure (All SGs)	1,2,3,4	3 divisions	[18.7 psia]	N
3.a. SIS Actuation on Low Pressurizer Pressure	1,2,3(~~j~~h)	3 divisions	[1668 psia(~~b~~)(~~c~~)]	L
3.b. SIS Actuation on Low Delta P_{sat}	3(~~m~~k),4(~~n~~l)	3 divisions	[220 psi(~~b~~)(~~c~~)]	O

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(a) A division is OPERABLE provided: a) the minimum sensors required for functional capability for all sensors providing input to the Trip/Actuation Function/Permissive are OPERABLE; and b) the associated signal processors are OPERABLE.

~~(b) If the as-found setpoint is outside its predefined as-found tolerance, then the Trip/Actuation Function shall be evaluated to verify that it is functioning as required before returning the Trip/Actuation Function to service.~~

~~(c) The setpoint shall be reset to a value that is within the as-left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the division shall be declared inoperable. Setpoints more conservative than the LTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures to confirm Trip/Actuation Function performance. The methodologies used to determine the as-found and the as-left tolerances are specified in a document controlled under 10 CFR 50.59.~~

(~~j~~h) With P12 permissive ~~P12~~ inhibited.

(~~k~~i) Except when all MFW full load lines are isolated.

(~~l~~j) Except when all MFW full load and low load lines are isolated.

(~~m~~k) With P12 permissive ~~P12~~ validated.

(~~n~~l) With P15 permissive ~~P15~~ inhibited.

Table 3.3.1-2 (page 4 of 78)
Acquisition and Processing Unit Requirements Referenced from Table 3.3.1-1

TRIP / ACTUATION FUNCTION / PERMISSIVE	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	MINIMUM REQUIRED FOR FUNCTIONAL CAPABILITY(a)	NOMINAL LIMITING TRIP SETPOINT / DESIGN LIMIT	CONDITION
3.c. SIS Actuation on Low RCS Loop Level	4(om)	3 divisions	[18.9 in.(b)(c)]	O
	5(m),6(m)	2 divisions		R
4. RCP Trip on Low Delta Pressure across RCP with SIS Actuation	1,2,3,4	3 divisions	[80% Nominal Pressure(b)(c)]	N
5. Partial Cooldown Actuation on SIS Actuation	1,2,3	3 divisions	[NA]	M
6.a. Emergency Feedwater System (EFWS) Actuation on Low-Low SG Level (Affected SGs)	1,2,3	3 divisions	[40% Wide Range(b)(c)]	M
6.b. EFWS Actuation on Loss of Offsite Power (LOOP) and SIS Actuation (All SGs)	1,2	3 divisions	[NA]	J
7.a. Main Steam Relief Train (MSRT) Actuation on High SG Pressure (Affected SG)	1,2,3,4(pn)	3 divisions	[1385 psia(b)(c)]	N
7.b. MSRT Isolation on Low SG Pressure (Affected SG)	1,2,3(jh)	3 divisions	[580 psia(b)(c)]	L
8.a. Main Steam Isolation Valve (MSIV) Isolation on SG Pressure Drop (All SGs)	1,2,3(qo)	3 divisions	[29 psi/min; 102 psi < steady state; Max 1088 psia(b)(c)]	M
8.b. MSIV Isolation on Low SG Pressure (All SGs)	1,2,3(jh)(qo)	3 divisions	[725 psia(b)(c)]	L
8.c. MSIV Isolation on High Containment Pressure (All SGs)	1,2,3,4	3 divisions	[18.7 psia]	N

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(a) A division is OPERABLE provided: a) the minimum sensors required for functional capability for all sensors providing input to the Trip/Actuation Function/Permissive are OPERABLE; and b) the associated signal processors are OPERABLE.

(b) If the as-found setpoint is outside its predefined as-found tolerance, then the Trip/Actuation Function shall be evaluated to verify that it is functioning as required before returning the Trip/Actuation Function to service.

(c) The setpoint shall be reset to a value that is within the as-left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the division shall be declared inoperable. Setpoints more conservative than the LTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures to confirm Trip/Actuation Function performance. The methodologies used to determine the as-found and the as-left tolerances are specified in a document controlled under 10 CFR 50.59.

(jh) With P12 permissive P12 inhibited.

(om) With P15 permissive P15 validated.

(pn) When the SGs are relied upon for heat removal.

(qo) Except when all MSIVs are closed.

Table 3.3.1-2 (page 67 of 78)
Acquisition and Processing Unit Requirements Referenced from Table 3.3.1-1

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TRIP / ACTUATION FUNCTION / PERMISSIVE	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	MINIMUM REQUIRED FOR FUNCTIONAL CAPABILITY[(a)]	NOMINAL LIMITING TRIP SETPOINT / DESIGN LIMIT	CONDITION
14. Hydrogen Mixing Dampers Opening	1,2,3,4	3 divisions	[17.4 psia on the Containment Service Compartment Pressure (NR) sensors or 0.5 psi on the Containment Equipment Compartment / Containment Service Compartment Delta Pressure sensors]	N
C. PERMISSIVES				
P2 - Flux (Power Range) Measurement Higher than First Threshold	1 (≥≥ 10% RTP)	3 divisions	[10% RTP]	H
P3 - Flux (Power Range) Measurement Higher than Second Threshold	1 (≥≥ 70% RTP)	3 divisions	[70% RTP]	G
P5 - Flux (Intermediate Range) Measurement Higher than Threshold	1,2 (≥≥ 10^{-5}% RTP)	3 divisions	[10^{-5}% RTP]	J

(a) A division is OPERABLE provided: a) the minimum sensors required for functional capability for all sensors providing input to the Trip/Actuation Function/Permissive are OPERABLE; and b) the associated signal processors are OPERABLE.

(b) If the as-found setpoint is outside its predefined as-found tolerance, then the Trip/Actuation Function shall be evaluated to verify that it is functioning as required before returning the Trip/Actuation Function to service.

(c) The setpoint shall be reset to a value that is within the as-left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the division shall be declared inoperable. Setpoints more conservative than the LTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures to confirm Trip/Actuation Function performance. The methodologies used to determine the as-found and the as-left tolerances are specified in a document controlled under 10 CFR 50.59.

(e) As specified in the COLR.

Table 3.3.1-2 <u>(page 8 of 8)</u>
Acquisition and Processing Unit Requirements Referenced from Table 3.3.1-1

TRIP / ACTUATION FUNCTION / PERMISSIVE	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	MINIMUM REQUIRED FOR FUNCTIONAL CAPABILITY(a)	<u>NOMINAL</u> ~~LIMITING~~ TRIP SETPOINT ~~/ DESIGN LIMIT~~	CONDITION
P7 - RCP Not in Operation	3(~~t~~r),4(~~t~~r)	3 divisions	[~~50% no load current~~<u>90% nominal speed for 600 sec.</u>]	O
	5(~~t~~r),6(~~t~~r)	2 divisions		Q
P8 - Shutdown Rod Cluster Control Assembly Position Lower than Threshold	3(~~u~~s),4(~~u~~s)	3 divisions	[~~All rods in~~<u>NA</u>]	O
	5(~~u~~s)	2 divisions		Q
P12 - Pressurizer Pressure Lower than Threshold	3 (RCS < 2005 psia),4(~~n~~l)	3 divisions	[2005 psia]	O
P14 - Hot Leg Pressure and Hot Leg Temperature Lower than Thresholds	1,2,3,4(~~p~~n)	3 divisions	[350ºF and 464 psia]	N
P15 - Hot Leg Pressure and Hot Leg Temperature Lower than Thresholds and RCPs Shutdown	4	3 divisions	[350ºF, 464 psia, and <u>90% nominal speed for 600 sec.</u> ~~50% no load current~~]	O
	5, 6	2 divisions		R
P16 - Hot Leg Pressure and Delta P_{sat} Lower than Thresholds, RCP Not in Operation, and Time Elapsed since Safety Injection start	1, 2, 3, 4	3 divisions	[290 psia, P_{sat} 73 psi, <u>90% nominal speed for 600 sec.</u> ~~50% no load current~~, and 1~~.5~~ hr~~s~~ post-SI]	N
P17 - Cold Leg Temperature Lower than Threshold	4(~~v~~t)	3 divisions	[248ºF]	<u>O,</u>S
	5(~~v~~t),6(~~v~~t)	2 divisions		S

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(a) A division is OPERABLE provided: a) the minimum sensors required for functional capability for all sensors providing input to the Trip/Actuation Function/Permissive are OPERABLE; and b) the associated signal processors are OPERABLE.

~~(b) If the as-found setpoint is outside its predefined as-found tolerance, then the Trip/Actuation Function shall be evaluated to verify that it is functioning as required before returning the Trip/Actuation Function to service.~~

~~(c) The setpoint shall be reset to a value that is within the as-left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the division shall be declared inoperable. Setpoints more conservative than the LTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures to confirm Trip/Actuation Function performance. The methodologies used to determine the as-found and the as-left tolerances are specified in a document controlled under 10 CFR 50.59.~~

(~~n~~<u>l</u>) With P<u>15 p</u>ermissive ~~P15~~ inhibited.

(~~p~~<u>n</u>) When the SGs are relied upon for heat removal.

(~~t~~<u>r</u>) With P<u>7 p</u>ermissive ~~P7~~ validated (no RCPs in operation).

(~~u~~<u>s</u>) With P<u>7 p</u>ermissive ~~P7~~ inhibited (one or more RCPs in operation).

(~~v~~<u>t</u>) When PSRV OPERABILITY <u>is</u> required by LCO 3.4.11.

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.2.1	Verify each ECCS manual, power operated, and automatic valve in the flow path, that is not locked, sealed, or otherwise secured in position, is in the correct position.	31 days
SR 3.5.2.2	Verify ECCS piping is full of water.	31 days
SR 3.5.2.3	Verify each ECCS pump's developed head at the test flow point is greater than or equal to the required developed head.	In accordance with the Inservice Testing Program
SR 3.5.2.4	Verify each ECCS automatic valve in the flow path that is not locked, sealed, or otherwise secured in position, actuates to the correct position on an actual or simulated actuation signal.	24 months
SR 3.5.2.5	Verify each ECCS pump starts automatically on an actual or simulated actuation signal.	24 months
SR 3.5.2.6	Verify, by visual inspection, each ECCS train suction inlet from the In-Containment Refueling Water Storage Tank is not restricted by debris and the suction inlet trash racks and screens show no evidence of structural distress or abnormal corrosion.	24 months
SR 3.5.2.7	Verify that the flow split for hot leg injection is ≥ 75% of LHSI flow.	24 months

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3.6 CONTAINMENT SYSTEMS

3.6.9 CONVECT System

LCO 3.6.9 The CONVECT System shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

---NOTE---

Separate Condition entry is allowed for each Hydrogen Mixing Damper and rupture or convection foil.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Hydrogen Mixing Dampers (HMD) inoperable.	A.1 Restore HMD to OPERABLE status.	72 hours
B. One or more rupture or convection foils is inoperable.	B.1 Restore foil to OPERABLE status.	72 hours
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 3. AND C.2 Be in MODE 5.	6 hours 36 hours

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SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.9.1	Verify each HMD opens automatically on an actual or simulated actuation signal.	24 months
SR 3.6.9.2	Verify, by visual inspection, each rupture and convection foil is in place, has no evidence of structural deterioration, and is not impaired by debris.	24 months

3.6 CONTAINMENT SYSTEMS

3.6.10 Reactor Containment Building (RCB) Compartment Doors

LCO 3.6.10 The RCB compartment doors listed in Table 3.6.10-1 shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

---NOTE---

Separate Condition entry is allowed for each RCB compartment door.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A One or more RCB compartment doors inoperable.	A.1 Restore RCB compartment door to OPERABLE status.	72 hours
B. Required Action and associated Completion Time met.	B.1 Be in MODE 3. AND B.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.6.10.1 Verify, by visual inspection, each RCB compartment door in Table 3.6.10-1 is not impaired by debris.	24 months
SR 3.6.10.2 Verify each Radiation Door in Table 3.6.10-1 begins to open at less than the indicated torque	24 months

Table 3.6.10-1

RCB Compartment Doors

---REVIEWER'S NOTE---
Torque values required to open each Radiation Door at an assumed differential pressure of 2.9 psid +20% will be provided by the COL applicant.

RCB Elevation and Door Number	Door Function – Pressure Relief	Opening Torque
-8 ft Door 4	Non-Radiation Door, Blowout Panel	NA
-8 ft Door 7	Non-Radiation Door, Blowout Panel	NA
-8 ft Door 10	Non-Radiation Door, Blowout Panel	NA
-8 ft Door 11	Non-Radiation Door, Blowout Panel	NA
-8 ft Door 13	Non-Radiation Door, Blowout Panel	NA
-8 ft Door 14	Non-Radiation Door, Blowout Panel	NA
+5 ft Door 4	Radiation Door, Hinges Swing Open	[ ] ft-lb
+5 ft Door 5	Radiation Door, Hinges Swing Open	[ ] ft-lb
+5 ft Door 13	Radiation Door, Hinges Swing Open	[ ] ft-lb
+5 ft Door 14	Radiation Door, Hinges Swing Open	[ ] ft-lb
+29 ft Door 2	Radiation Door, Hinges Swing Open	[ ] ft-lb
+45 ft Door 2	Radiation Door, Hinges Swing Open	[ ] ft-lb
+45 ft Door 15	Non-Radiation Door, Blowout Panel	NA

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Inhibiting Inhibition of the P13 permissive automatically enables the High SG Level trip when the hot leg temperature is greater than or equal to approximately 200°F. When below this threshold, the trip is disabled by validating manual validation of the P13 permissive P13.

19. High Containment Pressure

In case of a postulated initiating event leading to water or steam discharge into the containment, a reactor trip is performed in order to ensure containment integrity and to adapt the reactor power to the capacity of the safety systems. This trip protects against the following postulated accidents or AOOs:

- Increase in heat removal by secondary system,
- Decrease in heat removal by the secondary system, and
- Decrease in reactor coolant inventory.

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This function is also necessary to actuate the Containment Isolation (Stage 1) on High Containment Pressure Engineered Safety Feature (ESF) function.

The High Containment Pressure trip requires four divisions of the following sensors and processors to be OPERABLE in MODES 1, 2, 3, and 4.

- Containment Equipment Compartment Pressure sensors,
- Containment Service Compartment Pressure (Narrow Range) sensors,
- APUs, and
- ALUs.

In case of a postulated initiating event leading to water or steam discharge into the containment, a reactor trip is performed in order to ensure containment integrity and to adapt the reactor power to the capacity of the safety systems. The LTSP NTSP is set high enough to allow for small pressure increases in containment expected during normal operation (i.e., plant heatup) and is not indicative of an abnormal condition. It is set low enough to initiate a reactor trip when an abnormal condition is indicated.

There are no permissives associated with this trip.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The automatic SSS Isolation on High SG Level for Period of Time function requires four divisions of the following sensors and processors to be OPERABLE:

- RTCB Position Indication sensors,
- SG Level (Narrow Range) sensors,
- APUs, and
- ALUs.

The SSS Isolation on High SG Level for Period of Time ~~LTSP~~ NTSP is set high enough to avoid spurious actuation but low enough in order to prevent water level in the SGs from rising and entering the steam lines.

~~Inhibiting~~ Inhibition of the P13 permissive automatically enables the SSS Isolation on High SG Level for Period of Time function when the hot leg temperature is greater than or equal to approximately 200°F. When below this threshold, the function is disabled by ~~validating~~ manual validation of the P13 permissive ~~P13~~.

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f. SSS Isolation on High Containment Pressure (All SGs)

The automatic SSS Isolation on High Containment Pressure (All SGs) function requires four divisions of the following sensors and processors to be OPERABLE in MODES 1, 2, 3, and 4:

- Containment Equipment Compartment Pressure sensors,
- Containment Service Compartment Pressure (Narrow Range) sensors,
- APUs, and
- ALUs.

The NTSP is high enough to allow for small pressure increases in containment expected during normal operation (i.e., plant heatup) and is not indicative of an abnormal condition. It is low enough to initiate a SSS isolation when an abnormal condition is indicated.

There are no permissives associated with this function.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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c. Isolation on High Containment Pressure (All SGs)

For most main steam line pipe breaks, the affected SG depressurizes. For small breaks, the setpoint for MSIV Isolation on SG Pressure Drop or Low SG Pressure may not promptly detect the break. This function isolates all four MSIVs in the event of a small steam line break in order to limit mass and energy releases into the containment.

The automatic MSIV Isolation on High Containment Pressure (All SGs) function requires four divisions of the following sensors and processors to be OPERABLE in MODES 1, 2, 3, and 4:

- Containment Equipment Compartment Pressure,
- Containment Service Compartment Pressure (Narrow Range) sensors,
- APUs, and
- ALUs.

The NTSP is high enough to allow for small pressure increases in containment expected during normal operation (i.e., plant heatup) and is not indicative of an abnormal condition. It is low enough to initiate a MSIV isolation when an abnormal condition is indicated.

There are no permissives associated with this function.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

9. Containment Isolation

a. Isolation (Stage 1) on High Containment Pressure

In case of a LOCA, the containment has to be isolated in order to prevent release of radioactivity to the environment.

The automatic Stage 1 Containment Isolation (Stage 1)on High Containment Pressure function requires four divisions of the following sensors and processors to be OPERABLE in MODES 1, 2, 3, and 4:

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- Containment Equipment Compartment Pressure sensors,
- Containment Service Compartment Pressure (Wide Narrow Range) sensors,
- Containment Service Compartment Pressure (Wide Range) sensors,
- APUs, and
- ALUs.

The LTSP NTSP for the Stage 1 Containment Isolation on High Containment Pressure function is set high enough to avoid spurious operation but low enough to ensure offsite dose consequences are maintained below 10 CFR 50.34 and 10 CFR 100.21 limits.

There are no permissives associated with this function.

b. Isolation (Stage 1) on SIS Actuation

In case of the listed events, the containment has to be isolated in order to prevent release of radioactivity to the environment.

This function mitigates the following postulated accidents or AOOs:

- Inadvertent opening of a pressurizer pilot operated safety valve, and
- LOCA.

The automatic Stage 1 Containment Isolation (Stage 1) on SIS Actuation function requires four divisions of the following processors to be OPERABLE in MODES 1, 2, 3, and 4:

- APUs, and
- ALUs.

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

14. Hydrogen Mixing Dampers Opening

In case of a postulated initiating event leading to water or steam discharge into the containment, internal containment dampers are opened in order to promote containment atmospheric mixing.

The automatic Hydrogen Mixing Dampers Opening function requires four divisions of the following sensors and processors to be OPERABLE in MODES 1, 2, 3, and 4:

- Containment Service Compartment Pressure (Narrow Range) sensors,
- Containment Equipment Compartment / Containment Service Compartment Delta Pressure sensors,
- APUs, and
- ALUs.

The NTSP is high enough to avoid spurious operation but low enough to ensure offsite dose consequences are maintained below 10 CFR 50.34 and 10 CFR 100.21 limits.

There are no permissives associated with this function.

C. PROTECTION SYSTEM PERMISSIVES

Protection System permissives are provided to ensure reactor trips and ESF are in the correct configuration for the current unit status. They back up operator actions to ensure Functions are not bypassed during unit conditions under which the safety analysis assumes the Functions are not bypassed. Therefore, the permissive Functions do not need to be OPERABLE when the associated Reactor Trip or ESF functions are outside the applicable MODES. The permissives are:

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Hot leg pressure (WR) measurements and Delta P_{sat} (calculated separately) are each compared to a setpoint. The following logic is used:

- Two-out-of-four hot leg pressure measurements are less than a setpoint (approximately 290 psia),
- Two out of four of the Delta P_{sat} measurements are less than a setpoint (approximately 73 psi),
- RCPs indicating stopped (see P15 permissive), and
- SIS actuation followed by a delay (approximately 1 hour).

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Once these conditions are met, the operator is prompted to manually validate the P16 permissive.

12. P17 - Cold Leg Temperature Lower than Threshold

The P17 permissive corresponds to the temperature conditions where brittle fracture protection is required.

The P17 permissive is utilized in the following reactor trips or ESF functions:

- ESF 11.a: CVCS Charging Line Isolation on High-High Pressure Level,
- ESF 12.a: PSRV Actuation - First Valve, and
- ESF 12.b: PSRV Actuation - Second Valve.

The P17 permissive requires four divisions of the following sensors and processors to be OPERABLE when Pressurizer Safety Relief Valve OPERABILITY is required by LCO 3.4.11, "Low Temperature Overpressure Protection (LTOP)":

- Cold Leg Temperature (Wide Range) sensors,
- APUs, and
- ALUs.

The value for the P17 permissive ~~P17~~ is the threshold for actuation of cold overpressure mitigation systems.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

These sensors support the following functions and Permissives:

- Reactor Trip 4: High Core Power Level,
- Reactor Trip 5: Low Saturation Margin,
- ESF 11.c: CVCS Isolation on ADM - Standard Shutdown Conditions, and
- P17 permissive P17: Cold Leg Temperature Lower than Threshold.

7. Containment Equipment Compartment Pressure

Four Containment Equipment Compartment Pressure sensors are required to be OPERABLE in MODES 1, 2, 3 and 4. These sensors support the following functions:

- Reactor Trip 19: High Containment Pressure function, which in turn supports ESF 9a: Containment Isolation (Stage 1) on High Containment Pressure,.
- ESF 2.f: SSS Isolation on High Containment Pressure (All SGs), and
- ESF 8.c: MSIV Isolation on High Containment Pressure (All SGs).

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8. Containment Service Compartment Pressure (Narrow Range)

Four Containment Service Compartment Pressure (Narrow Range) sensors are required to be OPERABLE in MODES 1, 2, 3 and 4. These sensors support the following functions:

- Reactor Trip 19: High Containment Pressure function, which in turn supports ESF 9a: Containment Isolation (Stage 1) on High Containment Pressure, and
- ESF 2.f: SSS Isolation on High Containment Pressure (All SGs),
- ESF 8.c: MSIV Isolation on High Containment Pressure (All SGs), and
- ESF 14: Hydrogen Mixing Dampers Opening.

9. Containment Service Compartment Pressure (Wide Range)

Four Containment Service Compartment Pressure (Wide Range) sensors are required to be OPERABLE in MODES 1, 2, 3, and 4. These sensors support the following functions:

- ESF 9.a: Containment Isolation (Stage 1) on High Containment Pressure, and
- ESF 9.c: Containment Isolation (Stage 2) on High-High Containment Pressure.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

10. Containment Equipment Compartment / Containment Service Compartment Delta Pressure

Two Containment Equipment Compartment / Containment Service Compartment Delta Pressure sensors per division (8 total) are required to be OPERABLE in MODES 1, 2, 3 and 4. These sensors support ESF 14: Hydrogen Mixing Dampers Opening function.

11. Hot Leg Pressure (Narrow Range)

Four Hot Leg Pressure (Narrow Range) sensors are required to be OPERABLE in MODES 4, 5, and 6 when the PSRVs are required to be OPERABLE per LCO 3.4.11, "Low Temperature Overpressure Protection (LTOP)." These sensors support the following ESF functions:

- ESF 12.a: PSRV Actuation - First Valve, and
- ESF 12.b: PSRV Actuation - Second Valve.

1210. Hot Leg Pressure (Wide Range)

Four Hot Leg Pressure (Wide Range) sensors are required to be OPERABLE in MODES 1, 2, 3, 4, 5, and 6., and when the PSRVs are required to be OPERABLE per LCO 3.4.11, "Low Temperature Overpressure Protection (LTOP)." These sensors support the following reactor trips, ESF functions and Permissives:

- Reactor Trip 4: High Core Power Level,
- Reactor Trip 5: Low Saturation Margin,
- Reactor Trip 13: Low Hot Leg Pressure,
- ESF 3.b: SIS Actuation on Low Delta P_{sat},
- ESF 7.a: MSRT Actuation on High SG Pressure (Affected SG) (for setpoint control),
- ESF 12.a: PSRV Actuation - First Valve,
- ESF 12.b: PSRV Actuation - Second Valve,
- P6 permissive P6: Thermal Core Power Higher than Threshold,
- P14 permissive P14: Hot Leg Pressure and Hot Leg Temperature Lower than Thresholds,
- P15 permissive P15: Hot Leg Pressure and Hot Leg Temperature Lower than Thresholds and RCPs Shutdown, and
- P16 permissive P16: Hot Leg Pressure and Delta P_{sat} Lower than Thresholds, RCPs Not in Operation, and Time Elapsed since Safety Injection Start.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

MANUAL ACTUATION SWITCHES

1. Reactor Trip

Four manual Reactor Trip switches are required to be OPERABLE in:

- MODES 1 and 2, and
- MODES 3, 4, and 5 with the RCSL System capable of withdrawing a RCCA or one or more RCCAs not fully inserted.

These switches support all reactor trip functions.

2. SIS Actuation

Four manual SIS Actuation switches are required to be OPERABLE in MODES 1, 2, 3, 4, 5, and 6. These switches support the following functions:

- ESF 3.a: SIS Actuation on Low Pressurizer Pressure,
- ESF 3.b: SIS Actuation on Low Delta P_{sat}, and
- ESF 3.c: SIS Actuation on Low RCS Loop Level.

3. SG Isolation

Four manual SG Isolation switches per SG (16 total) are required to be OPERABLE in MODES 1, 2, and 3, and in MODE 4 when the SGs are relied upon for heat removal. These switches support the following functions:

- ESF 2.b: MFW Full Load Isolation on High SG Level (Affected SGs),
- ESF 2.c: SSS Isolation on SG Pressure Drop (Affected SGs),
- ESF 5: Partial Cooldown Actuation on SIS Actuation,
- ESF 6.a: EFWS Actuation on Low-Low SG Level (Affected SGs),
- ESF 8.a: MSIV Isolation on SG Pressure Drop (All SGs), and
- ESF 8.b: MSIV Isolation on Low SG Pressure (All SGs)., and
- ESF 8.c: MSIV Isolation on High Containment Pressure (All SGs).

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Table B 3.3.1-1 (page 910 of 1114)
Protection System (PS) Functional Dependencies

TRIP/ACTUATION FUNCTION/PERMISSIVE	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	COMPLETE DIVISIONS FOR FUNCTIONAL CAPABILITY SENSORS / PROCESSORS	DIVISION 1	DIVISION 2	DIVISION 3	DIVISION 4
14. Hydrogen Mixing Damper Opening	1,2,3,4	3	Containment Service Compartment Pressure (NR) Containment Equipment Compartment / Containment Service Compartment Delta Pressure (2 per division) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Containment Service Compartment Pressure (NR) Containment Equipment Compartment / Containment Service Compartment Delta Pressure (2 per division) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Containment Service Compartment Pressure (NR) Containment Equipment Compartment / Containment Service Compartment Delta Pressure (2 per division) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Containment Service Compartment Pressure (NR) Containment Equipment Compartment / Containment Service Compartment Delta Pressure (2 per division) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)

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BASES

SURVEILLANCE REQUIREMENTS (continued)

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SR 3.5.2.7

This Surveillance verifies that the LHSI flow split between the hot leg and the cold leg when in the hot leg injection mode remains consistent with analysis assumptions. The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage.

REFERENCES

1. 10 CFR 50, Appendix A, GDC 35.
2. 10 CFR 50.46.
3. FSAR Section 6.2.
4. FSAR Chapter 15.
5. NRC Memorandum to V. Stello, Jr., from R.L. Baer, "Recommended Interim Revisions to LCOs for ECCS Components," December 1, 1975.
6. ASME Code for Operation and Maintenance of Nuclear Power Plants.

BASES

APPLICABLE SAFETY ANALYSES (continued)

The IRWST must also meet volume, boron concentration, boron isotopic inventory (i.e., enrichment), and temperature requirements for non-LOCA events. The volume is not an explicit assumption in non-LOCA events since the required volume is a small fraction of the available volume. The deliverable volume limit is set by the required volumes for an outage and is therefore not limiting. The minimum IRWST provides sufficient water depth for ECCS pump NPSH requirements.

The maximum temperature ensures that the amount of cooling provided from the IRWST during the heatup phase of a feedline break is consistent with safety analysis assumptions; the minimum is an assumption in ~~both~~ the MSLB analysis. ~~and inadvertent ECCS actuation analyses, although the inadvertent ECCS actuation event is typically nonlimiting.~~

For a large break LOCA analysis, the minimum water volume of 500,342 gallons and the lower boron concentration limit of 1700 ppm of ≥ 37% enriched boron are used to compute the post LOCA sump boron concentration necessary to assure subcriticality. The large break LOCA is the limiting case since the safety analysis assumes that all control rods are out of the core. This minimum volume bounds the ECCS pump NPSH requirements.

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~~The maximum water volume of 523,703 gallons and the upper limit on boron concentration of 1900 ppm are used to determine the maximum allowable time to switch to hot leg recirculation following a LOCA.~~ The purpose of switching a portion of the LHSI flow from cold leg to hot leg injection is ~~to avoid boron precipitation in the core and~~ to reduce containment pressure and temperature following the accident. This also serves to backflush the loops, reduce the boiling in the top of the core, and recapture any boron precipitation.

The upper temperature limit of 122°F is used in the small break LOCA analysis and containment OPERABILITY analysis. Exceeding this temperature will result in a higher peak clad temperature, because there is less heat transfer from the core to the injected water for the small break LOCA. For the containment response following an MSLB, the lower limit on boron concentration and the upper limit on IRWST water temperature are used to maximize the total energy release to containment.

The minimum temperature value of 59°F is consistent with mechanical requirements, particularly reactor pressure vessel brittle fracture risk.

The IRWST satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

B 3.6 CONTAINMENT SYSTEMS

B 3.6.3 Containment Isolation Valves

BASES

BACKGROUND

The containment isolation valves form part of the containment pressure boundary and provide a means for fluid penetrations not serving accident consequence limiting systems to be provided with two isolation barriers that are closed on a containment isolation signal. These isolation devices are either passive or active (automatic). Manual valves, de-activated automatic valves secured in their closed position (including check valves with flow through the valve secured), blind flanges, and closed systems are considered passive devices. Check valves, or other automatic valves designed to close without operator action following an accident, are considered active devices. Two barriers in series are provided for each penetration so that no single credible failure or malfunction of an active component can result in a loss of isolation or leakage that exceeds limits assumed in the safety analyses. One of these barriers may be a closed system. These barriers (typically containment isolation valves) make up the Containment Isolation System.

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Automatic isolation signals are produced during accident conditions. Containment Isolation stage 1 (CI-1) occurs upon Containment equipment compartment pressure > ~~MAX1p~~Max1p, Containment service compartment pressure > Max2p, Containment service compartment pressure (WR) > Max3p, Containment radiation > ~~MAX1p~~Max1p, or receipt of a Safety Injection System (SIS) signal. The CI-1 signal isolates nonessential process lines in order to minimize leakage of fission product radioactivity. Containment Isolation stage 2 (CI-2) occurs upon Containment service compartment pressure (WR) > ~~MAX2p~~Max3p. The CI-2 signal isolates the remaining process lines, except systems required for accident mitigation.

As a result, the containment isolation valves (and blind flanges) help ensure that the containment atmosphere will be isolated from the environment in the event of a release of fission product radioactivity to the containment atmosphere as a result of a Design Basis Accident (DBA).

The OPERABILITY requirements for containment isolation valves help ensure that containment is isolated within the time limits assumed in the safety analyses. Therefore, the OPERABILITY requirements provide assurance that the containment function assumed in the safety analyses will be maintained.

B 3.6 CONTAINMENT SYSTEMS

B 3.6.4 Containment Pressure

BASES

BACKGROUND

The containment pressure is limited during normal operation to preserve the initial conditions assumed in the accident analyses for a loss of coolant accident (LOCA) or main steam line break (MSLB). These limits also prevent the containment pressure from exceeding the containment design negative pressure differential with respect to the outside atmosphere in the event of transients which result in a negative pressure.

Containment pressure is a process variable that is monitored and controlled. The containment pressure limits are derived from the input conditions used in the containment functional analyses and the containment structure external pressure analysis. Should operation occur outside these limits coincident with a Design Basis Accident (DBA), post accident containment pressures could exceed calculated values and may result in leakage greater than assumed in the accident analysis.

APPLICABLE SAFETY ANALYSES

Containment internal pressure is an initial condition used in the DBA analyses to establish the maximum peak containment internal pressure. The limiting DBAs considered, relative to containment pressure, are the LOCA and MSLB, which are analyzed using computer pressure transients. The worst case LOCA generates larger mass and energy release than the worst case MSLB. Thus, the LOCA event bounds the MSLB event from the containment peak pressure standpoint (Ref. 1).

The initial pressure condition used in the containment analysis was 15.96 psia (1.26 psig). This resulted in a maximum peak pressure from a LOCA of 55.0 psig. The containment analysis (Ref. 1) shows that the maximum peak calculated containment pressure results from the limiting LOCA. P_a is set at 55 psig. The maximum containment pressure resulting from the worst case LOCA, 55.0 psig, does not exceed the containment design pressure, 62 psig.

The containment was also designed for an external pressure load equivalent to -3.0 psig. An inadvertent actuation of the Severe Accident Heat Removal System is not considered a credible event for the U.S. EPR since it is manually actuated for beyond design basis events only

06.02.01-24 (Ref. 1). ~~An inadvertent ventilation system actuation results in a negative pressure transient of less than 0.1 psig.~~

Containment pressure satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

BASES

LCO

Maintaining containment pressure at less than or equal to the LCO upper pressure limit ensures that, in the event of a DBA, the resultant peak containment accident pressure will remain below the containment design pressure. Maintaining containment pressure at greater than or equal to the LCO lower pressure limit ensures that the containment will not exceed the design negative differential pressure ~~following negative pressure transients~~.

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The value~~s chosen~~ for the maximum pressure ~~were~~ was chosen to be less than the value used in the containment analyses. The value ~~chosen~~ for the minimum pressure was chosen to maintain the containment within the design pressure for normal operation ~~or in the event of a negative pressure transient~~.

APPLICABILITY

In MODES 1, 2, 3, and 4, a DBA could cause a release of radioactive material to containment. Since maintaining containment pressure within limits is essential to ensure initial conditions assumed in the accident analyses are maintained, the LCO is applicable in MODES 1, 2, 3 and 4.

In MODES 5 and 6, the probability and consequences of these events are reduced due to the pressure and temperature limitations of these MODES. Therefore, maintaining containment pressure within the limits of the LCO is not required in MODE 5 or 6.

ACTIONS

A.1

When containment pressure is not within the limit of the LCO, it must be restored to within this limit within 1 hour. The Required Action is necessary to return operation to within the bounds of the containment analysis. The 1 hour Completion Time is consistent with the ACTIONS of LCO 3.6.1, "Containment," which requires that containment be restored to OPERABLE status within 1 hour.

B.1 and B.2

If containment pressure cannot be restored to within limits within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

BASES

APPLICABLE SAFETY ANALYSES (continued)

The limiting DBA for the maximum peak containment air temperature is an MSLB. The initial containment average air temperatures assumed in the design basis analyses (Ref. 1) are 86°F and 131°F. This resulted in a maximum containment air temperature of 479°F. The building surface temperature is no greater than the saturation temperature at the building design temperature of 62 psig, or 309°F. The containment has been qualified for this temperature (Ref. 2).

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~~The temperature limit is used to establish the environmental qualification operating envelope for containment. The basis of the containment design temperature, however, is to ensure the performance of safety related equipment inside containment (Refs. 3 and 4).~~

The containment pressure transient is sensitive to the initial air mass in containment and, therefore, to the initial containment air temperature. The limiting DBA for establishing the maximum peak containment internal pressure is ~~an MSLB~~a LOCA. The temperature limit is used in this analysis to ensure that in the event of an accident the maximum containment internal pressure will not be exceeded.

Containment average air temperature satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

LCO

During a DBA, with an initial containment average air temperature less than or equal to the LCO temperature limit, the resultant accident temperature profile assures that the containment structural temperature is maintained below its design temperature and that required safety related equipment will continue to perform its function.

APPLICABILITY

In MODES 1, 2, 3, and 4, a DBA could cause a release of radioactive material to containment. In MODES 5 and 6, the probability and consequences of these events are reduced due to the pressure and temperature limitations of these MODES. Therefore, maintaining containment average air temperature within the limit is not required in MODE 5 or 6.

B 3.6 CONTAINMENT SYSTEMS

B 3.6.9 CONVECT System

BASES

BACKGROUND

The CONVECT System consists of rupture and convection foils installed in the steam generator pressure equalization ceiling and hydrogen mixing dampers (HMDs) installed in the walls between the lower annulus area and the air space of the In-Containment Refueling Water Storage Tank (IRWST).

The steam generator pressure equalization ceiling incorporates rupture foils and convection foils in each of the two steam generator compartments. The rupture foils open passively under differential pressure. Differential pressure causes the foil to pull away from its frame. The convection foils function in the same way as the rupture foils with the added feature that the convection foils open by fusible links on an elevated temperature as well.

Eight HMDs are installed between the IRWST and the annular compartments within the reactor containment building (RCB). The HMDs open on high pressure, differential pressure, and on a loss of power. The HMDs are closed by a motor operator and open on spring energy.

The CONVECT system, along with the RCB compartment doors, allow portions of the RCB to be accessible during operation. The accessible portion consists of the dome area including the main operational floor and the annular rooms, while the inaccessible portion is the equipment rooms (steam generators, reactor coolant pumps, pressurizer, etc.). The two-room containment design supports entry into the accessible service areas and compartments of the RCB during all modes of operation. The RCB ventilation systems are divided into subsystems that provide physically separated ventilation systems to support the two-room concept and limit/control airborne contamination from the non-accessible equipment compartments into the accessible service compartments.

Pressure and temperature variations attributable to normal operation of the HVAC system will not cause the opening of the foils or HMDs since such variations are below the threshold for which the components are designed.

BASES

BACKGROUND (continued)

In the event of a high energy line break (HELB), the RCB is transformed from a two-room configuration into a one-room configuration in order to limit the resulting loads on the RCB structures. The specific function of such a transformation is to achieve an adequate containment layout to equalize pressure between the individual RCB compartments and, by establishing global convection, to promote efficient mixing of the RCB atmosphere. Efficient mixing is necessary to provide the maximum structure surface area for the condensation of released steam.

APPLICABLE SAFETY ANALYSES

The limiting DBAs considered relative to containment pressure and temperature are the loss of coolant accident (LOCA) and the main steam line break (MSLB). The LOCA and MSLB are analyzed using computer codes designed to predict the resultant containment pressure and temperature transients. DBAs are assumed not to occur simultaneously or consecutively.

For a LBLOCA, a large free flow cross-sectional area has to be provided very early in the accident to limit the peak pressure in the RCB. This requirement is fulfilled by the rupture foils which will open on a predefined pressure difference.

For a SBLOCA, only a few of the installed rupture foils would open due to a smaller mass and energy release. The convection foils will open as a result of the elevated compartment temperature.

In the case of an MSLB, the CONVECT System allows atmospheric circulation within the RCB via the rupture and convection foils and HMDs.

The CONVECT System satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

This LCO establishes the minimum equipment requirements to ensure that the CONVECT System rupture and convection foils and HMDs are OPERABLE. Included are the requirements that each rupture and convection foil is in place, has no evidence of structural deterioration, and is not impaired by debris and that the HMDs are demonstrated OPERABLE. The rupture and convection foils and HMDs function to establish global convection to promote efficient mixing of the RCB atmosphere in the event of a DBA.

BASES

APPLICABILITY

In MODES 1, 2, 3, and 4, the HMDs and all rupture foils and convection foils must be OPERABLE.

In MODES 5 and 6, the probability and consequences of a LOCA or MSLB are reduced due to the pressure and temperature limitations in these MODES. Therefore, the CONVECT System is not required in these MODES.

ACTIONS

A Note provides clarification that, for this LCO, separate Condition entry is allowed for each Hydrogen Mixing Damper and rupture or convection foil.

A.1

With one or more HMD(s) inoperable, the inoperable HMD(s) must be restored to OPERABLE status within 72 hours. The 72 hour Completion Time is acceptable taking into account the redundant flow paths provided by the remaining HMDs and the low probability of a DBA occurring in this period.

B.1

With one or more rupture or convection foil(s) inoperable, the inoperable foil(s) must be restored to OPERABLE status within 72 hours. The 72 hour Completion Time is acceptable taking into account the redundant flow paths provided by the remaining foils and the low probability of a DBA occurring in this period.

C.1 and C.2

If an inoperable HMD or rupture or convection foil cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required conditions in an orderly manner and without challenging plant systems.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.6.9.1

This surveillance verifies that each HMD opens on an actual or simulated actuation signal to ensure that each HMD is OPERABLE. The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the need to limit the movement of warmer air from the equipment area to the service area of containment if the Surveillance were performed with the reactor at power. Operating experience has shown that these components usually pass this Surveillance when performed at the 24 month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

SR 3.6.9.2

Verifying, by visual inspection, that each rupture and convection foil is in place, has no evidence of structural deterioration, and is not impaired by debris provides assurance that the foils are free to open in the event of a DBA. The 24 month Frequency is based on passive nature of the foils. Because of the high radiation in the vicinity of the foils during power operation, this Surveillance is normally performed during a shutdown.

REFERENCES

1. FSAR Section 6.2.

B 3.6 CONTAINMENT SYSTEMS

B 3.6.10 Reactor Containment Building (RCB) Compartment Doors

BASES

BACKGROUND

The RCB is divided into two regions, an accessible and a non-accessible portion. The reactor containment building dome, operating area, and designated annular rooms are included in the accessible portion. The equipment spaces inside the secondary shield wall and the primary shield wall are included in the non-accessible portion.

The two-room concept divides the RCB into separate ventilation spaces during normal operation by compartment doors, rupture and convection foils, and hydrogen mixing dampers. During a DBA the two-room volume transitions into a one-room single convective volume where the RCB compartment doors, the rupture and convection foils, and the hydrogen mixing dampers open, as required depending on the location of the pipe break, to turn the RCB into one volume for the DBA.

There are two separate designs for the RCB compartment doors which support the function of turning the RCB into one volume for the DBA mitigation. There are radiation doors that have a pressure relief function to mitigate the DBA where the door swings open to support the two-room to one-room transition. There are non-radiation doors that do not open to relieve the pressure; however, they have built-in blowout panels that functions to relieve the pressure in support of the two-room to one-room transition. The doors that provide access to the equipment compartments are heavy, radiation shield doors. The radiation doors identified in Table 3.6.10-1 are safety-related and designed to open at the designated differential pressure in the event of a DBA to support the transformation of the containment into the one-room configuration. The safety-related doors identified in Table 3.6.10-1 as non-radiation doors incorporate a blow-out panel that is designed to blowout at the designated differential pressure.

APPLICABLE SAFETY ANALYSES

The limiting DBAs considered relative to containment pressure and temperature are high energy line breaks (HELB), including the loss of coolant accident (LOCA). The LOCA and other HELB are analyzed using computer codes designed to predict the resultant containment pressure and temperature transients. DBAs are assumed not to occur simultaneously or consecutively.

Thirteen (13) RCB compartment doors are classified as safety-related and are credited to open to limit compartment pressure and to limit RCB pressure by providing vent paths to additional areas of the RCB.

BASES

APPLICABLE SAFETY ANALYSIS (continued)

The safety-related RCB compartment doors satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

This LCO establishes the minimum equipment requirements to ensure that the RCB compartment doors are OPERABLE. Included are the requirements that each RCB compartment door is not impaired by debris and that the radiation doors open at their design differential pressure. The RCB compartment doors function to limit compartment and RCB pressure.

APPLICABILITY

In MODES 1, 2, 3, and 4, the RCB compartment doors listed in Table 3.6.10-1 must be OPERABLE.

In MODES 5 and 6, the probability and consequences of a LOCA or other HELB are reduced due to the pressure and temperature limitations in these MODES. Therefore, the safety-related RCB compartment doors are not required to be OPERABLE in these MODES.

ACTIONS

A Note provides clarification that, for this LCO, separate Condition entry is allowed for each compartment door.

A.1

With one or more RCB compartment door(s) inoperable, the inoperable door(s) must be restored to OPERABLE status within 72 hours. The 72 hour Completion Time is acceptable taking into account the redundant flow paths provided by the remaining RCB compartment doors and the low probability of a DBA occurring in this period.

B.1 and B.2

If an inoperable RCB compartment door cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required conditions in an orderly manner and without challenging plant systems.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.6.10.1

Verifying, by visual inspection, that each RCB compartment door is not impaired by debris provides reasonable assurance that the radiation doors and non-radiation doors blowout panels are free to open in the event of a DBA. The 24 month Frequency is based on the passive nature of the doors and blowout panels.

Because of the high radiation in the vicinity of the RCB compartment doors during power operation, this Surveillance is normally performed during a shutdown.

SR 3.6.10.2

Verifying the opening torque of each radiation door provides reasonable assurance that the radiation doors have not developed excessive friction. The purpose of the Surveillance is to verify that in the event of a DBA, the radiation doors would open as assumed in the containment analyses. The 24 month Frequency is based on passive nature of the radiation doors.

Because of the high radiation in the vicinity of the radiation doors during power operation, this Surveillance is normally performed during a shutdown.

REFERENCES

1. FSAR Section 6.2.