ArevaEPRDCPEm Resource

From: BRYAN Martin (EXTERNAL AREVA) [Martin.Bryan.ext@areva.com]
Sent: Wednesday, November 17, 2010 2:39 PM
To: Tesfaye, Getachew
Cc: DELANO Karen (AREVA); ROMINE Judy (AREVA); RYAN Tom (AREVA); LENTZ Tony (EXTERNAL AREVA); KANE Steve (EXTERNAL AREVA); HALLINGER Pat (EXTERNAL AREVA); PATTON Jeff (AREVA); RANSOM James (AREVA); WILLIFORD Dennis (AREVA); Miernicki, Michael; GARDNER Darrell (AREVA)
Subject: DRAFT Response to U.S. EPR Design Certification Application RAI No. 300, FSAR Ch. 16 OPEN ITEM, Supplement 5
Attachments: RAI 300 Supplement 5 Response US EPR DC - DRAFT.pdf

Getachew,

Attached is a draft response for RAI 300, 73 parts of Questions 16-311, 16-312, and 16-313 as shown below in advance of the Dec. 16, 2010 final date.

RAI 300 – 16-311, 16-129(a)
RAI 300 – 16-311, 16-129(c)
RAI 300 – 16-311, 16-131(a)
RAI 300 – 16-311, 16-131(b)
RAI 300 – 16-311, 16-131(c)
RAI 300 – 16-311, 16-131(d)
RAI 300 – 16-311, 16-138(a)
RAI 300 – 16-311, 16-141(a)
RAI 300 – 16-311, 16-145(a)
RAI 300 – 16-311, 16-145(d)
RAI 300 – 16-311, 16-147(a)
RAI 300 – 16-311, 16-149(a)
RAI 300 – 16-311, 16-149(b)
RAI 300 – 16-311, 16-150(a)
RAI 300 – 16-311, 16-150(b)
RAI 300 – 16-311, 16-150(c)
RAI 300 – 16-311, 16-151
RAI 300 – 16-311, 16-153
RAI 300 – 16-311, 16-154
RAI 300 – 16-311, 16-162(a)
RAI 300 – 16-311, 16-162(b)
RAI 300 – 16-311, 16-166
RAI 300 – 16-311, 16-167
RAI 300 – 16-311, 16-169(b)
RAI 300 – 16-311, 16-174(a)
RAI 300 – 16-311, 16-180(a)
RAI 300 – 16-311, 16-180(b)
RAI 300 – 16-311, 16-182(a)
RAI 300 – 16-311, 16-182(b)
RAI 300 – 16-311, 16-182(c)
RAI 300 – 16-311, 16-190(a);
RAI 300 – 16-311, 16-190(b)
RAI 300 – 16-311, 16-190(d)
RAI 300 – 16-311, 16-190(e)
RAI 300 – 16-311, 16-190(f)
RAI 300 – 16-311, 16-190(g)

RAI 300 – 16-311, 16-193(b)
RAI 300 – 16-311, 16-193(c)
RAI 300 – 16-311, 16-193(d)
RAI 300 – 16-311, 16-194
RAI 300 – 16-311, 16-195
RAI 300 – 16-311, 16-198
RAI 300 – 16-311, 16-199
RAI 300 – 16-311, 16-208
RAI 300 – 16-311, 16-209

RAI 300 – 16-312, 16-212(a)
RAI 300 – 16-312, 16-212(b)
RAI 300 – 16-312, 16-213
RAI 300 – 16-312, 16-217(b)
RAI 300 – 16-312, 16-217(c)
RAI 300 – 16-312, 16-217(d)
RAI 300 – 16-312, 16-217(f)
RAI 300 – 16-312, 16-219
RAI 300 – 16-312, 16-226
RAI 300 – 16-312, 16-227
RAI 300 – 16-312, 16-234(a)
RAI 300 – 16-312, 16-234(b)

RAI 300 – 16-313, 16-11
RAI 300 – 16-313, 16-22
RAI 300 – 16-313, 16-23(a)
RAI 300 – 16-313, 16-23(b)
RAI 300 – 16-313, 16-26
RAI 300 – 16-313, 16-27
RAI 300 – 16-313, 16-29(b)
RAI 300 – 16-313, 16-33
RAI 300 – 16-313, 16-36
RAI 300 – 16-313, 16-39
RAI 300 – 16-313, 16-40(a)
RAI 300 – 16-313, 16-40(b)
RAI 300 – 16-313, 16-42
RAI 300 – 16-313, 16-43
RAI 300 – 16-313, 16-49(a)
RAI 300 – 16-313, 16-51

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

Thanks,

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 20, 2010 3:30 PM

To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 300, FSAR Ch. 16 OPEN ITEM, Supplement 5

Getachew,

AREVA NP Inc. provided responses to the four questions of RAI No. 300 on March 26, 2010. Supplement 1, Supplement 2, and Supplement 3 responses to RAI No. 300 were sent on May 3, 2010, June 15, 2010, and August 27, 2010, respectively, to provide a revised schedule. Supplement 4 response to RAI No. 300 was sent on October 07, 2010, to provide a partial response to 29 parts of the remaining four questions.

A revised schedule is provided below to allow additional time to address comments and have additional interaction with the staff on the remaining parts of the four questions.

A complete answer is not provided for the remaining 4 questions. The schedule for a technically correct and complete response to these questions is changed and is provided below.

Question #	Response Date
RAI 16 — 311	December 16, 2010
RAI 16 — 312	December 16, 2010
RAI 16 — 313	December 16, 2010
RAI 16 — 314	December 16, 2010

Sincerely,

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

From: BRYAN Martin (External RS/NB)
Sent: Thursday, October 07, 2010 10:55 AM
To: Tesfaye, Getachew
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); LENTZ Tony (External RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 300, FSAR Ch. 16 OPEN ITEM, Supplement 4

Getachew,

AREVA NP Inc. provided responses to the four questions of RAI No. 300 on March 26, 2010. Supplement 1, Supplement 2, and Supplement 3 responses to RAI No. 300 were sent on May 3, 2010, June 15, 2010, and August 27, 2010, respectively, to provide a revised schedule.

The attached file, “RAI 300 Supplement 4 US EPR DC.pdf,” provides a partial response.

The following table indicates the respective pages in the response document, “RAI 300 Supplement 4 US EPR DC.pdf,” that contain AREVA NP’s response to the subject questions.

Question #	Start Page	End Page
RAI 300 — 16-311, Part 16-129(b)	3	3
RAI 300 — 16-311, Part 16-130	4	4
RAI 300 — 16-311, Part 16-138(b)	5	5
RAI 300 — 16-311, Part 16-138(c)	6	6
RAI 300 — 16-311, Part 16-141(b)	7	7
RAI 300 — 16-311, Part 16-144	8	8
RAI 300 — 16-311, Part 16-147(b)	9	9
RAI 300 — 16-311, Part 16-147(c)	10	10
RAI 300 — 16-311, Part 16-147(d)	11	11
RAI 300 — 16-311, Part 16-147(e)	12	12
RAI 300 — 16-311, Part 16-150(d)	13	13
RAI 300 — 16-311, Part 16-162(c)	14	14
RAI 300 — 16-311, Part 16-169(a)	15	15
RAI 300 — 16-311, Part 16-174(b)	16	16
RAI 300 — 16-311, Part 16-185	17	17
RAI 300 — 16-311, Part 16-190(h)	18	18
RAI 300 — 16-311, Part 16-191(a)	19	19
RAI 300 — 16-311, Part 16-191(b)	20	20
RAI 300 — 16-311, Part 16-200	21	21
RAI 300 — 16-311, Part 16-207	22	23
RAI 300 — 16-312, Part 16-217(a)	25	25
RAI 300 — 16-312, Part 16-217(e)	26	26
RAI 300 — 16-312, Part 16-223	27	27
RAI 300 — 16-313, Part 16-18	29	29
RAI 300 — 16-313, Part 16-29(a)	30	30
RAI 300 — 16-313, Part 16-46	31	31
RAI 300 — 16-313, Part 16-49(b)	32	32
RAI 300 — 16-314, Part 16-237(a)	34	34
RAI 300 — 16-314, Part 16-237(b)	35	35

The schedule for a technically correct and complete response to the remaining parts of the four questions remains unchanged and will be provided on October 21, 2010.

Sincerely,

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

From: BRYAN Martin (External RS/NB)
Sent: Friday, August 27, 2010 12:00 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 300, FSAR Ch. 16 OPEN ITEM, Supplement 3

Getachew,

AREVA NP provided technically correct and complete responses to 2 of the 6 questions on March 26, 2010. In a meeting with the NRC on April 27-28, 2010, it was agreed that further interactions should take place prior to formal submittal of the remaining 4 RAI responses. AREVA provided an updated schedule for the remaining 4 responses on May 3, 2010. AREVA provided an updated schedule for the remaining 4 responses on June 15, 2010 to allow for additional interaction with the NRC.

A revised schedule is provided below to allow additional time to address comments and have additional interaction with the staff on the four remaining questions.

A complete answer is not provided for the remaining 4 questions. The schedule for a technically correct and complete response to these questions is changed and is provided below.

Question #	Response Date
RAI 16 — 311	October 21, 2010
RAI 16 — 312	October 21, 2010
RAI 16 — 313	October 21, 2010
RAI 16 — 314	October 21, 2010

Sincerely,

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

From: BRYAN Martin (EXT)
Sent: Tuesday, June 15, 2010 2:32 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); RYAN Tom (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 300, FSAR Ch. 16 OPEN ITEM, Supplement 2

Getachew,

AREVA NP provided technically correct and complete responses to 2 of the 6 questions on March 26, 2010. In a meeting with the NRC on April 27-28, 2010, it was agreed that further interactions should take place prior to formal submittal of the remaining 4 RAI responses. AREVA provided an updated schedule for the remaining 4 responses on May 3, 2010.

Based on the stated availability of the NRC staff, as well as preparation time for their input to these interactions, AREVA is providing a revised schedule below.

A complete answer is not provided for the remaining 4 questions. The schedule for a technically correct and complete response to these questions is changed and is provided below.

Question #	Response Date
RAI 16 — 311	August 31, 2010
RAI 16 — 312	August 31, 2010
RAI 16 — 313	August 31, 2010
RAI 16 — 314	August 31, 2010

Sincerely,

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

From: BRYAN Martin (EXT)
Sent: Monday, May 03, 2010 5:55 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); PANNELL George L (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 300, FSAR Ch. 16 OPEN ITEM, Supplement 1

Getachew,

AREVA NP provided technically correct and complete responses to 2 of the 6 questions on March 26, 2010. In a meeting with the NRC on April 27-28, 2010, it was agreed that further interactions should take place prior to formal submittal of the remaining 4 RAI responses. Based on the stated availability of the NRC staff, as well as preparation time for their input to these interactions, AREVA is providing a revised schedule below.

A complete answer is not provided for the remaining 4 questions. The schedule for a technically correct and complete response to these questions is changed and is provided below.

Question #	Response Date
RAI 16 — 311	June 24, 2010
RAI 16 — 312	June 24, 2010
RAI 16 — 313	June 24, 2010
RAI 16 — 314	June 24, 2010

Sincerely,

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

From: BRYAN Martin (EXT)
Sent: Friday, March 26, 2010 5:39 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); PANNELL George L (AREVA NP INC); WILLIFORD Dennis C (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 300, FSAR Ch. 16 OPEN ITEM

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information RAI 300. The attached file, "RAI 300 Response US EPR DC.pdf" provides technically correct and complete responses to 2 of the 6 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 16-310.

The following table indicates the respective pages in the response document, "RAI 300 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 16 — 310	2	3
RAI 16 — 311	4	9
RAI 16 — 312	10	11
RAI 16 — 313	12	16
RAI 16 — 314	17	17
RAI 16 — 315	18	23

A complete answer is not provided for 4 of the 6 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 16 — 311	May 3, 2010
RAI 16 — 312	May 3, 2010
RAI 16 — 313	May 3, 2010
RAI 16 — 314	May 3, 2010

Sincerely,

Martin (Marty) C. Bryan
Licensing Advisory Engineer
AREVA NP Inc.
Tel: (434) 832-3016
Martin.Bryan.ext@areva.com

From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Thursday, November 19, 2009 5:49 PM
To: ZZ-DL-A-USEPR-DL
Cc: Le, Hien; DeMarshall, Joseph; Kowal, Mark; Hearn, Peter; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 300 (3730,3742),FSAR Ch. 16 OPEN ITEM

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on September 23, 2009, and discussed with your staff on November 18, 2009. Draft RAI Question 16-311 was revised as a result of that discussion to request a revised response to RAI 16-199. The questions in this RAI are OPEN ITEMs in the safety evaluation report for Chapter 16 for Phases 2 and 3 reviews. As such, the schedule we have established for your application assumes technically correct and complete responses prior to the start of Phase 4 review. For any RAI that cannot be answered prior to the start of Phase 4 review, it is expected that a date for receipt of this information will be provided so that the staff can assess how this information will impact the published schedule.

Thanks,

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

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 2271

Mail Envelope Properties (BC417D9255991046A37DD56CF597DB71084B07EF)

Subject: DRAFT Response to U.S. EPR Design Certification Application RAI No. 300, FSAR Ch. 16 OPEN ITEM, Supplement 5
Sent Date: 11/17/2010 2:39:15 PM
Received Date: 11/17/2010 2:44:04 PM
From: BRYAN Martin (EXTERNAL AREVA)

Created By: Martin.Bryan.ext@areva.com

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"HALLINGER Pat (EXTERNAL AREVA)" <Pat.Hallinger.ext@areva.com>
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"PATTON Jeff (AREVA)" <Jeff.Patton@areva.com>
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"RANSOM James (AREVA)" <James.Ransom@areva.com>
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"WILLIFORD Dennis (AREVA)" <Dennis.Williford@areva.com>
Tracking Status: None
"Miernicki, Michael" <Michael.Miernicki@nrc.gov>
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Tracking Status: None
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Tracking Status: None

Post Office: AUSLYNCMX02.adom.ad.corp

Files	**Size**	**Date & Time**
MESSAGE	14626	11/17/2010 2:44:04 PM
RAI 300 Supplement 5 Response US EPR DC - DRAFT.pdf	1864020	

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

Response to

Request for Additional Information No. 300 (3730, 3742), Supplement 5

11/19/2009

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 16 - Technical Specifications
Application Section: FSAR Chapter 16

QUESTIONS for Technical Specification Branch (CTSB)

DRAFT

Question 16-311:

Potential Open Item

Provide the additional information and update the following RAI responses for each of the Instrumentation System Tech Spec items identified, based on the results of Audit Meetings between AREVA NP and NRC Staff on 7/30/09, 7/31/09, 8/13/09 and 8/14/09.

Request for Additional Information No. 103 (1270)

DRAFT

Question 16-311

Followup to Question 16-129:

a) Condition C, Required Action C.2 guidance and associated Bases changes.

Response to Question 16-129(a):

This issue was further clarified on Page 16-18 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 103, Question 16-129, the staff requested that the applicant provide an explanation regarding the effects of placing the different types of signal processing components in "Lockout." In a November 26, 2008, response, the applicant provided incomplete information in that it did not address either the Remote Acquisition Units (RAUs) or the Rod Cluster Control Assembly Units (RCCAUs). Furthermore, the Bases discussion in the associated FSAR markup did not make a clear distinction between the Acquisition and Processing Units and the Actuation Logic Units (ALUs) when describing the Lockout function. In an audit on July 30-31, 2009, the applicant acknowledged the deficiencies and agreed to make the necessary changes to the Bases. In addition, the following issues were also identified:
>
> - LCO 3.3.1, Condition C, Required Action C.2, direction to "Place the Trip/Actuation Function in the associated APU in lockout" is misleading. Individual Trip/Actuation Functions do not have Lockout capability. Only the APU to which the Trip/Actuation Functions are assigned can be "Locked Out." In an audit on July 30-31, 2009, the applicant acknowledged the deficiency and agreed to make the necessary changes to the GTS and Bases.
> - LCO 3.3.1, Condition C, Required Action C.2, provides insufficient guidance depending on the number of Limiting Trip Setpoints (LTSPs) that are affected. For example, if a LTSP problem is common to all four divisions of a given Trip/Actuation Function, the action to place each of the four associated divisional APUs in Lockout is not the intention. In an audit on July 30-31, 2009, the applicant acknowledged the deficiency and agreed to make the necessary changes to the GTS and Bases.

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases were revised in U.S. EPR FSAR, Revision 2 to clarify how the lockout function is implemented for each type of signal processor.

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification, LCO 3.3.1 and the associated Bases description will be revised to appropriately reference Nominal Trip Setpoints and correct an editorial omission. Additionally, the phrase "reactor trip output" will be changed to "reactor trip signal."

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications and Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-129:

c) Use of “division” rather than “subsystem” in ALU Bases discussion.

Response to Question 16-129(c):

This issue was further clarified on Page 16-18 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In addition, the following issues were also identified:
>
> > Bases B 3.3.1, Background, Signal Processors, Page B 3.3.1-9, third paragraph of the June 30, 2009, FSAR markup, references to “division” are inaccurate. “Division” should be replaced by “subsystem.” In an audit on July 30-31, 2009, the applicant acknowledged the inaccuracies and agreed to make the necessary changes to the Bases.

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised to replace the word "division" with the word "subsystem" in two locations. Previous corrections were also incorporated into U.S. EPR FSAR, Revision 2.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-131:

a) Condition V Required Action guidance.

Response to Question 16-131(a):

This issue was further clarified on Page 16-19 of the NRC's March 10, 2010 Safety Evaluation, which states:

> The following issues were identified based on evaluation of the June 30, 2009, FSAR markup:
>
> > LCO 3.3.1, Condition V, Required Action V.2, provides insufficient guidance depending on the number of divisions affected. For example, if there were less than the minimum required operable ALUs in only one division, opening of all reactor trip breakers would not be warranted. In an audit on July 30-31, 2009, the applicant acknowledged the deficiency and agreed to make the necessary changes to the GTS and Bases.

Because functions are performed by the Acquisition and Processing Units (APUs), Required Action V.1 was deleted and the subsequent action re-numbered in U.S. EPR FSAR, Revision 2. The Required Actions for Conditions V and W were revised to differentiate between the associated reactor trip breaker and all reactor trip breakers.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

DRAFT

Question 16-311

Followup to Question 16-131:

b) Condition V Bases clarification.

Response to Question 16-131(b):

This issue was further clarified on Page 16-19 of the NRC's March 10, 2010 Safety Evaluation, which states:

> The following issues were identified based on evaluation of the June 30, 2009, FSAR markup:
>
> > Bases B 3.3.1, Actions, Section V.1 and V.2, does not make the distinction that the functions on the associated ALUs are to be declared inoperable. The Bases simply state that the ALUs must be declared inoperable.

The U.S. EPR FSAR Tier 2, Chapter 16, Protection System (LCO 3.3.1) Bases description for Required Action V was revised in U.S. EPR FSAR, Revision 2 to reflect the change described in Question 16-131(a).

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

DRAFT

Question 16-311

Followup to Question 16-131:

c) Condition U applicability.

Response to Question 16-131(c):

U.S. EPR Tier 2, Chapter 16 Protection System (LCO 3.3.1) Condition U.1 and the associated Bases were revised in U.S. EPR FSAR, Revision 2 to specify that it applies only to the Rod Cluster Control Assembly (RCCA) Analog Position Indicators.

The RCCA position indicators do not have to be declared inoperable when the minimum number of Actuation Logic Units (ALUs) required for function capability is not met. RCCA position indication and ALU operability are not related. Therefore, Condition U is no longer a Required Action for the inoperability of an ALU and its reference has been deleted and replaced with a reference to Condition O.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

DRAFT

Question 16-311

Followup to Question 16-131:

d) Corrections associated with RCCA Position Indication and RCCA Bottom Position Indication.

Response to Question 16-131(d):

This issue was further clarified on Page 16-19 of the NRC's March 10, 2010 Safety Evaluation, which states:

> The following issues were identified based on evaluation of the June 30, 2009, FSAR markup:
>
> > LCO 3.3.1, Condition U, is specified for both the Rod Cluster Control Assembly Bottom Position Indicators and the RCCA Units in Mode 1, with Permissive P2 validated (LCO Table 3.3.1-1). Condition U is also specified for Permissive P8 in Modes 3 and 4, with Permissive P7 inhibited (FSAR Tier 2, Table 3.3.1-2, "Acquisition and Processing Unit Requirements Referenced from FSAR Tier 2, Table 3.3.1-1"). Required Action U.2 is associated with RCCA Position Indication, not RCCA Bottom Position Indication. RCCA Bottom Position Indication is not used in the Low Departure from Nucleate Boiling (DNB) function and is, therefore, not required in Mode 1 with Permissive P2 validated. In addition, the RCCA Position Indicators are not included in either LCO Table 3.3.1-1 or the Bases.

RCCA Analog Position Indicators were added to U.S. EPR FSAR Tier 2, Chapter 16, LCO Table 3.3.1-1 in U.S. EPR FSAR, Revision 2. The minimum number of Remote Acquisition Units (RAUs) required for functional capability was corrected in Bases Table B 3.3.1-1. A description of the RCCA Analog Position Indicator sensors was added to the Bases and subsequent entries renumbered. The description of the RCCA Bottom Position Indicator sensors was revised. Differentiation between the Analog and Bottom Position Indicators was incorporated into the Bases description of the Low Departure from Nucleate Boiling Ratio (DNBR) reactor trip function. Appropriate differentiation and corrections were made in U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases Table B 3.3.1-1.

Required Action U.1 and the associated Bases were revised to reference "Analog" instead of "Bottom Position Indicators." The RCCA Bottom Position Indicators are only used in the selection of the appropriate Anti-Dilution Mitigation (ADM) function. Therefore, Condition Q, which is to suspend operations involving positive reactivity additions, is appropriate for their inoperability. The RCCA Analog Position Indicators are used in setpoint selection for three of the Low DNBR trips. Therefore, Condition U, which is to declare the indicators inoperable and enter the applicable Conditions and Required Actions of LCO 3.1.7, RCCA Position Indication, is appropriate for their inoperability.

Additional clarifications will be made to Bases Table B 3.3.1-1 to show that all RCCA Bottom Position Indicators and one RCCA Unit are required to support each division. The Bases will also be revised to state that RAUs in each division are redundant. The RAUs in each division acquire one-fourth of the total Self Powered Neutron Detectors measurements and distribute those measurements to APUs in all four divisions allowing for an accurate calculation over the whole reactor core in each division. If both RAUs in a division fail, an automatic reactor trip will occur.

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Note that changes to the Bases Table B 3.3.1-1 supersede changes that were previously made in response to RAI 103, Supplement 1, Question 16-195.

For consistency throughout LCO Table 3.3.1-1, the RCCA Bottom Position Indicator sensors and the RCCA Units will be revised to show Condition “O” required for Modes 3 and 4 and Condition “Q” required for Mode 5. The Bases description for Conditions U.1 and U.2 will be revised to address inoperability of the RCCA Units.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications and Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-138:

a) Numerous discrepancies associated with Bases discussions describing Permissive signal capabilities.

Response to Question 16-138(a):

This issue was further clarified on Page 16-20 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 103, Question 16-138, the staff requested that the applicant provide a technical justification regarding the omission of permissive signals from LCO 3.3.1, "Protection System." In a June 30, 2009, response to RAI 103, Question 16-138, the applicant proposed to revise the GTS to include permissives that enable RT and ESF functions credited in the safety analysis, along with Permissive P16, which is implicitly credited by virtue of the fact that it enables alignment of the safety injection system from cold leg injection to hot leg injection. The response was determined to be acceptable with the exception of numerous discrepancies associated with Bases discussions describing permissive signal capabilities.

The response to the question discussed permissives in terms of whether they are validated to either enable or disable a function. The discussions in the Bases was reviewed and revised as necessary to be consistent with this philosophy. Changes were made in U.S. EPR FSAR, Revision 2 to the following Bases descriptions:

- Reactor Trips - Low DNBR,
- Reactor Trips - High Linear Power Density,
- Reactor Trips - High Core Power Level,
- Reactor Trips - Low Saturation Margin,
- Reactor Trips - RCS Loop Flow Rate,
- Reactor Trips - Low RCP Speed,
- Reactor Trips - High Neutron Flux (Intermediate Range),
- Reactor Trips - Low Doubling Time (Intermediate Range),
- Reactor Trips - Low Pressurizer Pressure,
- Reactor Trips - High Pressurizer Level,
- Reactor Trips - Low Hot Leg Pressure,
- Reactor Trips - Low SG Pressure,
- Reactor Trips - Low SG Level,
- Reactor Trips - High SG Level,
- ESF Function - Main Feedwater Full Load Isolation on High SG Level (Affected SG),

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- ESF Function - SSS Isolation on Low SG Pressure (Affected SG),
- ESF Function - SSS Isolation on High SG Level for Period of Time (Affected SG),
- ESF Function - SIS Actuation on Low Pressurizer Pressure,
- ESF Function - SIS Actuation on Low Delta Psat,
- ESF Function - SIS Actuation on Low RCS Loop Level,
- ESF Function - Partial Cooldown Actuation on SIS Actuation,
- ESF Function - EFWS Actuation on Low-Low SG Level (Affected SG),
- ESF Function - EFWS Actuation on LOOP and SIS Actuation (All SGs),
- ESF Function - MSRT Isolation on Low SG Pressure,
- ESF Function - MSIV Isolation on Low SG pressure (All SGs),
- ESF Function - CVCS Charging Line Isolation on High-High Pressurizer Level,
- ESF Function - CVCS Isolation on ADM - Shutdown Condition (RCP not operating),
- ESF Function - CVCS Isolation on ADM - Standard Shutdown Conditions,
- ESF Function - CVCS Isolation on ADM at Power, and
- ESF Function - PSRV Actuation - First and Second Valve.

Additional minor and editorial corrections will be incorporated into the Technical Specifications and Bases (e.g., LCO Table 3.3.1-1 will be revised to explicitly include a number in each row of the Required Number of Sensors, Switches, Signal Processors, or Actuation Devices column, and the symbols in front of P2, P3, and P5 permissives in LCO Table 3.3.1-2 will be changed from a “≥” to “>” with corresponding changes in the Bases descriptions for the permissives).

A discussion regarding the minimum required for functional capability determinations for sensors and signal processors, the overall safety analysis requirements, and the application of single failure criteria for the Technical Specifications in Modes 5 and 6 will be provided in the final response of this RAI.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications and Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-141:

a) Bases enhancements to ensure information accuracy and consistency.

Response to Question 16-141(a):

This issue was further clarified on Page 16-21 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 103, Question 16-141, the staff requested that the applicant provide an explanation regarding the three values that make up the variable low setpoint specified for Steam Generator Pressure Drop Function A.14 in FSAR Tier 2, Table 3.3.1-2. The staff also requested the same information for the variable low setpoints associated with main steam isolation valve (MSIV) isolation on SG Pressure Drop (All SGs) Function B.8.a (RAI 103, Question 16-166), and startup and shutdown feedwater isolation on SG Pressure Drop (Affected SGs) Function B.2.c (RAI 103, Question 16-167). In a November 26, 2008, response to RAI 103, Questions 16-141, 16-166, and 16-167, the applicant revised the Bases for each of the referenced functions to include the requested information. The changes, however, resulted in inconsistencies amongst the individual Bases sections, as well as the inclusion of unnecessary setpoint algorithm specifics.

The following changes were made in Revision 2 to the U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases:

- The equation describing the calculation of the pressure drop setpoint was deleted from the discussion of the Steam Generator (SG) Pressure Drop reactor trip,
- The equation was deleted from the discussion of the Startup and Shutdown System Isolation on SG Pressure Drop Engineered Safety Features (ESF) function, and
- The equation was deleted from the discussion of the MSIV Isolation on SG Pressure Drop ESF function. The sentence discussing the maximum value was also deleted.

A description of how the SG pressure drop is detected will be added to the Bases description of the SG Pressure Drop reactor trip.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-145:

a) Extraneous information regarding Operability included in Permissive P6 Bases discussion.

Response to Question 16-145(a):

This issue was further clarified on Page 16-22 of the NRC's March 10, 2010 Safety Evaluation, which states:

> The P6 Permissive Bases discussion on Page B 3.3.1-62 of the FSAR markup provided with the June 30, 2009, response (last paragraph), contains superfluous information pertaining to operability as it relates to 10 CFR 50.36, Criterion 3.

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases were revised in U.S. EPR FSAR, Revision 2 to delete the phrase "not required to be OPERABLE" in the Bases discussion of P6 permissive and P13 permissive.

The Bases Applicable Safety Analyses, LCO, and Applicability section and the description of P6 permissive and P13 permissive will be clarified to state that permissives that disable a reactor trip or ESF function when the permissives are validated are not part of a primary success path of a safety sequence analysis.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-145:

d) Explanation regarding Intermediate Range sensor mode applicability. Applicable modes specified for the Intermediate Range sensors in Table 3.3.1-1 and the Bases are 1, 2, and 3 with the Reactor Control, Surveillance and Limitation (RCSL) System capable of withdrawing an RCCA or one or more RCCA's not fully inserted. Mode 1 applicability for Intermediate Range sensors is typically ≤ 10% RTP.

Response to Question 16-145(d):

This issue was further clarified on Pages 16-22 and 16-23 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 103, Question 16-145, the staff requested that the applicant provide an explanation regarding the mode applicability for P6 Permissive instrumentation with respect to Reactor Trip Function A.8, High-Neutron Flux - Intermediate Range, as well as validation of the ≤15 percent rated thermal power (RTP) Limiting Trip Setpoint value. In a June 30, 2009, response to RAI 103, Question 16-145, the applicant sufficiently described how the mode requirements for the P6 Permissive sensors were chosen to envelope the required modes of the functions and permissives they support. However, there was no discussion pertaining to the LTSP for A.8. In an audit on August 13-14, 2009, the applicant explained that, because P6 Permissive validation is manual, the ≤15 percent RTP LTSP would remain active above the 10 percent RTP operability requirement specified in FSAR Tier 2, Table 3.3.1-2, until the permissive was manually validated by the operator. The staff agreed with the clarification provided during the audit. The RAI response needs to be updated with this information in order to ensure its completeness and accuracy.
>
> The applicable modes specified for the Intermediate Range sensors (A.13) in LCO Table 3.3.1-1 of the FSAR markup provided with the June 30, 2009, response and the associated Bases, are 1, 2, and 3 with the RCSL system capable of withdrawing an RCCA or one or more RCCA's not fully inserted. The staff questioned the Mode 1 applicability requirement on the basis that Intermediate Range sensor operability typically only extends up to 10 or 15 percent RTP. The Mode 1 requirement appears to be due to the fact that these sensors support Permissive P5 as well, which is utilized in both the High-Core Power Level and the Low Saturation Margin Reactor Trip functions. Permissive P5, Flux (Intermediate Range) Measurement Higher than Threshold, is representative of Intermediate Range Detector neutron flux measurements above a low-power setpoint value (approximately 10^{-5} percent) which corresponds to the boundary between the operating ranges of the Source Range and Intermediate Range detectors.

Mode requirements for sensors have been chosen to envelope the required modes of the functions and permissives they support.

The Intermediate Range sensors provide input to multiple functions, including:

- The High Neutron Flux (Intermediate Range) reactor trip function. This function is assumed in the safety analysis to be operable in Modes 1 with RTP less than or equal to 10 percent, in Mode 2, and in Mode 3 when the Reactor Control, Surveillance and Limitation (RCSL) System is capable of withdrawing a RCCA or one or more RCCAs not fully inserted.

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- The Low Doubling Time (Intermediate Range) reactor trip function. This function is also assumed in the safety analysis to be operable in Mode 1 with RTP less than or equal to 10 percent, in Mode 2, and in Mode 3 when the RCSL System is capable of withdrawing an RCCA or one or more RCCAs not fully inserted.
- P5 permissive. As discussed in the Response to RAI 103, Question 16-138, P5 permissive is required to be operable in Mode 1 and in Mode 2 above 10^{-5} RTP.

Therefore, the Intermediate Range sensors are required to be operable in Modes 1 and 2, and in Mode 3 when the RCSL System is capable of withdrawing a RCCA or one or more RCCAs are not fully inserted.

Inhibiting the P6 permissive enables the High Neutron Flux (Intermediate Range) and Low Doubling Time reactor trips when the power level is less than or equal to approximately 10 percent RTP. When nuclear power is above this threshold, these trips are disabled by validating P6 permissive. In order to validate P6 permissive, not only does the calculated core power level have to be greater than the threshold value, but the operator has to also manually validate the permissive. Because the P6 permissive validation is manual, the ≤15 percent RTP LTSP would remain active above the 10 percent RTP operability requirement specified in U.S. EPR FSAR Tier 2, LCO Table 3.3.1-2, until the permissive was manually validated by the operator.

As discussed in U.S. EPR FSAR Tier 2 Section 7.1.1.5.3, four Intermediate Range sensors monitor more than seven decades up to at least 60 percent RTP. The sensors remain operable and are not disabled above the 60 percent RTP. Accuracy above this power level is not an operability concern since the permissive does not change state based on the accuracy of the input from the sensor. Therefore, the Intermediate Range sensors are adequate to support P5 and P6 permissives above the range where they provide input to the reactor trip functions.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

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Question 16-311

Followup to Question 16-147:

a) Discrepancy regarding use of “and” versus “or” in Pressurizer Pressure (NR) Bases discussion associated with Mode Applicability.

Response to Question 16-147(a):

This issue was further clarified on Page 16-24 of the NRC's March 10, 2010 Safety Evaluation, which states:

> The Pressurizer Pressure NR Bases discussion on Page B 3.3.1-74 of the FSAR markup provided with the June 30, 2009, response (last paragraph), inaccurately describes the Mode 4 conditions associated with sensor operability.

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases were revised in U.S. EPR FSAR, Revision 2 to state "or" greater than approximately 50 percent instead of "and" greater than approximately 50 percent.

The Bases will be revised to change the phrase “all RCPs” to “at least one RCP” in the Bases description for the Pressurizer Pressure (Narrow Range) sensor.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-149:

a) Table 3.3.1-2 mode applicability footnotes for Functions B.3.c, B.11.b and B.11.c.

Response to Question 16-149(a)

This issue was further clarified on Page 16-25 of the NRC's March 10, 2010 Safety Evaluation, which states:

> However, the staff noted that the footnote assignments corresponding to the applicable modes for Sensor A.23 in LCO Table 3.3.1-1 and Function B.3.c in LCO Table 3.3.1-2 were questionable on the basis that (1) Permissive P15 may not be validated (i.e., RCP in operation) below Mode 4, and (2) footnotes have been specified for each applicable mode associated with Functions B.11.b, B.11.c, and Permissives P7, P8 in LCO Table 3.3.1-2 with respect to the operational status of RCPs (P7 either validated or inhibited). In addition, the staff noted that the assignment of Footnote (s) in Mode 6 for Function B.11.b and Permissive P7 was also questionable because of applicant information that RCPs would not be running in Mode 6.

With regard to the staff's first concern in the Safety Evaluation regarding P15 permissive, Sensor A.23, Reactor Coolant System (RCS) Loop Level, is only required to support the Safety Injection System (SIS) Actuation on Low RCS Loop Level function in Mode 4 with P15 permissive validated and in Modes 5 and 6. P15 permissive allows the automatic SIS actuation to switch between the Low RCS Loop Level and Low Delta Psat function in Mode 4 (Refer to U.S. EPR FSAR Tier 2, Figures 7.3-2, "SIS Actuation," and 7.2-34, "P15 Permissive Logic").

The following summarizes the use of Reactor Coolant Pumps (RCPs) during plant shutdown and startup operation. RCP pumps are normally run during the Cooldown from Mode 3 to Mode 4 using the four operating RCP to maximize SG heat transfer and to provide adequate cooling of the RCS Pressure Vessel Closure Head. The RCS must remain above 370 psia for continued RCP operation. During the cooldown from Mode 4 to Mode 5, when the RCS temperature is reduced to less than ≈250°F by automatic cooling via the SGs, two trains of Residual Heat Removal (RHR) are lined-up to the RCS and the associated Low Head Safety Injection (LHSI) pumps are manually started. When the LHSI/RHR trains are placed into service, the RCS heat rejection to the secondary side (via SGs) is no longer essential. Correspondingly, the forced flow of all four RCPs is not essential, thus two RCPs are secured to reduce the heat input to the RCS and reduce the time to cooldown to refueling temperatures. During the cooldown from Mode 4 to Mode 5, when the RCS temperature has decreased to approximately 160°F, a third RCP is manually removed from service. The final RCP is secured after the RCS has been cooled to approximately 130°F; the Pressurizer is less than approximately 160°F, and RCS fluid chemistry within limits. RCPs are not typically placed in service again until the unit is ready for start-up. To start-up, air is evacuated from the RCS. If not previously placed into service after the reactor cavity was refilled, both Chemical and Volume Control System (CVCS) charging pumps are started to provide RCP seal injection and are used for filling of the RCS after it is evacuated. The RCS is also filled through the RCP seal packages by the CVCS. To support RCP operation, the Pressurizer is heated using the Pressurizer heaters to establish a steam bubble in the Pressurizer and raise RCS pressure. The minimum RCS pressure for continued RCP operation is 370 psia. At that point, the RCPs are started to commence RCS heat-up.

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The Protection System Technical Specifications are written to address the requirements of 10 CFR 50.36, Criterion 3:

> A structure, system, or component that is part of the primary success path and which functions or actuates to mitigate a Design Basis Accident or Transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier:

As stated in the NRC Policy Statement on Technical Specification Improvements for Nuclear Power Plants:

> A third concept in the adequate protection of the public health and safety is that in the event that a postulated Design Basis Accident or Transient should occur, structures, systems, sand components are available to function or to actuate in order to mitigate the consequence of the Design Basis Accident or Transient. Safety sequence analyses or their equivalent have been performed in recent years and provide a method of presenting the plant response to an accident. These can be used to define the primary success paths.
>
> A safety sequence analysis is a systematic examination of the actions required to mitigate the consequences of events considered in the plant's Design Basis Accident and Transient analyses, as presented in Chapters 6 and 15 of the plant's FSAR (or equivalent chapters). Such a safety sequence analysis considers all applicable events, whether explicitly or implicitly presented. The primary success path of a safety sequence analysis consists of the combination and sequences of equipment needed to operate (including consideration of the single failure criteria), so that the plant response to Design Basis Accidents and Transients limits the consequences of these events to within the appropriate acceptance criteria.
>
> It is the intent of this criterion to capture into Technical Specifications only those structures, systems, and components that are part of the primary success path of a safety sequence analysis.

It should also be noted, as stated in NUREG-1431, which provides the Standard Technical Specifications for Westinghouse plants:

> The shutdown Technical Specification requirements are designed to ensure that the unit has the capability to mitigate the consequences of certain postulated accidents. Worst case DBAs which are analyzed for operating MODES are generally viewed not to be a significant concern during shutdown MODES due to the lower energies involved. The Technical Specifications therefore require a lesser complement of electrical equipment to be available during shutdown than is required during operating MODES. More recent work completed on the potential risks associated with shutdown, however, have found significant risk associated with certain shutdown evolutions. As a result, in addition to the requirements established in the Technical Specifications, the industry has adopted NUMARC 91-06, "Guidelines for Industry Actions to Assess Shutdown Management," as an Industry initiative to manage shutdown tasks and associated electrical support to maintain risk at an acceptable low level. This may require the availability of additional equipment beyond that required by the shutdown Technical Specifications.

Therefore, the Technical Specifications must verify the configuration of the Protection System is sufficient to bound the operational constraints assumed in the safety analysis. Additional administrative controls and equipment may be necessary to manage and perform shutdown tasks.

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In Mode 4, when the RCPs are running, the SIS Actuation on Low Delta Psat function mitigates the postulated accidents or Anticipated Operational Occurrences (AOOs), including the small break and large break Loss of Coolant Accidents (LOCAs). As stated in the Protection System Bases, the SIS Actuation on Low RCS Loop Level function mitigates the following postulated accidents or AOOs:

- Loss of RHR during mid-loop operations,
- Uncontrolled loss of RCS inventory,
- Small break LOCA, and
- Large break LOCA.

The automatic SIS Actuation on Low RCS Loop Level function is required to be OPERABLE in:

- Mode 4 when no RCPs are running, the hot leg pressure is less than approximately 464 psia, and the hot leg temperature is less than approximately 350ºF, and
- Modes 5 and 6.

The Protection System architecture supports the plant response assumed in the safety analysis. The Technical Specifications reflect the Protection System design, embody the operation assumptions contained in the safety analysis, and satisfy Criterion 3 of 10 CFR 50.36.

With regard to the staff's second concern in the Safety Evaluation regarding the footnotes for ESF functions B.3.c, B.11b, and B.11.c in U.S. EPR FSAR Tier 2, Chapter 16, LCO Table 3.3.1-2 were reviewed to determine if they were consistent with regards to reflecting the requirements for RCPs running. The applicable footnote for Function B.11.b in Mode 6 will be added, the appropriate Bases description updated, and this correction will also reflected in Bases Table B 3.3.1-1.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications and Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-149:

b) Table 3.3.1-1 mode applicability footnotes for Sensor A.23.

Response to Question 16-149(b):

This issue was further clarified on Page 16-25 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 103, Question 16-149, the staff requested that the applicant provide a technical justification regarding omission of the SIS Actuation Signal on RCS Loop Low Level function from LCO 3.3.1, Protection System. In a June 30, 2009, response to RAI 103, Question 16-149, the applicant stated that the SIS Actuation on RCS Loop Low Level function and its associated sensor (RCS Loop Level) would be included in LCO 3.3.1 and the Bases. However, the staff noted that the footnote assignments corresponding to the applicable modes for Sensor A.23 in LCO Table 3.3.1-1 and Function B.3.c in LCO Table 3.3.1-2 were questionable on the basis that (1) Permissive P15 may not be validated (i.e., RCP in operation) below Mode 4, and (2) footnotes have been specified for each applicable mode associated with Functions B.11.b, B.11.c, and Permissives P7, P8 in LCO Table 3.3.1-2 with respect to the operational status of RCPs (P7 either validated or inhibited).

Mode requirements for sensors have been chosen to envelope the required modes of the functions and permissives they support. Mode requirements for individual sensors may be different depending upon which functions they support.

The Reactor Coolant System (RCS) Loop Level sensors (Sensor A.23) only provide input to the SIS Actuation on Low RCS Loop Level function. As shown in U.S. EPR Tier 2, LCO Table 3.3.1-2, the SIS Actuation on Low RCS Loop Level function is required to be operable in Mode 4 with P15 permissive validated and in Modes 5 and 6. These are the mode requirements currently specified for Sensor A.23 and no changes to LCO Table 3.3.1-1 are required.

A discussion of RCP operation and the application of P15 permissive is provided in the Response to Question 16-311, Part 16-149(a).

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

DRAFT

Question 16-311

Followup to Question 16-150:

a) Bases discrepancies regarding references to Cold Shutdown.

Response to Question 16-150(a):

This issue was further clarified on Page 16-26 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 103, Question 16-150, the staff requested that the applicant provide an explanation regarding inconsistencies between LCO Table 3.3.1-1, LCO Table 3.3.1-2, and the Bases associated with the mode applicability specified for ESFAS Function B.3.b (SIS Actuation on Low Delta P_{sat}) and its sensors, including P12 and P15 Permissive instrumentation. In a June 30, 2009, response to RAI 103, Question 16-150, the applicant sufficiently described how the mode requirements for the individual sensors have been chosen to envelope the required modes of the functions and permissives they support. However, the response did not adequately address the Bases discrepancies associated with the references to Cold Shutdown. The Low Delta P_{sat} function Bases discussions (FSAR markup provided with the June 30, 2009, response) on Page B 3.3.1-40 (last paragraph) and Page B 3.3.1-41 (third paragraph), both state that the function ensures SIS actuation in the Hot and Cold Shutdown conditions with Low Head Safety Injection/Residual Heat Removal (LHSI/RHR) in operation and at least one RCP operating. Hot and Cold Shutdown conditions are Modes 4 and 5, respectively. The modes specified in LCO Table 3.3.1-2 for Function B.3.b are $3^{(m)}$ and $4^{(n)}$ (Hot Standby and Hot Shutdown).

The phrase: "in the hot and cold shutdown conditions" was deleted in the Bases description of the Safety Injection System (SIS) functions in U.S. EPR FSAR, Revision 2.

The operability requirements related to the SIS Actuation on Low Delta Psat function and SIS Actuation on Low RCS Loop Level are discussed below:

> <u>SIS Actuation on Low Delta Psat</u>
>
> In Mode 5 (Average RCS temperature ≤ 200 °F), Safety Injection requirements are based on loss of RHR while operating at mid-loop conditions. Before entering mid-loop operation, the Reactor Coolant Pumps (RCPs) are secured and the Reactor Coolant System (RCS) is vented. Two Medium Head Safety Injection (MHSI) pumps are available and automatic injection is available on low loop level. In the event of a loss of RHR under these conditions the MHSI pumps would automatically inject on low loop level to maintain the core covered and replace the inventory that boils off.
>
> For loss of RHR scenarios with RCPs running, the RCS inventory would be essentially full with the pressurizer at normal level. The secondary side (SG) would also be available if RCPs were in operation. Under these conditions, a loss of RHR event would result in a minor heat-up until decay heat is removed through the secondary. Thus, Safety Injection on Low Delta Psat would not be required if RCPs were in operation.

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SIS Actuation on Low RCS Loop Level

In Modes 5 and 6, SI requirements are based on Loss of RHR events during reduced inventory (mid-loop) conditions. Therefore, SI on low RCS loop level is required in Modes 5 and 6. Before entering mid-loop operation, the RCPs are secured and the RCS is vented. Two MHSI pumps are available and automatic injection is available on low loop level. In the event of a loss of RHR under these conditions. the MHSI pumps would automatically inject on low loop level to maintain the core covered and replace the inventory that boils off.

The applicable modes for the SIS Actuation on Low RCS Loop Level function in U.S. EPR FSAR Tier 2, Chapter 16, LCO Table 3.3.1-2 will be revised to specify that the function is only required when no RCPs in operation and the Bases for both the SIS Actuation on Low Delta Psat and SIS Actuation on Low RCS Loop Level functions will be clarified.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications and Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-150:

b) Discrepancy regarding use of “and” versus “or” in Function B.3.b Bases discussion associated with Mode Applicability.

Response to Question 16-150(b):

This issue was further clarified on Page 16-27 of the NRC's March 10, 2010 Safety Evaluation, which states:

> The Low Delta P_{sat} function Bases discussion on Page B 3.3.1-41 of the FSAR markup provided with the June 30, 2009, response (second paragraph), inaccurately describes the Mode 4 conditions (Permissive P15 inhibited logic) associated with sensor and processor operability.

In the U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases, the word "or" will be replaced with the word "and" in the discussion of P15 permissive. The description of the required modes will be revised to change an “and” to an “or.”

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-150:

c) Bases discrepancy regarding use of the word “automatically” to describe the capability of Permissive P15 to disable Function B.3.b.

Response to Question 16-150(c):

This issue was further clarified on Page 16-26 of the NRC's March 10, 2010 Safety Evaluation, which states:

> The second bulleted item of the response to RAI 103, Question 16-150 on Page 20 of 63, inaccurately describes the Mode 4 conditions (Permissive P15 inhibited logic) associated with Function B.3.b operability.

This issue was further clarified on Page 16-27 of the NRC's March 10, 2010 Safety Evaluation, which states:

> The Low Delta P_{sat} function Bases discussion on Page B 3.3.1-41 of the FSAR markup provided with the June 30, 2009, response (last paragraph), uses the word “automatically” to describe the capability of Permissive P15 to disable Function B.3.b. P15 is manual with respect to validation.
>
> The second paragraph of the June 30, 2009, response to RAI 103, Question 16-151 on Page 22 of 63, uses the word “automatically” to describe the capability of Permissive P15 to disable Function B.3.b. P15 is manual with respect to validation.

P6, P12, P13, P14, P15, P16, and P17 permissives require operator action to manually validate the permissive. P14 permissive also requires operator action to inhibit the permissive. The use of the word "automatic" and "automatically" was reviewed throughout the Bases to provide consistency and accuracy in the description of how these permissives function. Changes were made in U.S. EPR FSAR, Revision 2 and as shown in the attachment.

Changes will also made to this terminology in the Response to RAI 300, Question 311, Part 16-138(a).

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-151:

Discrepancy in the RAI response regarding use of the word “automatically” to describe the capability of Permissive P15 to disable Function B.3.b.

Response to Question 16-151:

The word "automatically" was reviewed and corrected as discussed in the Response to Question 16-311, Part 16-150(c).

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

DRAFT

Question 16-311

Followup to Question 16-153:

Revision to FSAR Section 7.3.1.2.9 to address inconsistencies between the FSAR and Bases regarding Safeguards Building HVAC reconfiguration.

Response to Question 16-153:

This issue was further clarified on Page 16-27 of the NRC's March 10, 2010 Safety Evaluation, which states:

> The Containment Isolation (Stage1) on SIS Actuation Function Bases discussion on Page B 3.3.1-51 of the FSAR markup provided with the June 30, 2009, response (third paragraph), states that, "Safeguards Building HVAC is also reconfigured to process air through HEPA filters to ensure 10 CFR 50.34, 'Contents of Applications; Technical Information' and 10 CFR 100.21, 'Revocation, Suspension, Modification of Licenses, Permits, and Approvals for Cause' limits are not exceeded." There are no references to Safeguards Building Heating, Ventilation, and Air Conditioning (HVAC) reconfiguration on the Stage 1 Containment Isolation signal, either in FSAR Tier 2, Section 7.3.1.2.9 (Containment Isolation) or FSAR Tier 2, Section 7.3.1.2.16 (Main Control Room Air Conditioning System (CRACS) Isolation and Filtering). Also, there are no Safeguards Building HVAC functions depicted in associated FSAR Tier 2 logic Figures 7.3-20 (Containment Isolation) or 7.3-28 (MCR Isolation and Filtering). The same statement appears in the Bases discussion for Function B.9.a on Page B 3.3.1-50 (fifth paragraph) as well.

Functions and components initiated by the reactor trip and ESF functions are generally not described in the Bases. Therefore, the statements regarding Safeguards Building Heating, Ventilation and Air Conditioning (HVAC) Reconfigurations were removed from the Bases in U.S. EPR FSAR, Revision 2.

The first sentence of the Bases description of the Containment Isolation (Stage 1) on High Containment Radiation will be revised to be consistent with the other descriptions of containment isolation functions.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-154:

Table 3.3.1-1 mode applicability requirements necessary for Sensors A.7 and A.8 to support Table 3.3.1-2 ESF Function B.9.a.

Response to Question 16-154:

This issue was further clarified on Page 16-27 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 103, Question 16-154, the staff requested that the applicant specify the appropriate range for the Containment Service Compartment Pressure sensors in the Bases for ESFAS Function B.9.a (Containment Isolation (Stage 1) on High-Containment Pressure). In a June 30, 2009, response to RAI 103, Question 16-154, the Bases was revised to include the Wide Range designation for the sensors. The staff questions the applicant's response to Question 16-154 on Page 25 of 63 regarding the statement, "The Containment Service Compartment Pressure (Wide Range) sensors provide input to the Containment Isolation (Stage 1) on High-Containment Pressure function and the Containment Isolation (Stage 2) on High-High-Containment Pressure function." While the Containment Service Compartment WR sensors do provide input into the Containment Isolation (Stage 1) on High-Containment Pressure function, the actuation setpoint associated with this input is Max2p, not the Max1p setpoint specified for Function B.9.a in LCO Table 3.3.1-2 and FSAR Tier 2, Section 7.3.1.2.9. The inputs associated with the Max1p setpoint are provided by the Containment Equipment Compartment Pressure and Containment Service Compartment Pressure Narrow Range sensors that input into the High-Containment Pressure Reactor Trip function (A.19). The RT signal on High-Containment Pressure (> Max1p) is what actually provides the input resulting in the actuation of Function B.9.a. The mode applicability currently specified for both the Equipment Compartment Pressure sensors and Containment Service Compartment Pressure NR sensors in LCO Table 3.3.1-1 (Modes 1, 2, and 3 [(g)]), does not align with the mode requirements specified for Function B.9.a in LCO Table 3.3.1-2 (Modes 1, 2, 3, and 4). Simply stated, it does not appear that the operability requirements for the containment pressure sensors necessary to support Function B.9.a in Modes 3 (other than 3[(g)]) and 4 have been specified.

The NRC's observation is correct and the previous response to Question 16-154 required clarification. The Reactor Trip on High Containment Pressure signal is necessary to actuate the Containment Isolation (Stage 1) on High Containment Pressure Engineered Safety Feature (ESF) function at the Max 1P setpoint. Therefore:

- U.S. EPR FSAR Tier 2, Chapter 16, LCO Table 3.3.1-2 and the Bases description of the Reactor Trip on High Containment Pressure function, and Bases Table B 3.3.1-1 were revised in U.S. EPR FSAR, Revision 2 to show that the Reactor Trip on High Containment Pressure function is required in Modes 1 through 4.
- The Reactor Trip on High Containment Pressure function receives input from the Containment Equipment Compartment Pressure and Containment Service Compartment Pressure (Narrow Range) sensors. U.S. EPR FSAR Tier 2, Chapter 16, LCO Table 3.3.1-1 and the Bases descriptions of these sensors were revised in U.S. EPR FSAR, Revision 2 to show that these sensors are required in Modes 1 through 4.

DRAFT

In addition, the Condition in LCO Table 3.3.1-2 for Function A.19, Reactor Trip on High Containment Pressure, will be changed to “N” instead of “K” and the Bases description of the Containment Isolation (Stage 1) on High Containment Pressure function will be corrected.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-162:

a) Bases discrepancy regarding the reference to Function B.3.c.

Response to Question 16-162(a):

This issue was further clarified on Page 16-29 of the NRC's March 10, 2010 Safety Evaluation, which states:

> The Partial Cooldown Actuation on SIS Actuation function Bases discussion on Page B 3.3.1-44 of the FSAR markup provided with the June 30, 2009, response (second paragraph), incorrectly references Function B.3.c (SIS Actuation on Low RCS Loop Level) when identifying the applicable SIS Actuation signals. Function B.5 is required to be operable in Modes 1, 2, and 3. Function B.3.c is required in Modes 4[(o)], 5, and 6.

The reference to Function B.3.c will be deleted in the Bases description of the Partial Cooldown on SIS Actuation function since it is not applicable to the Modes in which Partial Cooldown on SIS Actuation is required.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-162:

b) Bases discrepancy regarding use of the word “automatically” to describe the capability of Permissive P14 to enable Function B.5.

Response to Question 16-162(b):

This issue was further clarified on Page 16-29 of the NRC's March 10, 2010 Safety Evaluation, which states:

> The Partial Cooldown Actuation on SIS Actuation function Bases discussion on Page B 3.3.1-44 of the FSAR markup provided with the June 30, 2009, response (third paragraph), uses the word “automatically” to describe the capability of Permissive P14 to activate Function B.5. P14 is manual with respect to both validation and inhibition.

The word "automatically" was reviewed and corrected as discussed in the Response to Question 16-311, Part 16-150(c).

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

DRAFT

Question 16-311

Followup to Question 16-166:

Bases enhancements to ensure information accuracy and consistency.

Response to Question 16-166:

As discussed in the Response to Question 16-311, Part 16-141(a), the equation describing the pressure drop calculation and the sentence discussing maximum value was deleted in U.S. EPR FSAR, Revision 2.

A description of how the SG pressure drop is detected will be added to the Bases description of the MSIV Isolation on SG Pressure Drop (All SGs) function.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-167:

Bases enhancements to ensure information accuracy and consistency.

Response to Question 16-167:

As discussed in the response to Question 16-311, Part 16-141(a), the equation describing the pressure drop calculation was deleted in U.S. EPR FSAR, Revision 2.

A description of how the SG pressure drop is detected will be added to the Bases description of the Startup and Shutdown System Isolation on SG Pressure Drop (Affected SG) function.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-169:

b) Relocation of information to enhance Bases presentation.

Response to Question 16-169(b):

This issue was further clarified on Page 16-30 of the NRC's March 10, 2010 Safety Evaluation, which states:

> Bases discussion pertaining to the postulated accidents mitigated by Function B.2.c (Startup and Shutdown Feedwater Isolation on SG Pressure Drop (Affected SGs), on Pages B 3.3.1-35 and B 3.3.1-36 of the FSAR markup provided with the June 30, 2009, response, lacks clarity and consistency with respect to the placement of information.

In U.S. EPR FSAR, Revision 2, the Bases discussion pertaining to the postulated accidents mitigated by Function B.2.c (Startup and Shutdown Feedwater Isolation on SG Pressure Drop (Affected SG) was clarified.

The Protection System Bases will be revised to change the term “Feedwater System” to “feedwater system” and feedwater will be changed to lower-case in other Bases citations.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-174:

a) Inconsistent use of “SSS Feedwater Isolation” in the Bases.

Response to Question 16-174(a):

This issue was further clarified on Page 16-31 of the NRC's March 10, 2010 Safety Evaluation, which states:

> The FSAR markup for RAI 103, Question 16-174 resulted in Bases inconsistencies regarding use of the word, “Feedwater,” when referring to the “SSS Feedwater Isolation on SG Pressure Drop (Affected SGs)” function.

The acronym “SSS” was revised in U.S. EPR FSAR, Revision 2 Technical Specifications Protection System Bases to reflect "Startup and Shutdown System."

The Protection System Technical Specifications and Bases will be revised to be editorially consistent in the use of the term “Startup and Shutdown System.”

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications and Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-180:

a) Inconsistent use of footnote (f) in Table 3.3.1-1 for Sensor A.6.

Response to Question 16-180(a):

This issue was further clarified on Page 16-32 of the NRC's March 10, 2010 Safety Evaluation, which states:

> However, the same information is not accurately reflected in the changes incorporated in the FSAR markup provided with the June 30, 2009, response for Sensor A.6 in LCO Table 3.3.1-1. Footnote presentation is inconsistent. Footnote (f) for example, is used to represent a stand-alone condition in conjunction with Modes 1 through 4, and as a superscript in Mode 5.

Footnote (f) was deleted in Revision 2 to U.S. EPR FSAR Tier 2, Chapter 16, LCO Table 3.3.1-1 for the Hot Leg Pressure (Wide Range) sensors (Sensor A.10) since the sensor is already required to be operable in all modes.

The Protection System LCO Table 3.3.1-1 Footnote (f) [Note that Footnote (f) will be renumbered to Footnote (h)], regarding when Pressurizer Safety Relief Valve operability is required by LCO 3.4.11, will generally be presented in the Technical Specifications as a stand-alone condition. However, the Technical Specifications and Bases are also being revised to reflect the use of the Hot Leg Pressure (Narrow Range) sensor in ESF Functions 12.a and 12.b, PSRV Actuation – First Valve and Second Valve. As a result, Footnote (h), regarding when Pressurizer Safety Relief Valve operability is required by LCO 3.4.11, is not always presented in the Technical Specifications as a stand-alone condition to avoid potential confusion. The Hot Leg Pressure (Narrow Range) is not required to support any other reactor trip or ESF function. Since the minimum number of components required for functional capability is different when the Low Temperature Overpressure Protection (LTOP) function is required in Mode 4 (3 required) versus when the LTOP function is required in Modes 5 and 6 (2 required), the operators could be confused regarding the required number of components if Footnote (h) always appeared in the Technical Specifications without an associated Mode.

Numerous other changes in the Technical Specifications and Bases will be incorporated, such as listing Mode 4 requirements on a separate line in LCO Table 3.3.1-1 when a cited Condition only applies in that Mode. U.S. EPR FSAR Tier 2, Tables 15.0-18 and 15.0-25 will be revised for consistency with U.S. EPR FSAR Tier 2, Table 15.0-8 with respect to the setpoint for Control Room HVAC Reconfiguration to Recirculation Mode on High Intake Activity function.

FSAR Impact:

U.S. EPR FSAR Tier 2, Tables 15.0-18 and 15.0-25 and Chapter 16, Technical Specifications and Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-180:

b) Discrepancy regarding the applicable modes specified for Sensor A.6 in Table 3.3.1-1, and those necessary for Sensor A.6 to support Permissive P17 in the modes specified in Table 3.3.1-2.

Response to Question 16-180(b):

This issue was further clarified on Page 16-32 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In addition, Sensor A.6 mode applicability does not align with the mode requirements specified for Permissive P17 in LCO Table 3.3.1-2. Cold Leg Temperature WR sensors provide inputs to Permissive P17 which supports Low Temperature Overpressure Protection (LTOP) and is required to be operable when required by LCO 3.4.11. P17 modes of applicability are $4^{(u)}$, $5^{(u)}$, and $6^{(u)}$. Mode 6 is not specified for Sensor A.6 in LCO Table 3.3.1-1. Also, the staff noted that the description for Function B.11.c in the fourth bullet of the response to RAI 103, Question 16-180 on Page 46 of 63 was inaccurate. The CVCS Charging Line does not isolate on CVCS Anti-Dilution Mitigation (ADM).

As discussed in the Response to Question 16-311, Part 16-180(a), changes were made to U.S. EPR FSAR Tier 2, Chapter 16, LCO Table 3.3.1-2 to the Mode requirements for Functions B.12.a and B.12.b and for P17 permissive to provide consistency with how Mode requirements are specified when LCO 3.4.11 is referenced. Also as discussed in the response to Question 16-311, Part 16-180(a), U.S. EPR FSAR Tier 2, Chapter 16, LCO Table 3.3.1-1 was revised to require Sensor A.6, Cold Leg Temperature (Wide Range), to be operable when Pressurizer Safety Relief Valve operability is required by LCO 3.4.11.

The issue regarding the use of the words "charging line" is addressed in response to Question 16-311, Part 16-182(a).

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

DRAFT

Question 16-311

Followup to Question 16-182:

a) Description inaccuracies associated with Functions B.11.b, B.11.c and B.11.d.

Response to Question 16-182(a):

This issue was further clarified on Page 16-21 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In addition, the following issues were also identified based on evaluation of the response:
>
> > Description inaccuracies associated with Functions B.11.b, B.11.c, and B.11.d in Tables 16-138-1 and 16-138-2 of the response. The referenced functions do not isolate the chemical and volume control system (CVCS) charging line.

This issue was further clarified on Page 16-32 of the NRC's March 10, 2010 Safety Evaluation, which states:

- The descriptions associated with CVCS Isolation on ADM Functions B.11.b, B.11.c, and B.11.d in LCO Table 3.3.1-2 and the Bases are inaccurate. The CVCS Charging Line does not isolate on Anti-Dilution Mitigation.

U.S. EPR FSAR Tier 2, Chapter 16, LCO Table 3.3.1-2 and the Bases were revised in U.S. EPR FSAR, Revision 2 to delete the words "Charging Line" from the title and discussion of Anti Dilution Mitigation functions B.11.b, B.11.c and B.11.d. The Applicable Modes category for the Function 11.a in LCO Table 3.3.1-2 was corrected and the remaining footnotes renumbered as required.

In addition, Bases Table B 3.3.1-1 will be revised to include a missing footnote for ESF Function B.11.a, CVCS Charging Line Isolation on High-High Pressurizer Level. The Complete Divisions for Functional Capability column will be revised to reflect two sensors for Functions B.11.b and B.11.c in Modes 5 and 6. The title of Function 11.a will be clarified.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-182:

b) Table 3.3.1-2 footnote presentation associated with footnotes (b) and (c) for Functions B.11.c, B.11.d, A.1.a, A.1.b, A.1.c, A.1.d, A.1.e, and A.2.

Response to Question 16-182(b):

This issue was further clarified on Page 16-32 of the NRC's March 10, 2010 Safety Evaluation, which states:

> The placement associated with Footnotes (b) and (c) in LCO Table 3.3.1-2 for Functions A.1.a, A.1.b, A.1.c, A.1.d, A.1.e, A.2, B.11.c, and B.11.d is incorrect. The footnotes should appear as superscripts for the referenced functions.

Footnotes (b) and (c) in U.S. EPR FSAR Tier 2, Chapter 16, LCO Table 3.3.1-2 will be deleted. Revised footnotes will be added to U.S. EPR FSAR Tier 2, Chapter 16, LCO Table 3.3.1-1 to clarify the surveillance testing requirements of appropriate sensors. The Bases will be revised to reflect this sensor-based approach.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications and Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-182:

c) Bases clarification regarding Permissive P7 Reactor Coolant Pump (RCP) operational requirements.

Response to Question 16-182(c):

This issue was further clarified on Page 16-32 of the NRC's March 10, 2010 Safety Evaluation, which states:

> The CVCS Isolation on ADM at Shutdown Conditions (RCP not operating) function Bases discussion on Page B 3.3.1-56 in the FSAR markup provided with the June 30, 2009, response (fourth paragraph), inaccurately describes the RCP operational conditions required for validation of the P7 Permissive.

The description of how P7 permissive functions will be revised in response to Question 16-311, Part 16-138(a).

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

DRAFT

Question 16-311

Followup to Question 16-190:

a) Ambiguities associated with RCS Loop Flow sensor Operability requirements in Bases Table B 3.3.1-1 (3 of 4 per division and per loop) and Tech Spec Table 3.3.1-1 (3 per division and per loop) for Functions A.1, A.4 and A.5.

Response to Question 16-190(a);

This issue was further clarified on Page 16-33 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 103, Question 16-190, the staff requested that the applicant provide an explanation regarding inconsistencies associated with Bases Table B 3.3.1-1, Protection System Functional Dependencies. In a June 30, 2009, response to RAI 103, Question 16-190, the applicant adequately addressed items a, b, e, and f. However, it did not adequately address Items c and d.
> …
>
> Item c identifies ambiguities associated with RCS Loop Flow instrumentation requirements. LCO Table 3.3.1-1 and Bases Table B 3.3.1-1 were revised by the FSAR markup provided with the June 30, 2009, response to specify a minimum requirement of three RCS Loop Flow sensors "per division and per loop." If two sensors within the same division (different loops) were to become inoperable, a shutdown would be required in accordance with Condition J, even though the minimum requirements for loop operability remained satisfied. Bases Table B 3.3.1-1 guidance does not appear to consider the fact that the, "Low RCS Flow," and "Low-Low RCS Flow," reactor trips both employ four divisions of two-out-of-four voting logic that receive RCS Loop Flow sensor information from the other divisions as well.

U.S. EPR FSAR Tier 2, Chapter 16, LCO Table 3.3.1-1 was revised in U.S. EPR FSAR, Revision 2 to specify three RCS Loop Flow sensors are required for each loop. U.S. EPR FSAR Tier 2, Chapter 16, Bases Table B 3.3.1-1 will be revised to consistently specify "RCS Loop Flow (3 of 4 per loop)" for Functions A.1.b, A.1.c, A.1.e, A.4, and A.5.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-190:

b) Ambiguities associated with RCS Loop Flow sensor Operability requirements in Tech Spec Table 3.3.1-1 (3 per division and per loop).

Response to Question 16-190(b):

The Response to this question was part of Question 16-311, Part 16-190(a).

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

DRAFT

Question 16-311

Followup to Question 16-190:

d) Clarification regarding the number of required RCCA Position Indicators specified in Bases Table B 3.3.1-1 for Function A.1.

Response to Question 16-190(d):

This issue was further clarified on Page 16-34 of the NRC's March 10, 2010 Safety Evaluation, which states:

> Bases Table B 3.3.1 of the FSAR markup provided with the June 30, 2009, response (Page B 3.3.1-100), does not specify the correct values for the minimum number of RCCA Position Indicators per division for Function A.1, Low DNBR.

Functions A.1.b, A.1.c, and A.1.e in U.S. EPR FSAR Tier 2, Chapter 16, Bases Table B 3.3.1-1 were revised in U.S. EPR FSAR, Revision 2 to state that 22 RCCA Analog Position Indicators are required for Divisions 1, 2, and 3, and 23 RCCA Analog Position Indicators are required for Division 4. The word “analog” was inadvertently omitted and will be added.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-190:

e) Clarification regarding the number of required RCCA Bottom Position Indicators in Bases Table B 3.3.1-1 for Permissive P8.

Response to Question 16-190(e):

This issue was further clarified on Page 16-34 of the NRC's March 10, 2010 Safety Evaluation, which states:

> Bases Table B 3.3.1 of the FSAR markup provided with the June 30, 2009, response (Page B 3.3.1-107), does not specify any values for the minimum number of RCCA Bottom Position Indicators per division for Permissive P8.

In response to Question 16-311, Part 16-131(d), P8 permissive in U.S. EPR FSAR Tier 2, Chapter 16, Bases Table B 3.3.1-1 will be revised to state that all 89 RCCA Bottom Position Indicators are required for each division.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

DRAFT

Question 16-311

Followup to Question 16-190:

f) Clarification regarding the number of RCCA Units in Bases Table B 3.3.1-1 for Permissive P8.

Response to Question 16-190(f):

This issue was further clarified on Page 16-34 of the NRC's March 10, 2010 Safety Evaluation, which states:

> Bases Table B 3.3.1 of the FSAR markup provided with the June 30, 2009, response (Page B 3.3.1-107), does not specify the correct values for the minimum number of RCCA Units per division for Permissive P8.

P8 permissive in U.S. EPR FSAR Tier 2, Chapter 16, Bases Table B 3.3.1-1 was revised in U.S. EPR FSAR, Revision 2 to show that only one RCCA Unit per division is required. Note that this corrects information that was previously provided in RAI 103, Supplement 2, Question 16-138, which added specific permissives to the Technical Specifications, including Bases Table B 3.3.1-1.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

DRAFT

Question 16-311

Followup to Question 16-190:

g) Bases clarification regarding the Low Saturation Margin trip Bases text that states "[t]herefore, the Low Saturation Margin reactor trip function assures that the High Core Power Level trip Function remains valid."

Response to Question 16-190(g):

This issue was further clarified on Page 16-34 of the NRC's March 10, 2010 Safety Evaluation, which states:

> The Low Saturation Margin Bases discussion on Page B 3.3.1-21 of the FSAR markup provided with the June 30, 2009, response (first paragraph), does not clearly describe the reason for the Low Saturation Margin Reactor Trip. The Bases states that the function "assures" that the High-Core Power Level trip function remains valid. FSAR Tier 2, Section 7.2.1.2.4, "Reactor Trip on High Core Power Level or Low Saturation Margin," states the "RT on low saturation margin is introduced because, in case of saturation occurring in a hot leg, the thermal power level calculation becomes invalid." The High-Core Power Level trip uses an enthalpy balance to calculate core thermal power.

The spelling of the word "therefore" was previously corrected in the U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases. The clause which states: "the Low Saturation Margin reactor trip function assures that the High Core Power Level trip function remains is not invalidated." will be revised to state: "the Low Saturation Margin reactor trip function is introduced because, in case of saturation occurring in a hot leg, the thermal core power level calculation becomes invalid."

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-193:

b) Discrepancy between the revised definition for SENSOR OPERATIONAL TEST (SOT) provided in the response to Question 16-243 of RAI 122, and the definition in Bases Section SR 3.3.1.5.

Response to Question 16-193(b):

This issue was further clarified on Page 16-38 of the NRC's March 10, 2010 Safety Evaluation, which states:

> SR 3.3.1.5, Sensor Operational Test, Bases discussion on Page B 3.3.1-96 of the FSAR markup provided with the June 30, 2009, response, incorrectly states, “required for division OPERABILITY,” instead of, “required for sensor OPERABILITY.”

The U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases discussions for Protection System (LCO 3.3.1) SR 3.3.1.5 was revised in U.S. EPR FSAR, Revision 2 to replace the word "division" with "sensor."

The Bases description of SR 3.3.1.5 will be reworded to more accurately reflect the definition of a Sensor Operational Test. The reference to SR 3.3.1.5 will be deleted from the signal processors listed in U.S. EPR FSAR Tier 2, Chapter 16, LCO Table 3.3.1-1.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-193:

c) Discrepancy between the revised definition for CALIBRATION provided in the response to Question 16-243 of RAI 122, and the definition in Bases Section SR 3.3.1.6.

Response to Question 16-193(c):

This issue was further clarified on Page 16-38 of the NRC's March 10, 2010 Safety Evaluation, which states:

> SR 3.3.1.6, Calibration, Bases discussion on Page B 3.3.1-96 of the FSAR markup provided with the June 30, 2009, response, incorrectly states, “parameter that the sensor monitors,” instead of, “parameter that the division monitors.”

The U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases discussions for Protection System (LCO 3.3.1) SR 3.3.1.6 was revised in U.S. EPR FSAR, Revision 2 to replace the word "sensor" with "division."

The Bases description of SR 3.3.1.6 will be revised to include an explanation for the exclusion of the neutron detectors.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-193:

d) Potential discrepancies regarding the applicability of SR 3.3.1.8 to Sensors A.24 and A.25, and Manual Actuation Switch B.1 in Table 3.3.1-1.

Response to Question 16-193(d):

This issue was further clarified on Page 16-38 of the NRC's March 10, 2010 Safety Evaluation, which states:

> SR 3.3.1.8, Actuating Device Operational Test (ADOT) is listed for Sensors A.24 and A.25, and Manual Actuation Switch B.1 in Table 3.3.1-1 of the FSAR markup provided with the June 30, 2009, response. Assignment of SR 3.3.1.8 to sensors A.24 and A.25 is questionable considering the description of ADOT in Definitions Section 1.1 of the GTS. Assignment of SR 3.3.1.8 to Manual Actuation Switch B.1 (Reactor Trip) is also questionable considering that SR 3.3.1.3, Actuation Device Operational Test, which verifies the operability of the Reactor Trip Circuit Breakers and Reactor Trip Contactors every 31 days, has not been specified for component B.1.

In U.S. EPR FSAR Tier 2, Chapter 16, LCO Table 3.3.1-1, Surveillance Requirement (SR) 3.3.1.8 was deleted in U.S. EPR FSAR, Revision 2 from the RCCA Bottom Position Indicators, the Reactor Trip Circuit Breaker Position Indication, and the manual actuation switches.

A graphical representation of the overall Protection System surveillance testing philosophy was provided in response to RAI 103, Question 16-193 (Supplement 1) and is provided below for reference in this discussion. This graphical representation applies to the Protection System automatic functions.

As shown in the figure, regardless of whether a sensor or switch is a digitally-based or analog-based component, the Calibration is the surveillance that verifies the sensor is providing an acceptable output. Therefore, a Calibration is an appropriate and required surveillance for the Reactor Trip Circuit Breaker Position Indication, RCCA Analog Position Indicators, and the manual actuation switches.

The manual reactor trip function is shown on U.S. EPR FSAR Tier 2, Figure 7.2-3. Each button is wired directly into the hardwired logic for trip actuation that bypasses the electronics of the Protection System. The Calibration surveillance verifies that the sensor is providing an acceptable output. The Actuating Device Operational Test (ADOT) verifies the operability of all devices in the division required for actuating device operability. Verification of the operability of the manual reactor trip actuation capability once per cycle is consistent with NUREG-1431. Verification of the operability of the reactor trip breakers on a more frequent basis is also consistent with NUREG-1431.

The Reactor Trip Circuit Breaker Position Indication and RCCA Analog Position Indicators provide input into the APUs. As shown on the figure provided below, the Sensor Operational Test (SOT) verifies the operability of other devices in the division, besides the sensor itself, that are required for operability.

U.S. EPR FSAR Tier 2, Chapter 16, LCO Table 3.3.1-1 will be revised to specify the above surveillances for these sensors and manual actuation switches.

DRAFT

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications and Bases will be revised as described in the response and indicated on the enclosed markup.

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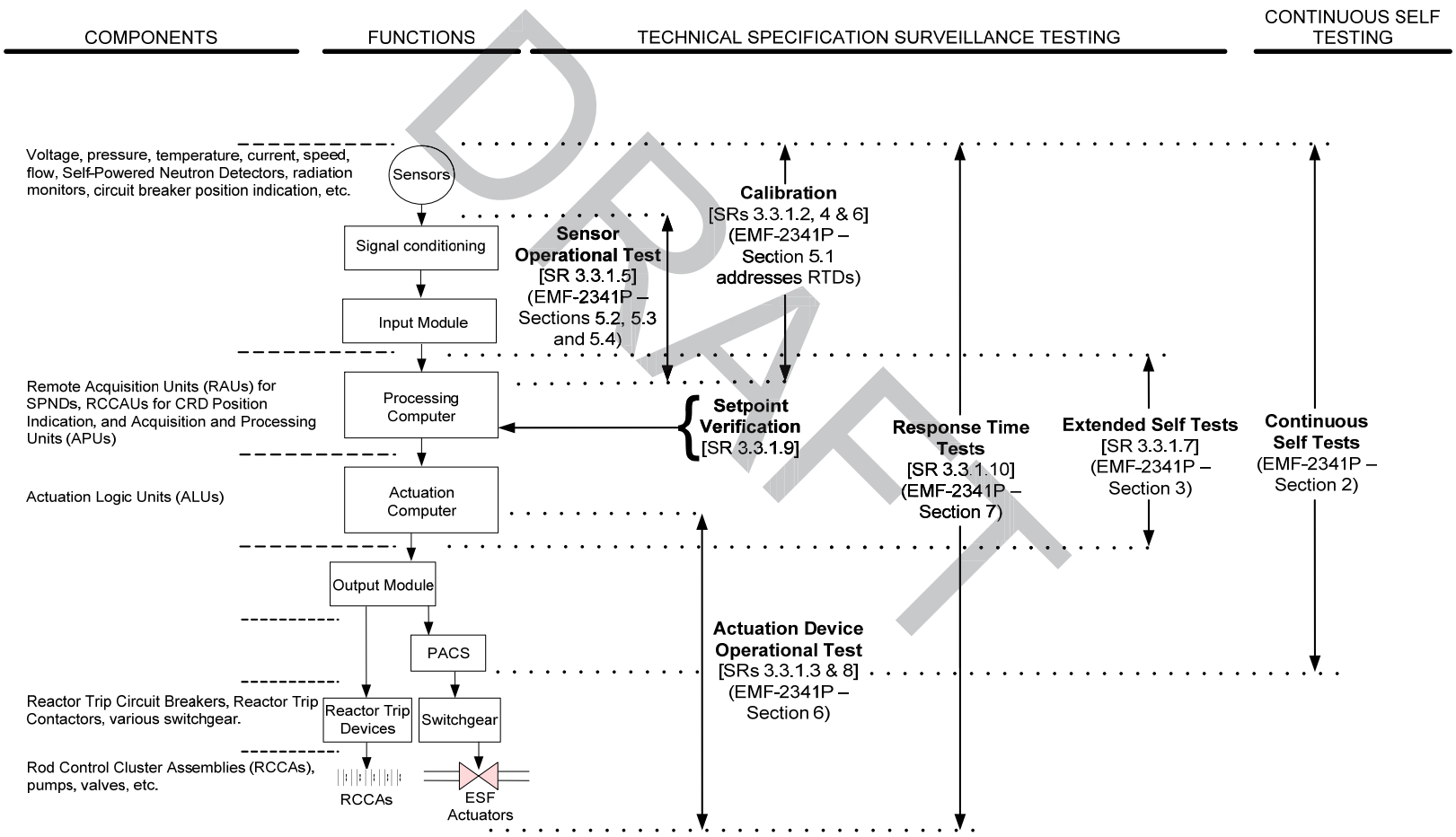
SUMMARY OF PROTECTION SYSTEM TESTING

(Comparison with EMF-2341P, Generic Strategy for Periodic Surveillance Testing of TELEPERM XS Systems)



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Question 16-311

Followup to Question 16-194:

Inconsistencies regarding use of the terms “channel” and “division” throughout the Protection System Bases B 3.3.1.

Response to Question 16-194:

This issue was further clarified on Page 16-38 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 103, Question 16-194, the staff requested an explanation regarding setpoint relationships, references to Sensor Operational Test, and use of the word “channel” in the Bases. In a March 19, 2009, response to RAI 103, Question 16-194, the applicant adequately addressed each of these issues; however, the staff noted inconsistencies throughout Bases B 3.3.1 regarding use of the terms “channel” and “division.”

As discussed in the Response to RAI 122, Question 16-243, since protective action signals are shared between all four divisions throughout the design of the Protection System, the use of the term "channel" as defined in both IEEE Standards 338-1997 and 603-1998 does not accurately describe the overall configuration of the Protection System. The use of the term "division" more accurately describes how the system architecture is designed and functions. The use of the terms "channel" and "division" in the Protection System Bases were reviewed and determined to be accurate. Note that the term "channel uncertainties" is correct as defined in AREVA Topical Report ANP-10275P-A, "U.S. EPR Instrument Setpoint Methodology Topical Report," since it reflects the latest industry guidance provided by American National Standards Institute (ANSI), and Instrument Society of America (ISA), in ANSI/ISA-67.04.01-2006, “Setpoint for Nuclear Safety-Related Instrumentation,” May 2006.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

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Question 16-311

Followup to Question 16-195:

Discrepancy regarding the RAI Block reference associated with the FSAR Markup for Question 16-195 in Table 3.3.1-1.

Response to Question 16-195:

This issue was further clarified on Page 16-38 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 103, Question 16-195, the staff requested that the applicant provide an explanation regarding the, "Minimum Required for Functional Capability," value specified for the SPNDs in LCO, Table 3.3.1-1. In a March 19, 2009, response to RAI 103, Question 16-195, the applicant proposed to revise the GTS and Bases to specify a minimum required value of 67 SPNDs. However, the FSAR markup (RAI block identifiers) associated with changes to both the SPNDs and Remote Acquisition Units, in LCO, Table 3.3.1-1 are incorrect. The identifiers should reference RAI 103, Question 16-195, instead of 16-193.

In the Response to RAI 16-193, there was a typographical error in the markup for U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications. The change in the minimum number of Self Powered Neutron Detectors (SPNDs) required for functional capability should have been annotated as part of the Response to Question 16-195 instead of 16-193. Clarifications regarding the number of required RAUs is addressed in Response to Question 311, Part 16-131(d).

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

DRAFT

Question 16-311

Followup to Question 16-198:

RAI reference errors in the response to Question 16-198.

Response to Question 16-198:

This issue was further clarified on Page 16-40 of the NRC's March 10, 2010 Safety Evaluation, which states:

> The first two paragraphs of the March 19, 2009, response to RAI 103, Question 16-198, on Page 14 of 21, contain RAI reference errors. The first paragraph should reference RAI 103 instead of RAI 110. The second paragraph is missing the reference to RAI 110.

There was an editorial error in the Response to Question 16-215. Question 16-197 is a part of RAI 103; not RAI 110, as specified in the response. In addition, the RAI should have been specified for Question 16-198. It is from RAI 110.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

DRAFT

Question 16-311

Followup to Question 16-199:

Revise RAI response.

Response to Question 16-199:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications, LCO 3.3.2, Post Accident Monitoring Instrumentation, Table 3.3.2 and associated Bases, will be revised to clarify the required number of channels.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications and Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-311

Followup to Question 16-208:

LCO reference omission from Reporting Requirements Section 5.6.3, CORE OPERATING LIMITS REPORT (COLR).

Response to Question 16-208

This issue was further clarified on Page 16-44 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 103, Question 16-208, the staff requested that the applicant provide an explanation regarding the use of a footnote reference stating, "As specified in the COLR," to represent the Limiting Safety System Setting setpoint values specified for the Low DNBR Reactor Trip functions in the GTS Table 3.3.1-2. In a November 26, 2008, response to RAI 103, Question 16-208, the applicant confirmed that the Core Operating Limits Report was listed in TS Administrative Controls, FSAR Tier 2, Section 5.6, "Reporting Requirements." The response only partially addressed the staff's concerns regarding the control requirements associated with the analytical methods used to determine the LSSS setpoint values to be specified in the COLR. The staff noted that (1) Protection System LCO 3.3.1 was not identified among the individual specifications included in COLR Section 5.6.3.a of the Reporting Requirements, and (2) the NRC-approved document describing the analytical methods used to determine the LSSS setpoint values for the Low DNBR and High Linear Power Density Reactor Trip functions, was not identified in COLR Section 5.6.3.b of the "Reporting Requirements."

A reference to the Protection System LCO was added to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Section 5.6.3 in U.S. EPR FSAR, Revision 2. The analytical methods used to determine the core operating limits, including the Low DNBR and High Linear Power Density Reactor Trip functions, are identified in COLR Section 5.6.3.b of the "Reporting Requirements." The COLR was developed to reduce the need for plant cycle-specific License Amendments. Approval of the COLR approach was based on the cycle specific values being determined using NRC approved methodologies. The calculation of Channel Uncertainties is not cycle specific. Reference to the NRC approved Topical Report that is utilized to determine Channel Uncertainties does not have to be referenced in the Reporting Requirements section of the Technical Specifications that provides the requirements for the COLR.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

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Question 16-311

Followup to Question 16-209:

LCO reference omission from Reporting Requirements Section 5.6.4, Reactor Coolant System (RCS) PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR).

Response to Question 16-209

This issue was further clarified on Page 16-44 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 103, Question 16-209, the staff requested that the applicant provide an explanation regarding the use of a footnote reference stating, "As specified in the Pressure Temperature Limits Report (PTLR)," to represent the Limiting Safety System Setting setpoint values specified for the Pressurizer Safety Relief Valve (PSRV) Actuation functions in the GTS Table 3.3.1-2. In a November 26, 2008, response to RAI 103, Question 16-209, the applicant confirmed that the PTLR was listed in TS Administrative Controls Section 5.6, "Reporting Requirements." The response only partially addressed the staff's concerns regarding the control requirements associated with the analytical methods used to determine the LSSS setpoint values to be specified in the PTLR. The staff noted that (1) Protection System LCO 3.3.1 was not identified among the individual specifications included in PTLR Section 5.6.4.a of the Reporting Requirements, and (2) the NRC-approved document describing the analytical methods used to determine the LSSS setpoint values for the PSRV Actuation functions, was not identified in PTLR Section 5.6.4.b of the "Reporting Requirements."

A reference to the U.S. EPR FSAR Tier 2, Chapter 16, Protection System LCO was added to Technical Specifications Section 5.6.4 in U.S. EPR FSAR, Revision 2. The analytical methods used to determine the RCS pressure and temperature limits are identified in Pressure-Temperature Limitations Report (PTLR), Section 5.6.4.a of the "Reporting Requirements." The PTLR was developed to reduce the need for plant cycle-specific License Amendments. Approval of the PTLR approach was based on the cycle specific values being determined using NRC approved methodologies. The calculation of Channel Uncertainties is not cycle specific. Reference to the NRC approved Topical Report that is utilized to determine Channel Uncertainties does not have to be referenced in the Reporting Requirements section of the Technical Specifications that provides the requirements for the PTLR.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

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Question 16-312:

Potential Open Item

Provide the additional information and update the following RAI responses for each of the Instrumentation System Tech Spec items identified, based on the results of Audit Meetings between AREVA NP and NRC Staff on 7/30/09, 7/31/09, 8/13/09 and 8/14/09.

Request for Additional Information No. 110 (1295)

DRAFT

Question 16-312

Followup to Question 16-212:

a) Omission of Regulatory Guide 1.97 (Revision 4) and IEEE Standard 492-2002 from the Post Accident Monitoring (PAM) Instrumentation Bases B 3.3.2 REFERENCES Section.

Response to Question 16-212(a):

This issue was further clarified on Page 16-44 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 110, Question 16-212, the staff requested that the applicant provide information necessary to ensure that the GTS Table 3.3.2-1, "Post-Accident Monitoring Instrumentation," includes the entire population of instruments required by GDC 13, "Instrumentation and Control," GDC 19, "Control Room," and GDC 64, "Monitoring Radioactivity Releases," and the guidance included in Institute of Electrical and Electronics Engineers (IEEE) Std 497-2002, "Criteria for Accident Monitoring Instrumentation for Nuclear Power Generating Stations," and RG 1.97, Revision 4. In a March 31, 2009, response to RAI 110, Question 16-212, the applicant removed the current list of PAM Instrumentation and associated discussions from TS Section 3.3.2, and Bases B 3.3.2, on the basis that PAM variable selection criteria in RG 1.97, Revision 4, depend on prior development of EPG, EOP, and AOP (procedures that cannot be completed prior to COL issuance). The staff has reviewed its current position regarding which accident monitoring instrumentation should be in technical specifications, in comparison to RG 1.97, Revision 4. The staff has concluded that accident monitoring instrumentation Type A, Type B, and Type C, as defined in RG 1.97, Revision 4, are similar to the Type A and the Category 1, non-Type A defined in RG 1.97, Revision 3. Therefore, it is, the staff's position that technical specifications should include (1) all RG 1.97, Revision 4, Type A instruments, and (2) all RG 1.97, Revision 4, Type B and Type C instruments in accordance with the unit's RG 1.97 Safety Evaluation Report. Therefore, a COL applicant should include a technical specification that meets this staff position if the applicant references RG 1.97, Revision 4. Identification of RG 1.97, Revision 4, Type A, Type B, and Type C accident monitoring instrumentation functions depends on the development of EOPs and AOPs which are post-COL activities. DC/COL-ISG-8 provides the guidance necessary to complete the plant-specific technical specification list of PAM instrumentation functions. This guidance provides three options:
>
> > Option 1 involves the use of plant-specific information. Option 1 appears impracticable for PAM instrumentation technical specifications, because the list of Type A, Type B, and Type C PAM instrumentation functions cannot be finalized before COL issuance.
> >
> > Option 2 involves the use of useable bounding information. Option 2 may be practical if the COL applicant is able to develop a truly bounding list of Type A, Type B, and Type C PAM instrumentation functions to be included in the plant-specific technical specifications. However, if a RG 1.97, Revision 4, analysis considering plant-specific EOPs and AOPs, which are based on the as-built plant, shows that additional PAM instrumentation functions are necessary, then the COL holder would need to request a license amendment to make changes to the plant-specific technical specification PAM instrumentation required functions list. The NRC would need to approve this amendment before the COL holder would be allowed to load fuel.

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Option 3 involves an administrative program to control PAM instrumentation functions. Option 3 would require establishing a plant-specific administrative controls program technical specification that would require using an NRC-approved methodology to determine the required PAM instrumentation functions, and maintaining the list of required PAM instrumentation functions in a specified document with appropriate regulatory controls. Option 3 may be practical, because the approved methodology, RG 1.97, Revision 4, is already established, and FSAR Tier 2, Section 7.5.2.2.1 already commits the COL holder to establish a list of all types of PAM instrumentation.

Since standard technical specifications for Westinghouse PWRs include a technical specification to govern post-accident monitoring instrumentation, the staff concludes that requirements for PAM instrumentation must be included in the U.S. EPR GTS. The staff issued a follow-up RAI 300, Question 16-315 to address this issue. In addition, the following items were also identified based on evaluation of the response:

RG 1.97, Revision 4 and IEEE Std 497-2002 have been omitted from the References Section of PAM Instrumentation Bases B 3.3.2.

AREVA has previously revised its position on Post-Accident Monitoring (PAM) Instrumentation in response to RAI 110, Supplement 4, Question 16-212.

References to Regulatory Guide 1.97, Revision 4, and IEEE Standard 497-2002 were added to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification, Post PAM Instrumentation Bases in U.S. EPR FSAR, Revision 2.

The first paragraph of the PAM Applicable Safety Analysis Bases discussion will be revised to delete the word “certain” and add the phrase “Type A, B, and C” in front of the word “variables.”

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

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Question 16-312

Followup to Question 16-212:

b) NUREG-0737, Supplement 1, "TMI Action Items," is listed in the PAM Instrumentation Bases B 3.3.2 REFERENCES Section, but is not included anywhere in the associated Bases. NUREG-0737 is referenced in the PAM Instrumentation Bases B 3.3.3 BACKGROUND Section of the WOG STS.

Response to Question 16-212(b):

This issue was further clarified on Page 16-46 of the NRC's March 10, 2010 Safety Evaluation, which states:

> NUREG-0737, "Clarification of TMI Action Plan Requirements," Supplement 1, "TMI Action Items," is listed in the References Section of PAM Instrumentation Bases B 3.3.2, but is not cited anywhere in the associated U.S. EPR Bases text. It was noted that NUREG-0737 is referenced in the Background Section of PAM Instrumentation Bases B 3.3.3 of NUREG-1431.

A citation to NUREG-0737, Supplement 1, including the appropriate reference, was added to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification, PAM Instrumentation Bases in U.S. EPR FSAR, Revision 2.

In the first paragraph of the PAM Background Bases discussion and in the References, the phrase "(TMI Action Plan)" will be added next to the citation of NUREG-0737.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

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Question 16-312

Followup to Question 16-213:

Response to Question 16-213 states that "the subject text is now bracketed as described in the response to Question 16-212." The response to Question 16-212 removes the current list of PAM Instrumentation and associated discussions from U.S. EPR FSAR Tier 2, Chapter 16 Technical Specifications Section 3.3.2, and U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification Bases B 3.3.2. There does not appear to be any bracketed text associated with the response to Question 16-212.

Response to Question 16-213:

This issue was further clarified on Page 16-46 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 110, Question 16-213, the staff requested that the applicant provide an explanation regarding the determination of primary to secondary loop coupling in the PAM Bases discussion associated with Hot Leg Temperature Wide Range instrumentation on Page B 3.3.2-4 of Bases B 3.3.2, Revision 0. Clarification is needed with regard to how the Hot Leg Temperature WR instruments can be used to confirm primary to secondary loop coupling without Cold Leg Temperature WR instrumentation. In a March 19, 2009, response to RAI 110, Question 16-213, the applicant stated that the subject text is now bracketed as described in the response to RAI 110, Question 16-212. There does not appear to be any bracketed text as stated in the response, only a bracketed period. Note that the response to RAI 110, Question 16-212, removed the current list of PAM Instrumentation (including all references to LCO Table 3.3.2-1), and associated discussions from TS Section 3.3.2, and TS Bases B 3.3.2, on the basis that PAM variable selection criteria in RG 1.97, Revision 4, depend on prior development of EPGs, EOPs, and AOPs (procedures that cannot be completed prior to COL issuance).

This issue was further clarified on Page 16-46 of the NRC's March 10, 2010 Safety Evaluation, which states:

> The staff issued a follow-up RAI 300, Question 16-312 to document and address the staff's concerns regarding (1) primary-to-secondary loop coupling determination issues, and (2) potential discrepancies associated with bracketing of information in Bases Section B 3.3.2.

In the Response to RAI 110, Supplement 1, for this question, reference was made to bracketed text. The PAM Technical Specifications and Bases have been revised in U.S. EPR FSAR, Revision 2 and all required information has been provided. There are no longer any Combined Operating License information items in the PAM Technical Specifications or Bases. In addition, there is no longer a discussion of primary to secondary loop coupling in the PAM Technical Specifications Bases. However, in order to support the closure of the above mentioned SER Open Item, the following explanation is provided. T_{hot} indications can be used to verify primary to secondary coupling by observing the T_{hot} response to changes in steam generator (SG) pressure. T_{hot} lowering in response to decreasing SG pressure is an indication that primary to secondary coupling exists. T_{hot} indication response will have a greater delay than when using T_{cold} instruments, due to low loop flow rates and the greater distance from the SG to the T_{hot} sensors. Another indication of coupling is to verify that T_{hot} tracks changes in core exit temperatures. T_{hot} close to and tracking core exit temperatures is an

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indication that natural circulation exists, which requires primary to secondary coupling. An alternate indication of primary to secondary coupling, independent of reactor coolant system (RCS) temperature indications, is to verify the ability to feed and steam the SG while maintaining SG pressure. Heat transfer must exist to sustain SG pressure during steaming.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

DRAFT

Question 16-312

Followup to Question 16-217:

b) Clarification regarding Note 6 of Table 15.0-7 for the Low Saturation Margin trip which states "however, it is required to maintain the validity of the high core power level trip."

Response to Question 16-217(b):

This issue was further clarified on Page 16-47 of the NRC's March 10, 2010 Safety Evaluation, which states:

> FSAR Tier 2, Table 15.0-7, Note 6, does not clearly state the reason for the Low Saturation Margin Reactor Trip. FSAR Tier 2, Section 7.2.1.2.4 states the, "RT on low saturation margin is introduced because, in case of saturation occurring in a hot leg, the thermal power level calculation becomes invalid." The High-Core Power Level trip uses an enthalpy balance to calculate core thermal power.

U.S. EPR FSAR Tier 2, Table 15.0-7, Note 6 will be revised to utilize the same wording presented in U.S. EPR FSAR Tier 2, Section 7.2.1.2.4.

FSAR Impact:

U.S. EPR FSAR Tier 2, Table 15.0-7 will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-312

Followup to Question 16-217:

c) Clarification regarding use of the term “RT check-back” in Table 15.0-8 under the Main Feedwater Isolation Function.

Response to Question 16-217(c):

This issue was further clarified on Page 16-47 of the NRC's March 10, 2010 Safety Evaluation, which states:

> FSAR Tier 2, Table 15.0-8 includes use of the term, “RT check-back” in the Main Feedwater Full Load Closure on Reactor Trip functional description. “RT check-back” is not used in the description for Function B.2.a in LCO Table 3.3.1-2. Although the associated Bases discussion makes reference to a “reactor trip check-back,” no explanation is provided and the meaning is not readily apparent.

The term “reactor trip check back" was changed in U.S. EPR FSAR, Revision 2 to "reactor trip confirmation signal" in the Bases description of the Main Feedwater Full Load Isolation on Reactor Trip function. The Bases discussion of the Startup and Shutdown System Isolation on Steam Generator Pressure Drop function was revised in U.S. EPR FSAR, Revision 2 to replace the words "listed events" with a listing of the events and the reference to a reactor trip being initiated on an SG pressure drop signal was deleted.

U.S. EPR FSAR Tier 2, Table 15.0-8 will be revised in U.S. EPR FSAR, Revision 2 to refer to the Main Feedwater Full Load Isolation on Reactor Trip (all SGs) function. This will change the word “closure” to “isolation.”

FSAR Impact:

U.S. EPR FSAR Tier 2, Table 15.0-8 will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-312

Followup to Question 16-217:

d) Note information associated with the Steam Generator (SG) Pressure Drop setpoint, similar to Note 1 in FSAR Figure 7.2-18, is missing from FSAR Figure 7.3-17 for Startup and Shutdown System (SSS) Feedwater Isolation on SG Pressure Drop Function B.2.c.

Response to Question 16-217(d):

This issue was further clarified on Page 16-48 of the NRC's March 10, 2010 Safety Evaluation, which states:

> Note 1 information in FSAR Tier 2, Figure 7.2-18 pertaining to the SG Pressure Drop Reactor Trip setpoint, is also relevant to the Startup and Shutdown Feedwater Isolation on SG Pressure Drop ESFAS setpoint, and should be included in FSAR Tier 2, Figure 7.3-17

The note on U.S. EPR FSAR Tier 2, Figure 7.3-17, which was added in U.S. EPR FSAR, Revision 2, will be revised to reference the correct setpoint.

FSAR Impact:

U.S. EPR FSAR Tier 2, Figure 7.3-17 will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-312

Followup to Question 16-217:

f) First paragraph of B 3.3.1 Bases text on page B 3.3.1-14 of Interim Revision 2 states that "credited functions are tabulated in FSAR Tables 15.0-7, 15.0-8, and 15.0-9." It does not appear that all functions specified in the referenced tables are actually credited.

Response to Question 16-217(f):

This issue was further clarified on Page 16-47 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 110, Question 16-217, the staff requested that the applicant provide confirmation that reactor trip and ESF actuation functions credited in the accident analysis are specifically identified by FSAR Tier 2, Table 7.2-1, "Reactor Trip Variables," and FSAR Tier 2, Table 7.3-1, "ESF Actuation Variables," since Bases references to FSAR Tier 2, Sections 7.2 and 7.3 in B 3.3.1, "Applicable Safety Analyses, LCO and Applicability," Page B 3.3.1-14 (Revision 0), were not sufficiently explicit to provide traceability to the accident analysis with respect to credited functions and associated instrumentation. In a June 30, 2009, response to RAI 110, Question 16-217, the applicant revised Bases B 3.3.1 to provide the necessary traceability by inclusion of the statement, "Credited functions are tabulated in FSAR Tier 2, Tables 15.0-7, 15.0-8, and 15.0-9." However, there is confusion over whether or not these tables should include only the credited functions. For example, the Steam Generator Isolation function is not included in the TS, but is listed in FSAR Tier 2, Table 15.0-8, with clarifying notes. The FSAR markup provided with the June 30, 2009, response removes Function B.6.c, EFWS Isolation on High-SG Level, from the TS on the basis of the response to RAI 103, Question 16-160, which states, "Emergency Feedwater Isolation on High-Steam Generator Level function is no longer credited in FSAR Tier 2, Table 15.0-8." Function B.6.c remains listed in the table with clarifying notes as well. The inclusion of these functions in the revision to FSAR Tier 2, Table 15.0-8 (FSAR markup provided with the June 30, 2009, response), appears to contradict the response to RAI 110, Question 16-217, which states that the table will be updated to delineate the safety-classified protection and safety-systems credited in the accident analysis.

The word "tabulated" was replaced with the word "included" on U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases description of reactor trip actuation devices in U.S. EPR FSAR, Revision 2.

As noted in their titles, U.S. EPR FSAR Tier 2, Table 15.0-7, Reactor Trip Setpoints and Delays Used in the Accident Analysis, and Table 15.0-8, Engineered Safety Features Actuation System (ESFAS) Functions Used in the Accident Analysis, list the functions that were modeled in the safety analysis and assumed to be available. It is only after the safety analysis has been completed, can it be determined which functions were credited for mitigation of an event or anticipated operational occurrence. The functions listed in the table were annotated with footnotes to provide this information.

U.S. EPR FSAR Tier 2, Table 15.0-8, Note 11, will be clarified with respect to the credited action for the associated functions.

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FSAR Impact:

U.S. EPR FSAR Tier 2, Table 15.0-8 will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-312

Followup to Question 16-219:

Bases enhancement to ensure the accuracy and completeness of information.

Response to Question 16-219:

This issue was further clarified on Page 16-48 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 110, Question 16-219, the staff requested that the applicant provide clarification within the Bases that acceptable limits during accidents are such that the offsite dose shall be maintained within an “acceptable fraction” of 10 CFR Part 100 limits, based on the probability of occurrence of the specific accident category. The Background Section of Bases B 3.3.1, Revision 0, did not identify the need for margins to 10 CFR Part 100 limits. In a December 1, 2008, response to RAI 110, Question 16-219, the applicant proposed a revision to the Bases to provide the necessary clarification. However, pertinent information from the comparable Bases paragraph in NUREG-1431 was not included in the proposed revision.

A sentence was added to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases in U.S. EPR FSAR, Revision 2 which states: "Different accident categories are allowed a different fraction of these limits, based on probability of occurrence."

The sentence in the Bases that states: “However, these values and their associated LTSPs are not considered to be LSSS as defined in 10 CFR 50.36,” will be deleted.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-312

Followup to Question 16-226:

Potential discrepancy regarding the deletion of “manual actuation switches” from the second paragraph of Bases page B 3.3.1-15, Interim Revision 2.

Response to Question 16-226:

This issue was further clarified on Page 16-49 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 110, Question 16-226, the staff requested that the Bases be clarified to specify the conditions in Modes 4 and 5 for which the Protection System instrumentation that supports reactor trip functions, is not required to be operable. In a June 30, 2009, response to RAI 110, Question 16-226, the applicant revised the Bases to include the necessary clarifying information; however, the response deleted the reference to “manual actuation switches” on Page B 3.3.1-15 of the FSAR markup provided with the June 30, 2009, response (first full paragraph). The conditions of operability in Modes 4 and 5 for Manual Actuation Switch B.1, Reactor Trip, are the same as for the PS sensors, signal processors, and actuation devices that would be required to support automatic reactor trip functions in Modes 4 and 5 with the RCSL System capable of withdrawing an RCCA or one or more RCCAs not fully inserted. The deleted text appears to be relevant to the Bases discussion.

The Bases will be revised to clarify the paragraph.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-312

Followup to Question 16-227:

The ≤ sign associated with the LTSP/Design Limit of 36.3 psia for Function B.9.c was not included in Table 3.3.1-2 of Interim Revision 2. The ≤ was incorporated into Revision 1 of the DCD and is specified in the FSAR Markup for RAI 110, Question 16-227.

Response to Question 16-227:

This issue was further clarified on Page 16-23 of the NRC's March 10, 2010 Safety Evaluation, which states:

> The Bases discussions for Functions B.9.c, B.9.d, B.10.a, B.10.b, B.12.a, B.12.b, and B.13 in the FSAR markup provided with the June 30, 2009, response include statements that identify the Limiting Safety System Setting (LSSS) setpoint values associated with these functions as LSSSs related to variables having significant safety functions, but which do not protect Safety Limits. 10 CFR 50.36(c)(1)(ii)(A) requires that the TSs include LSSSs for variables that have significant safety functions. For variables on which a Safety Limit has been placed, the LSSS must be chosen to initiate automatic protective action to correct abnormal situations before the SL is exceeded. 10 CFR 50.36(c)(1)(ii)(A) also contains requirements for a general class of LSSSs; LSSSs related to variables having significant safety functions but which do not protect SLs. All plant operating licenses have TSs for LSSSs that are not related to SLs. For these LSSSs, 10 CFR 50.36(c)(1)(ii)(A) also requires that a licensee take appropriate action if it is determined that the automatic safety system does not function as required. The use of Bases statements to distinguish between SL-LSSS and non-SL-LSSS functions is unnecessary. The distinctions add little value and the classification of U.S. EPR Protection System instrumentation setpoints as either SL-LSSS or non-SL-LSSS is not clearly understood for all functions.

This issue was further clarified on Page 16-50 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 110, Question 16-227, the staff requested that the applicant provide an explanation regarding the use of inequality signs associated with the Limiting Trip Setpoint values specified in LCO Table 3.3.1-2. In a March 19, 2009, response to RAI 110, Question 16-227, the applicant stated that use of ≤ or ≥ symbols is appropriate for the general class of Limiting Safety System Settings related to variables having significant safety functions but which do not protect Safety Limits, otherwise referred to as the “Design Limit” by the applicant. Although the column headings and placement of relevant footnotes were revised in LCO Table 3.3.1-2 to reflect the distinction between values associated with LTSPs and Design Limits, a discrepancy was noted regarding the use of inequality sign information for Function B.9.c, Containment Isolation (Stage 2) on High-High-Containment Pressure. The ≤ symbol specified for the LTSP/Design Limit of 36.3 psia in the FSAR markup (RAI 110, Question 16-227) and incorporated into Revision 1 of the FSAR, was not included in LCO Table 3.3.1-2 of the FSAR markup provided with the June 30, 2009, response, nor was there any footnote information in place of the ≤ sign to indicate that the value may be associated with a Safety Limit. In an audit on July 30-31, 2009, the applicant acknowledged the discrepancy and agreed to make any necessary corrections. 10 CFR 50.36(c)(1)(ii)(A) requires that the TSs include LSSSs for variables that have significant safety functions. For variables on which a Safety Limit has been placed, the LSSS must be chosen to initiate automatic protective action to

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correct abnormal situations before the SL is exceeded. 10 CFR 50.36(c)(1)(ii)(A) also contains requirements for a general class of LSSSs; LSSSs related to variables having significant safety functions but which do not protect SLs. All plant operating licenses have TSs for LSSSs that are not related to SLs. For these LSSSs, 10 CFR 50.36(c)(1)(ii)(A) also requires that a licensee take appropriate action if it is determined that the automatic safety system does not function as required. The use of Footnotes (b) and (c) to distinguish between SL-LSSS and non-SL LSSS functions in the Limiting Trip Setpoint / Design Limit column in LCO Table 3.3.1-2 of the TS is unnecessary. The distinctions add little value and the classification of U.S. EPR Protection System instrumentation setpoints as either SL-LSSS or non-SL LSSS is not clearly understood for all functions.

The paragraph which states:

> "The setpoint for this function does not provide an automatic trip setpoint that protects against violating the Reactor Core Safety Limits or Reactor Coolant System Pressure Safety Limit during AOOs. This LSSS is not a SL-LSSS."

was deleted from the description of:

- Containment Isolation (Stage 2) on High-High Containment Pressure ,
- Containment Isolation (Stage 1) on High Containment Radiation,
- Emergency Diesel Generator Start on Degraded Grid Voltage,
- Emergency Diesel Generator Start on Loss of Offsite Power,
- Pressurizer Safety Relief Valve Actuation – First and Second Valve, and
- Control Room HVAC Reconfiguration to Recirculation Mode on High Intake Activity.

In order to avoid unnecessary differentiation, the LCO Table 3.3.1-2 column heading "Limiting Trip Setpoint / Design Limit" will be replaced with the single term "Nominal Trip Setpoint." Descriptions throughout the Bases will be revised to reflect this change.

The less than or equal to sign associated with 36.3 psia will be deleted from Technical Specifications Function B.9.c in LCO Table 3.3.1-2.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications and Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-312

Followup to Question 16-234:

a) Discrepancies regarding omission of the Note in SR 3.3.3.2 (NUREG-1431) from EPR GTS surveillance requirement SR 3.3.2.1, and deletion of the associated Bases discussion in EPR Bases Section SR 3.3.2.1.

Response to Question 16-234(a):

This issue was further clarified on Page 16-51 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 110, Question 16-234, the staff requested that the applicant provide an explanation regarding the validity of the Bases discussion for SR 3.3.2.2, Sensor Operational Test, on Page B 3.3.2-8 of Revision 0. In a December 1, 2008, response to RAI 110, Question 16-234, the applicant deleted the requirement for performance of an SOT from LCO 3.3.2, Post-Accident Monitoring Instrumentation, on the basis of information contained in the Bases that does not accurately reflect the definition for SOT in GTS Definitions Section 1.1. The staff questions the applicant's decision to remove the surveillance requirement on the basis that the current definition for SOT appears to be applicable to PAM Instrumentation. This issue has been identified as an open item. In addition, the following issues were also identified based on evaluation of the response:
>
> The Note in SR 3.3.3.2 of NUREG-1431 and the associated Bases discussion pertaining to the exclusion of neutron detectors from the Channel Calibration surveillance have been omitted from Calibration surveillance SR 3.3.2.1 in the GTS and Bases. This information appears to be relevant to the FSAR.

The PAM instrumentation provides indication of plant parameters and does not initiate any plant functions. As defined in the Technical Specifications:

> A CALIBRATION shall be the adjustment, as necessary, of the sensor output such that it responds within the necessary range and accuracy to known values of the parameter that the division monitors. The CALIBRATION shall encompass all devices in the division required for sensor OPERABILITY. CALIBRATION of instrument divisions with resistance temperature detector (RTD) or thermocouple sensors may consist of an in-place qualitative assessment of sensor behavior and normal CALIBRATION of the remaining adjustable devices in the division. The CALIBRATION may be performed by means of any series of sequential, overlapping, or total steps.

A CALIBRATION is sufficient to provide the operability of the PAM instrumentation.

The Note excluding neutron detectors from the calibration surveillance requirement was added to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification, Surveillance Requirement (SR), 3.3.2.1 in U.S. EPR FSAR, Revision 2 and described in the Bases for the Surveillance Requirement.

The Bases description of SR 3.3.2.1 will be revised to more accurately reflect the definition of CALIBRATION and justify the exclusion of the Intermediate Range and Source Range neutron detectors.

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FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

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Question 16-312

Followup to Question 16-234:

b) Discrepancy regarding the omission of Bases text associated with Core Exit thermocouples in Bases Section SR 3.3.3.2 (NUREG-1431), from EPR Bases Section SR 3.3.2.1.

Response to Question 16-234(b):

This issue was further clarified on Page 16-51 of the NRC's March 10, 2010 Safety Evaluation, which states:

> Bases text associated with Core Exit thermocouples in Bases Section SR 3.3.3.2 of NUREG-1431 has been omitted from the comparable EPR Bases discussion for SR 3.3.2.1.

The Bases for the PAM instrumentation was revised in U.S. EPR FSAR, Revision 2 to include information regarding calibration of core exit thermocouple in SR 3.3.2.1.

The Bases description of SR 3.3.2.1 will be updated to correct a reference to “Channel Calibration.” Page numbers in this section will also be corrected.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

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Question 16-313

Potential Open Item

Provide the additional information and update the following RAI responses for each of the Electrical Power System Tech Spec items identified, based on the results of Audit Meeting between AREVA NP and NRC Staff on 6/24/09.

Request for Additional Information No. 74 (953)

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Question 16-313

Followup to Question 16-11

The applicant is requested to include mode restriction information in EPR Surveillance Requirement (SR) 3.8.1.10 and associated Bases section. EPR SR 3.8.1.10 omits bracketed NOTE 1 in WOG SR 3.8.1.10 which addresses mode restrictions associated with performance of the surveillance. EPR Bases omits discussion of the Note presented in the corresponding WOG Bases as well.

Response to Question 16-11:

This issue was further clarified on Page 16-76 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 74, Question 16-11, the staff requested that the applicant justify the omission of Mode Restriction information from GTS SR 3.8.1.10 and the associated Bases. GTS SR 3.8.1.10 omits bracketed Note 1 in Westinghouse STS SR 3.8.1.10, which states, "This Surveillance shall not normally be performed in MODE 1 or 2. However, this Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR." In an October 30, 2008, response to RAI 74, Question 16-11, the applicant stated that the proposed deviation from the STS is justified based on the acceptable small-risk associated with paralleling an EDG to offsite power for surveillance testing when considering the robust design features of the electrical distribution system and that three EDGs remain capable of mitigating a design-basis accident and supporting safe-shutdown of the nuclear power plant during performance of this surveillance testing. The associated STS Bases Reviewer's Note establishes the criteria for which the Mode Restrictions may be deleted. One of the criteria is that the performance of the SR will not cause perturbations to any of the electrical distribution systems that could result in a challenge to steady state operation or to plant-safety systems. The Reviewer's Note specifically states that the Mode Restrictions may be deleted if it can be demonstrated to the staff, on a plant-specific basis, that performing the SR with the reactor in any of the restricted modes can satisfy the established criteria. The staff questioned the applicant's position on the basis that an electrical system perturbation of some magnitude can be expected from a full-load reject when paralleled to the grid. Also, every offsite electrical power system is different. There may be something unique to a particular system whereby an assessment determining the safety of the plant is warranted for performance of SR 3.8.1.10 in Modes 1 or 2.

The mode restriction information in NUREG-1431, Westinghouse Owners' Group (WOG) Standard Technical Specifications (STS) Surveillance Requirement (SR) 3.8.1.10, Note 1 states, "This Surveillance shall not normally be performed in MODE 1 or 2. However, this Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR." The Bases further clarifies the mode restriction note to indicate that this surveillance may be performed for the purpose of reestablishing OPERABILITY (e.g., post work testing following corrective maintenance, corrective modification, deficient or incomplete surveillance testing, and other unanticipated OPERABILITY concerns).

The U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications and Bases will be revised to incorporate the mode restriction information contained in the WOG Standard Technical Specifications.

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FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications and Bases will be revised as described in the response and indicated on the enclosed markup.

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Question 16-313

Followup to Question 16-22:

The applicant is requested to include mode restriction information in EPR Surveillance Requirement (SR) 3.8.1.12 and associated Bases section. EPR SR 3.8.1.12 omits bracketed NOTE 2 in WOG SR 3.8.1.12 which addresses mode restrictions associated with performance of the surveillance. EPR Bases omits discussion of the Note presented in the corresponding WOG Bases as well.

Response to Question 16-22:

This issue was further clarified on Page 16-78 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 74, Question 16-22, the staff requested that the applicant justify the omission of Mode Restriction information from GTS SR 3.8.1.12 and the associated Bases. GTS SR 3.8.1.12 omits bracketed Note 2 in Westinghouse STS SR 3.8.1.12, which states, "This Surveillance shall not normally be performed in MODE 1 or 2. However, this Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR." In an October 30, 2008, response to RAI 74, Question 16-22, the applicant stated that the proposed deviation from the STS is justified based on the testing having no affect on the Emergency Power Supply System (EPSS) or plant loads, the availability of the EDG under test for accident mitigation, and that during testing three EDGs remain capable of mitigating a DBA and supporting safe-shutdown of the unit. The associated STS Bases Reviewer's Note establishes the criteria for which the mode restrictions may be deleted. One of the criteria is that the performance of the SR will not cause perturbations to any of the electrical distribution systems that could result in a challenge to steady state operation or to plant-safety systems. The Reviewer's Note specifically states that the mode restrictions may be deleted if it can be demonstrated to the staff, on a plant specific basis, that performing the SR with the reactor in any of the restricted modes can satisfy the established criteria. The staff questioned the applicant's claim that (1) there is no load shedding during performance of the SR, and (2) since there is no load shedding or sequencing of loads, there is no impact to the EPSS by performing the surveillance. The staff determined that load shedding and load sequencing may actually occur during performance of an actual or simulated ESF signal which auto starts the EDG from a standby condition. Electrical system perturbations can be expected from the shedding and sequencing of loads powered by the offsite power system. Also, every offsite electrical power system is different. There may be something unique to a particular system whereby an assessment determining the safety of the plant is warranted for performance of SR 3.8.1.12 in Modes 1 or 2.

The mode restriction information in WOG SR 3.8.1.12, Note 2 states, "This Surveillance shall not normally be performed in MODE 1 or 2. However, this Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR." The Bases further clarifies the mode restriction note to indicate that this surveillance may be performed for the purpose of reestablishing OPERABILITY (e.g., post work testing following corrective maintenance, corrective modification, deficient or incomplete surveillance testing, and other unanticipated OPERABILITY concerns).

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The U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications and Bases will be revised to incorporate the mode restriction information and additional surveillance contained in the WOG Standard Technical Specifications.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications and Bases will be revised as described in the response and as shown on the enclosed markup.

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Question 16-313

Followup to Question 16-23:

a) The applicant is requested to include mode restriction information in EPR Surveillance Requirement (SR) 3.8.1.13 and associated Bases section. EPR SR 3.8.1.13 omits the bracketed NOTE in WOG SR 3.8.1.13 which addresses mode restrictions associated with performance of the surveillance. EPR Bases omits discussion of the Note presented in the corresponding WOG Bases as well.

Response to Question 16-23(a):

This issue was further clarified on Page 16-78 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 74, Question 16-23, the staff requested that the applicant justify the omission of Mode Restriction information from GTS SR 3.8.1.13 and the associated Bases. GTS SR 3.8.1.13 omits the bracketed Note in Westinghouse STS SR 3.8.1.13, which states, "This Surveillance shall not normally be performed in MODE 1 or 2. However, this Surveillance may be performed to re-establish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR." In an October 30, 2008, response to RAI 74, Question 16-23, the applicant stated that the proposed deviation from the STS is justified based on the testing having no affect on the EPSS or plant loads, the capability to restore the EDG to an available status within a short time, and that during testing three EDGs remain capable of mitigating a DBA and supporting safe-shutdown of the nuclear plant. The associated STS Bases Reviewer's Note establishes the criteria for which the Mode Restrictions may be deleted. One of the criteria is that the performance of the SR will not cause perturbations to any of the electrical distribution systems that could result in a challenge to steady state operation or to plant-safety systems. The Reviewer's Note specifically states that the Mode Restrictions may be deleted if it can be demonstrated to the staff, on a plant-specific basis, that performing the SR with the reactor in any of the restricted Modes can satisfy the established criteria. … Note that GTS SR 3.8.1.18 is preceded by a Note that allows portions of the surveillance to be performed in Modes 1 through 4 to re-establish operability provided an assessment determines the safety of the plant is maintained or enhanced. There is no mention in the Bases discussion for SR 3.8.1.13 that the surveillance is strictly a logic function test or that it is to be performed without the EDG operating. Electrical system perturbations resulting from a failed surveillance performed with the EDG running would not be unexpected. Also, every offsite electrical power system is different. There may be something unique to a particular system whereby an assessment determining the safety of the plant is warranted for performance of SR 3.8.1.13 (diesel operating) in Modes 1 or 2.

The mode restriction information in WOG, SR 3.8.1.13 Note states, "This Surveillance shall not normally be performed in MODE 1 or 2. However, this Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR." The Bases further clarifies the mode restriction note by stating, "The reason for the Note is that performing the Surveillance would remove a required DG from service."

The U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications and Bases will be revised to incorporate the mode restriction information contained in the WOG Standard Technical Specifications. The Bases description of SR 3.8.1.13 will also be revised to state that the surveillance demonstrates

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that emergency diesel generator noncritical protective functions are bypassed on an actual or simulated Loss of Offsite Power signal on the emergency bus concurrent with an actual or simulated Safety Injection System (SIS) actuation signal.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications and Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-313

Followup to Question 16-23:

b) Question 16-23 response states "this test is a logic function test that is performed without the EDG operating." It appears that the test could actually be conducted with the EDG in service (i.e. during performance of LOP/LOCA testing IAW SR 3.8.1.18 for example), which is a common practice in the operating fleet. Designation of SR 3.8.1.13 as strictly a logic function test may be overly restrictive. In addition, there is no mention in the Bases of the test being a logic function test that is performed without the EDG operating. The applicant is requested to evaluate the testing strategy for SR 3.8.1.13 and make any necessary changes.

Response to Question 16-23(b):

This issue was further clarified on Page 16-78 of the NRC's March 10, 2010 Safety Evaluation, which states:

> The staff questioned the applicant's position that the performance of SR 3.8.1.13 is limited solely to a logic function test that is conducted without the EDG operating. If this were the case, the STS surveillance Note would not be necessary. The staff determined that the surveillance could actually be performed with the EDG in service (i.e., during performance of LOOP/LOCA testing in accordance with GTS SR 3.8.1.18 for example), which is common practice in the operating fleet.

The performance of SR 3.8.1.13 can be conducted with the emergency diesel generator (EDG) operating. This could be done during SR 3.8.1.18, which establishes the acceptable conditions to perform the test; an emergency start signal concurrent with a SIS actuation signal. The emergency start signals (loss of power and a SIS actuation signal) provides the necessary input to bypass the noncritical EDG trips. With the noncritical EDG trips bypassed, the performance of the SR verifies that with a trip input from one of the bypassed trips, a trip signal is not generated.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this response.

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Question 16-313

Followup to Question 16-26:

The applicant is requested to include mode restriction information in EPR Surveillance Requirement (SR) 3.8.1.9 and associated Bases section. EPR SR 3.8.1.9 omits bracketed NOTE 1 in WOG SR 3.8.1.9 which addresses mode restrictions associated with performance of the surveillance. EPR Bases omits discussion of the Note presented in the corresponding WOG Bases as well.

Response to Question 16-26:

This issue was further clarified on Page 16-79 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 74, Question 16-26, the staff requested that the applicant justify the omission of Mode Restriction information from GTS SR 3.8.1.9 and the associated Bases. GTS SR 3.8.1.9 omits bracketed Note 1 in Westinghouse STS SR 3.8.1.9, which states, "This Surveillance shall not normally be performed in MODE 1 or 2. However, this Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR." In an October 30, 2008, response to RAI 74, Question 16-26, the applicant stated that the proposed deviation from the STS is justified based on the acceptable small risk associated with paralleling an EDG to offsite power for surveillance testing when considering the robust design features of the electrical distribution system and that during testing three EDGs remain capable of mitigating a design-basis accident and supporting safe-shutdown of the unit. The associated STS Bases Reviewer's Note establishes the criteria for which the Mode Restrictions may be deleted. One of the criteria is that the performance of the SR will not cause perturbations to any of the electrical distribution systems that could result in a challenge to steady state operation or to plant-safety systems. The Reviewer's Note specifically states that the Mode Restrictions may be deleted if it can be demonstrated to the staff, on a plant specific basis, that performing the SR with the reactor in any of the restricted Modes can satisfy the established criteria. The staff questioned the applicant's position on the basis that an electrical system perturbation of some magnitude can be expected from rejection of the single largest post-accident load when paralleled to the grid. Also, every offsite electrical power system is different. There may be something unique to a particular system whereby an assessment determining the safety of the plant is warranted for performance of SR 3.8.1.9 in Modes 1 or 2.

The mode restriction information in WOG, STS, SR 3.8.1.9, Note 1 states, "This Surveillance shall not normally be performed in MODE 1 or 2. However, this Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR." The Bases further clarifies the mode restriction note to indicate that this surveillance may be performed for the purpose of reestablishing OPERABILITY (e.g., post work testing following corrective maintenance, corrective modification, deficient or incomplete surveillance testing, and other unanticipated OPERABILITY concerns).

The U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications and Bases will be revised to incorporate the mode restriction information contained in the WOG Standard Technical Specifications and show the mode restriction Notes as bracketed items in accordance with the NUREG-14431 precedent..

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FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications and Bases will be revised as described in the response and indicated on the enclosed markup.

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Question 16-313

Followup to Question 16-27:

Inconsistencies exist throughout Technical Specifications and the FSAR regarding appropriate use of the words "Engineered Safety Features (ESF) Systems." The response to Question 16-27 states "the systems that perform the ESF functions (e.g., emergency feedwater, control room air conditioning, and medium head safety injection, etc) are considered to be separate systems and are not part of the PS. There is no "Engineered Safety Features System" in the U.S. EPR design. However, the Bases will be clarified to state that both the Protection System and systems that perform Engineered Safety Features functions are operable." "Engineered Safety Features Systems" is cited throughout the FSAR. Section 7.3 of the FSAR for example, is titled "Engineered Safety Features Systems" and Chapter 15 includes references to ESF Systems. The applicant is requested to resolve the inconsistencies, clarify the response, and make any necessary changes.

Response to Question 16-27:

This issue was further clarified on Page 16-80 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 74, Questions 16-27, 16-36, 16-39, 16-42, and 16-43, the staff requested that the applicant provide an explanation regarding omission of the reference to "Engineered Safety Features Systems," in the first paragraph of the GTS Bases, Applicable Safety Analyses Sections for B 3.8.10, B 3.8.6, B 3.8.7, B 3.8.8, and B 3.8.9, respectively. Inconsistencies exist throughout TS and the FSAR with respect to use of the phrase "Engineered Safety Features Systems." In an October 30, 2008, response to RAI 74, Question 16-27, (which also serves as the response for the other RAIs identified above), the applicant stated, "The systems that perform the ESF functions (e.g., emergency feedwater, control room air conditioning, and medium head safety injection, etc) are considered to be separate systems and are not part of the PS. There is no 'Engineered Safety Features System' in the U.S. EPR design. However, the Bases will be clarified to state that both the Protection System and systems that perform Engineered Safety Features functions are operable." The staff determined that the distinction between ESF Systems and systems that perform ESF functions is confusing. "ESF systems" is cited throughout FSAR Tier 2, Chapter 7. For example, FSAR Tier 2, Section 7.3 is titled, "Engineered Safety Features Systems."

The first sentence in the U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases 3.8.10, Applicable Safety Analyses, will be clarified.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

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Question 16-313

Followup to Question 16-29:

b) The applicant is requested to resolve inconsistencies identified in Bases B 3.8.3 regarding the Diesel Lube Oil System. The revision 1 Bases discussions associated with the fourth paragraph on page B 3.8.3-1 and SR 3.8.3.2 on page B 3.8.3-5 appear to contain conflicting information.

Response to Question 16-29(b):

This issue was further clarified on Page 16-80 of the NRC's March 10, 2010 Safety Evaluation, which states:

> Bases B 3.8.3, Revision 1, discussions associated with the fourth paragraph on Page B 3.8.3-1 and SR 3.8.3.2, on Page B 3.8.3-5 contain conflicting information regarding diesel lube oil system specifics.

To resolve any appearance of conflict between the two statements, the U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases 3.8.3 Background and Bases description of SR 3.8.3.2 will be revised.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

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Question 16-313

Followup to Question 16-33:

The applicant is requested to correct an inaccuracy associated with the response to Question 16-33 regarding the statement "The chemical and volume control system (CVCS) charging line isolation on anti-dilution mitigation (ADM) at shutdown conditions (reactor coolant pump (RCP) not operating) engineered safety feature (ESF) function is shown on U.S. EPR FSAR Tier 2, Figure 7.3-22." The CVCS charging line does not isolate on ADM.

Response to Question 16-33:

This issue was further clarified on Page 16-80 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In addition, staff evaluation of the response identified an inaccuracy regarding the statement, “The chemical and volume control system charging line isolation on anti-dilution mitigation at shutdown conditions (RCP not operating) engineered safety feature (ESF) function is shown on FSAR Tier 2, Figure 7.3-22.” The CVCS charging line does not isolate on ADM.

The words “Charging Line” should not have been used to describe the Anti-Dilution Mitigation function.

As discussed in the Response to Question 16-311, Part 16-182(a), the U.S. EPR Tier 2 Technical Specifications and Bases were revised to delete the words "Charging Line" from the title of Anti-Dilution Mitigation Functions B.11.b, B.11.c and B.11.d.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

DRAFT

Question 16-313

Followup to Question 16-36:

Inconsistencies exist throughout Technical Specifications and the FSAR regarding appropriate use of the words "Engineered Safety Features (ESF) Systems." The response to Question 16-36 references the response to 16-27 which states "the systems that perform the ESF functions (e.g., emergency feedwater, control room air conditioning, and medium head safety injection, etc) are considered to be separate systems and are not part of the PS. There is no "Engineered Safety Features System" in the U.S. EPR design. However, the Bases will be clarified to state that both the Protection System and systems that perform Engineered Safety Features functions are operable." "Engineered Safety Features Systems" is cited throughout the FSAR. Section 7.3 of the FSAR for example, is titled "Engineered Safety Features Systems" and Chapter 15 includes references to ESF Systems. The applicant is requested to resolve the inconsistencies, clarify the response, and make any necessary changes.

Response to Question 16-36:

This issue was further clarified on Page 16-60 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 74, Questions 16-27, 16-36, 16-39, 16-42, and 16-43, the staff requested that the applicant provide an explanation regarding omission of the reference to "Engineered Safety Features Systems," in the first paragraph of the GTS Bases, Applicable Safety Analyses Sections for B 3.8.10, B 3.8.6, B 3.8.7, B 3.8.8, and B 3.8.9, respectively. Inconsistencies exist throughout TS and the FSAR with respect to use of the phrase "Engineered Safety Features Systems." In an October 30, 2008, response to RAI 74, Question 16-27, (which also serves as the response for the other RAIs identified above), the applicant stated, "The systems that perform the ESF functions (e.g., emergency feedwater, control room air conditioning, and medium head safety injection, etc) are considered to be separate systems and are not part of the PS. There is no 'Engineered Safety Features System' in the U.S. EPR design. However, the Bases will be clarified to state that both the Protection System and systems that perform Engineered Safety Features functions are operable." The staff determined that the distinction between ESF Systems and systems that perform ESF functions is confusing. "ESF systems" is cited throughout FSAR Tier 2, Chapter 7. For example, FSAR Tier 2, Section 7.3 is titled, "Engineered Safety Features Systems."

The first sentence in the U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases 3.8.6, Applicable Safety Analyses section will be clarified.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-313

Followup to Question 16-39:

Inconsistencies exist throughout Technical Specifications and the FSAR regarding appropriate use of the words "Engineered Safety Features (ESF) Systems." The response to Question 16-39 references the response to 16-27 which states "the systems that perform the ESF functions (e.g., emergency feedwater, control room air conditioning, and medium head safety injection, etc) are considered to be separate systems and are not part of the PS. There is no "Engineered Safety Features System" in the U.S. EPR design. However, the Bases will be clarified to state that both the Protection System and systems that perform Engineered Safety Features functions are operable." "Engineered Safety Features Systems" is cited throughout the FSAR. Section 7.3 of the FSAR for example, is titled "Engineered Safety Features Systems" and Chapter 15 includes references to ESF Systems. The applicant is requested to resolve the inconsistencies, clarify the response, and make any necessary changes.

Response to Question 16-39:

This issue was further clarified on Page 16-60 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 74, Questions 16-27, 16-36, 16-39, 16-42, and 16-43, the staff requested that the applicant provide an explanation regarding omission of the reference to "Engineered Safety Features Systems," in the first paragraph of the GTS Bases, Applicable Safety Analyses Sections for B 3.8.10, B 3.8.6, B 3.8.7, B 3.8.8, and B 3.8.9, respectively. Inconsistencies exist throughout TS and the FSAR with respect to use of the phrase "Engineered Safety Features Systems." In an October 30, 2008, response to RAI 74, Question 16-27, (which also serves as the response for the other RAIs identified above), the applicant stated, "The systems that perform the ESF functions (e.g., emergency feedwater, control room air conditioning, and medium head safety injection, etc) are considered to be separate systems and are not part of the PS. There is no 'Engineered Safety Features System' in the U.S. EPR design. However, the Bases will be clarified to state that both the Protection System and systems that perform Engineered Safety Features functions are operable." The staff determined that the distinction between ESF Systems and systems that perform ESF functions is confusing. "ESF systems" is cited throughout FSAR Tier 2, Chapter 7. For example, FSAR Tier 2, Section 7.3 is titled, "Engineered Safety Features Systems."

The first sentence in the U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases 3.8.7, Applicable Safety Analyses section will be clarified.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-313

Followup to Question 16-40:

a) CONDITION A of LCO 3.8.8, Inverters - Shutdown, states "one or more required inverters inoperable." The applicant is requested to clarify what is meant by the word "required" in terms of operable inverters for the U.S. EPR Electrical System design and to evaluate the technical accuracy of CONDITION A and the REQUIRED ACTIONS specified, considering that 1) the wording associated with CONDITION A of comparable LCO 3.8.8 in the WOG STS is similar, and 2) the WOG design has two inverters per train (total of four inverters), whereas the EPR design has one inverter per division (total of four inverters). The response to Question 16-40 states that "two divisions of Class 1E power are required to mitigate the consequences of an accident or an anticipated operational occurrence (AOO) in cold shutdown or refueling modes."

Response to Question 16-40(a):

This issue was further clarified on Page 16-81 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In a follow-up RAI 300, Question 16-313, the staff requested that the applicant clarify what was meant by the word "required" in terms of operable inverters for the U.S. EPR Electrical System design, and to evaluate the technical accuracy of Condition A and its Required Actions. The staff requested that this information consider that (1) the wording associated with Condition A of comparable LCO 3.8.8 in the Westinghouse STS is similar, (2) the Westinghouse design has two inverters per train (total of four inverters), whereas the U.S. EPR design has one inverter per division (total of four inverters), and (3) the Condition A Bases reference (first sentence) to "remaining OPERABLE Inverters," implies there is more than one operable inverter remaining following the loss of one or more "required" inverters. Follow-up RAI 300, Question 16-313 also requests the applicant correct an inaccuracy associated with the response to RAI 74, Question 16-40 regarding the statement, "The chemical and volume control system (CVCS) charging line isolation on anti-dilution mitigation (ADM) at shutdown conditions (reactor coolant pump (RCP) not operating) engineered safety feature (ESF) function is shown on FSAR Tier 2, Figure 7.3-22." The CVCS charging line does not isolate on ADM.

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification, LCO 3.8.8, Condition A, and the associated Bases was revised in U.S. EPR FSAR, Revision 2 to delete the word "required," where appropriate.

The issue regarding the use of the words "charging line" is addressed in response to Question 311, Part 16-182(a).

The word "inverter" in the first sentence of the U.S. EPR FSAR, Revision 2 "Applicability" Section in Bases B 3.8.8, Inverters – Shutdown, will be pluralized (i.e., "inverters required to be OPERABLE in MODES 5 and 6" instead of "inverter required to be OPERABLE in MODES 5 and 6").

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

DRAFT

Question 16-313

Followup to Question 16-40:

b) The applicant is requested to correct an inaccuracy associated with the response to Question 16-40 regarding the statement "The chemical and volume control system (CVCS) charging line isolation on anti-dilution mitigation (ADM) at shutdown conditions (reactor coolant pump (RCP) not operating) engineered safety feature (ESF) function is shown on U.S. EPR FSAR Tier 2, Figure 7.3-22." The CVCS charging line does not isolate on ADM.

Response to Question 16-40(b):

As discussed in the Response to Question 16-311, Part 16-182(a), the U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications and Bases were revised to delete the words "Charging Line" from the title of Anti-Dilution Mitigation Functions B.11.b, B.11.c and B.11.d.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

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Question 16-313

Followup to Question 16-42:

Inconsistencies exist throughout Technical Specifications and the FSAR regarding appropriate use of the words "Engineered Safety Features (ESF) Systems." The response to Question 16-42 references the response to 16-27 which states "the systems that perform the ESF functions (e.g., emergency feedwater, control room air conditioning, and medium head safety injection, etc) are considered to be separate systems and are not part of the PS. There is no "Engineered Safety Features System" in the U.S. EPR design. However, the Bases will be clarified to state that both the Protection System and systems that perform Engineered Safety Features functions are operable." "Engineered Safety Features Systems" is cited throughout the FSAR. Section 7.3 of the FSAER for example, is titled "Engineered Safety Features Systems" and Chapter 15 includes references to ESF Systems. The applicant is requested to resolve the inconsistencies, clarify the response, and make any necessary changes.

Response to Question 16-42:

This issue was further clarified on Page 16-60 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 74, Questions 16-27, 16-36, 16-39, 16-42, and 16-43, the staff requested that the applicant provide an explanation regarding omission of the reference to "Engineered Safety Features Systems," in the first paragraph of the GTS Bases, Applicable Safety Analyses Sections for B 3.8.10, B 3.8.6, B 3.8.7, B 3.8.8, and B 3.8.9, respectively. Inconsistencies exist throughout TS and the FSAR with respect to use of the phrase "Engineered Safety Features Systems." In an October 30, 2008, response to RAI 74, Question 16-27, (which also serves as the response for the other RAIs identified above), the applicant stated, "The systems that perform the ESF functions (e.g., emergency feedwater, control room air conditioning, and medium head safety injection, etc) are considered to be separate systems and are not part of the PS. There is no "Engineered Safety Features System" in the U.S. EPR design. However, the Bases will be clarified to state that both the Protection System and systems that perform Engineered Safety Features functions are operable. The staff determined that the distinction between ESF Systems and systems that perform ESF functions is confusing. "ESF systems" is cited throughout FSAR Tier 2, Chapter 7. For example, FSAR Tier 2, Section 7.3 is titled, "Engineered Safety Features Systems."

The first sentence in the U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases 3.8.8, Applicable Safety Analyses section will be clarified.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

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Question 16-313

Followup to Question 16-43:

Inconsistencies exist throughout Technical Specifications and the FSAR regarding appropriate use of the words "Engineered Safety Features (ESF) Systems." The response to Question 16-43 references the response to 16-27 which states "the systems that perform the ESF functions (e.g., emergency feedwater, control room air conditioning, and medium head safety injection, etc) are considered to be separate systems and are not part of the PS. There is no "Engineered Safety Features System" in the U.S. EPR design. However, the Bases will be clarified to state that both the Protection System and systems that perform Engineered Safety Features functions are operable." "Engineered Safety Features Systems" is cited throughout the FSAR. Section 7.3 of the FSAR for example, is titled "Engineered Safety Features Systems" and Chapter 15 includes references to ESF Systems. The applicant is requested to resolve the inconsistencies, clarify the response, and make any necessary changes.

Response to Question 16-43:

This issue was further clarified on Page 16-60 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 74, Questions 16-27, 16-36, 16-39, 16-42, and 16-43, the staff requested that the applicant provide an explanation regarding omission of the reference to "Engineered Safety Features Systems," in the first paragraph of the GTS Bases, Applicable Safety Analyses Sections for B 3.8.10, B 3.8.6, B 3.8.7, B 3.8.8, and B 3.8.9, respectively. Inconsistencies exist throughout TS and the FSAR with respect to use of the phrase "Engineered Safety Features Systems." In an October 30, 2008, response to RAI 74, Question 16-27, (which also serves as the response for the other RAIs identified above), the applicant stated, "The systems that perform the ESF functions (e.g., emergency feedwater, control room air conditioning, and medium head safety injection, etc) are considered to be separate systems and are not part of the PS. There is no 'Engineered Safety Features System' in the U.S. EPR design. However, the Bases will be clarified to state that both the Protection System and systems that perform Engineered Safety Features functions are operable." The staff determined that the distinction between ESF Systems and systems that perform ESF functions is confusing. "ESF systems" is cited throughout FSAR Tier 2, Chapter 7. For example, FSAR Tier 2, Section 7.3 is titled, "Engineered Safety Features Systems."

The first sentence in the U.S. EPR FSAR Chapter 16, Technical Specifications Bases 3.8.9, Applicable Safety Analyses section will be clarified.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

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Question 16-313

Followup to Question 16-49:

a) The applicant is requested to include applicable WOG B 3.8.2 LCO Bases information associated with automatic load sequencing, in the EPR B 3.8.2 LCO Bases Section. The proper sequencing of loads (even though achieved through the Protection System) ensures that sufficient time exists for the diesel to restore voltage and frequency before the next load is applied. As such, load sequencing has the potential to affect diesel operability.

Response to Question 16-49(a):

This issue was further clarified on Page 16-82 of the NRC's March 10, 2010 Safety Evaluation, which states:

> The staff determined that the applicant's response did not adequately justify exclusion of load sequencing information from the Bases. The load sequencing function remains applicable, regardless of the means by which it is accomplished. The proper sequencing of loads ensures that sufficient time exists for the diesel to restore voltage and frequency before the next load is applied. As such, load sequencing has the potential to affect diesel operability. In a follow-up RAI 300, Question 16-313, the staff requested that the applicant include applicable load sequencing information from the Westinghouse STS LCO Section of B 3.8.2, in the GTS LCO Section of B 3.8.2. Follow-up RAI 300, Question 16-313 also requested that the applicant evaluate the technical accuracy of the GTS B 3.8.1 LCO Bases statement on Page B 3.8.1-4 of Revision 1 that reads, "Proper sequencing of loads is a required function for EDG OPERABILITY." It appears that the bracketed phrase, "including tripping of nonessential loads," in the comparable STS B 3.8.1 LCO Bases statement, may be applicable to the referenced GTS Bases statement as well, on the basis of GTS surveillance requirements SR 3.8.1.11.b and 3.8.1.18.b which verify load shedding from the emergency buses.

The following sentence was added to the U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases, Page B 3.8.2-3 in U.S. EPR FSAR, Revision 2:

> "Proper sequencing of loads, including tripping of nonessential loads, is a required function for EDG OPERABILITY."

An inadvertently omitted comma will be added to the Bases for this sentence.

FSAR Impact:

The change to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be made as described in the response and indicated on the enclosed markup.

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Question 16-313

Followup to Question 16-51:

The applicant is requested to enhance the Distribution Systems - Operating Bases (B 3.8.9) LCO discussion regarding the ability of redundant equipment with divisional pairs to maintain safety-related functional capabilities when alternate power feed cross tie breakers are closed. The Bases does not adequately describe the capabilities of the inter-divisional alternate feed protection and coordination scheme to provide protection so that a fault on one division does not degrade the other division below an acceptable level with a tie breaker closed.

Response to Question 16-51:

This issue was further clarified on Page 16-82 of the NRC's March 10, 2010 Safety Evaluation, which states:

> In RAI 74, Question 16-51, the staff requested that the applicant enhance the Bases discussion associated with LCO 3.8.9, “Distribution Systems − Operating,” to describe how redundant electrical power distribution subsystem equipment within a divisional pair is considered operable and capable of performing its safety-related functions when alternate feed cross tie breakers are closed. In an October 30, 2008, response to RAI 74, Question 16-51, the applicant adequately described the capabilities of the inter-divisional alternate feed protection and coordination scheme to provide protection so that a fault on one division does not degrade the other division below an acceptable level with a tie breaker closed. The FSAR markup, however, did not include this information in the associated Bases discussion.

The following information was added to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications LCO 3.8.9 Bases in U.S. EPR FSAR, Revision 2:

> “Each division can be aligned to power a subset of loads ("alternate fed loads") in the other division in its divisional pair by means of an "alternate feed". An alternate feed provides a standby source of power to required safety systems, safety support systems, or components that do not have the required redundant trains to support extended EDG maintenance. An OPERABLE EDG supporting the alternate feed loads and the remaining OPERABLE EDG(S) can power the minimum required ESF functions and achieve completion of required safety function following an AOO or postulated accident, regardless of which two EDGs are inoperable.”

The following information is already contained in U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications LCO 3.8.9 Bases:

> “With a tie breaker closed to implement alternate feed, a fault within the alternate fed divisional pair may affect two redundant subsystems within the divisional pair. During alternate feed, this is acceptable since the other divisional pair power distribution subsystems are available to support redundant subsystems.”

During a Loss of Offsite Power, with one EDG inoperable and the other EDG in the divisional pair running with its alternate feed aligned, a subsequent single failure could cause the loss of power to the divisional pair. The remaining divisional pair would have sufficient capability to mitigate the consequences of a postulated design basis event or abnormal operational occurrence. Additional

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information regarding the inter-divisional alternate feeds protections and coordination will be added to the LCO description in the Bases for Section 3.8.9.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases will be revised as described in the response and indicated on the enclosed markup.

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U.S. EPR Final Safety Analysis Report Markups

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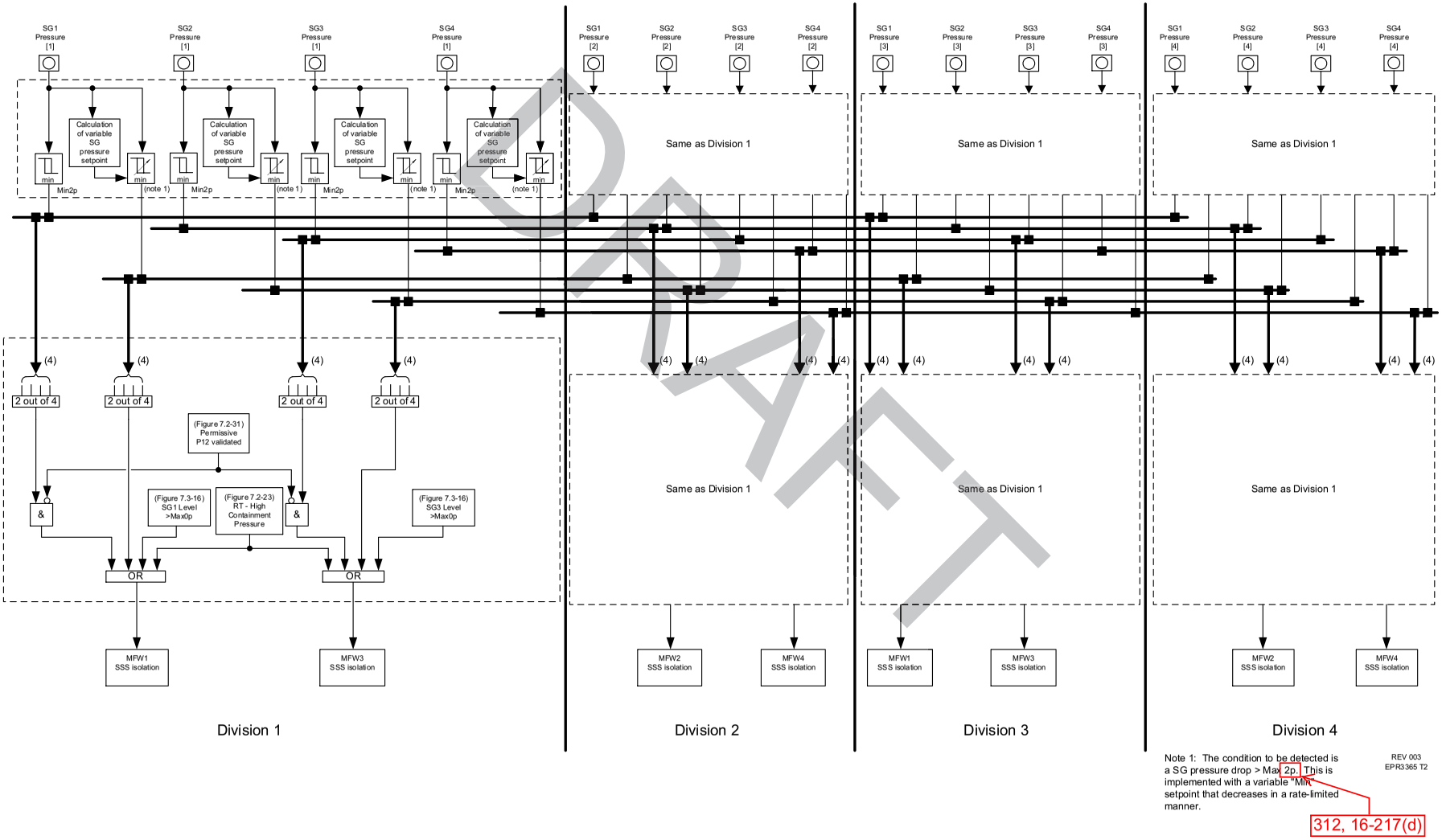
Figure 7.3-17—MFWS Isolation - SSS



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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312, 16-217(d)

NP - Nominal power - it should be noted that other terms are also used to depict reactor power, thermal power, rated thermal power, etc. Under steady-state conditions, these are equivalent.
NF - Nominal flow
NS - Nominal speed
NR - Narrow range

2. For RT functions the time delay is from the time the value is sensed at the sensor until the stationary gripper releases. It includes sensor delay, I&C delay (includes PS computerized portion, and PACS delays), and the delay for the trip breakers to open and the stationary gripper to release.

3. FWLB has conservatively assumed a setpoint of 0% NR.

4. A TT is credited following an RT. The PS is designed to issue the trip signal to the turbine island system after a one-second delay.

5. The PS includes an RT on high containment pressure. This trip is not credited in the analysis presented in this section; however, it is credited in the containment analysis presented in Chapter 6.

312, 16-217(b)

6. This safety-related signal was not explicitly credited in the safety analyses. An RT on low saturation margin is introduced because, in case of saturation occurring in a hot leg, the thermal core power level calculation becomes invalid.~~However, the Low Saturation Margin reactor trip function assures that the High Core Power Level trip function is not invalidated.~~

7. The pressure setpoint is variable and tracks the steam line pressure with a constant offset (102 psi). The setpoint has a limitation on its maximum pressure (1087.7 psia) and its maximum rate of decrease (29 psi/min). If the steamline pressure decreases more rapidly than the allowable rate, then the margin between the actual pressure and the setpoint decreases until the steam line pressure is less than the setpoint generating an RT.

8. The uncertainty related to this RT function is discussed in Reference 2.

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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
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
SG Isolation Signal	See SG Isolation function below		
Containment Isolation			
Containment pressure > Max 1p (Stage 1)	4 psig	0.5 psi	0.9
Containment activity > Max 1p (Stage 1)	100 X background		
SIS Actuation signal (Stage 1)	Not applicable	Not applicable	Not applicable

312, 16-217(c)

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10. MFW is isolated in two steps. First is the full load and the second is isolation of the startup and shutdown system (SSS).

11. These SGTR mitigation features are credited in the accident analysis as manual operator actions. ~~CVCS charging line isolation is also credited as a manual action.~~

312, 16-217(f)

12. Three seconds of the 3.9-second delay is associated with the bus supply breaker delay. This feature results in an RCP trip.

13. The pressure setpoint is variable and tracks the steam line pressure with a constant offset (102 psi). The setpoint has a limitation on its maximum pressure (1087.7 psia) and its maximum rate of decrease (29 psi/min). If the steamline pressure decreases more rapidly than the allowable rate, then the margin between the actual pressure and the setpoint decreases until the steam line pressure is less than the setpoint generating an MSIV closure.

14. The pressure setpoint is variable and tracks the steam line pressure with a constant offset (247 psi). The setpoint has a limitation on its maximum pressure (942.7 psia) and its maximum rate of decrease (29 psi/min). If the steamline pressure decreases more rapidly than the allowable rate, then the margin between the actual pressure and the setpoint decreases until the steam line pressure is less than the setpoint generating an MFW SSS isolation.

15. The MSLB analysis assumes a maximum flow to a depressurized SG of 572 gpm.

16. SG blowdown isolation is not a separate function but part of the EFWS actuation function.

17. The safety analysis credits the EDGs for scenarios with LOOP.

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Table 15.0-18—Summary of MCR/TSC Characteristics

Description		Value	References and Remarks
Exposure interval		30 days	RG 1.183, Section 4.2.6
Outside air intakes		Worst-case MCR air intake on Safeguard Building Division 3 (for main MCR intake)	
		SAC HVAC air intake for Safeguard Building Division 3 (for unfiltered inleakage)	
Atmospheric dispersion factors (χ/Q)		Accident specific, as presented individually for each DBA	
Occupancy factor	0–24 hrs	100%	RG 1.183, Section 4.2.6
	24–96 hrs	60%	
	96–720 hrs	40%	
Breathing rate		3.5E-04 m^3/sec	RG 1.183, Section 4.2.6
Free air volume of MCR envelope		200,000 ft^3	Total volume consists of 133,000 ft^3 for MCR proper on elevation 53 feet, plus 67,000 ft^3 HVAC room on elevation 69 feet)
Charcoal filtration system actuation time (delay time for system re-alignment)		1 min	Automatic actuation based on either a containment isolation signal or high radiation level at the intake duct radiation monitor
Filtration efficiency (halogens and particulates), intake, and recirculation-flow filters		99%	4-inch charcoal beds
Number of charcoal filtration systems in service		1 train	
Pre-isolation unfiltered intake flow		750 cfm/train 1500 cfm total	Two trains assumed to be operating before the DBA
Post-isolation filtered intake flow		1000 cfm (single train)	
Pre- and post-isolation unfiltered inleakage from areas surrounding the MCR pressure envelope, including ingress and egress		50 cfm total	Includes 10 cfm for egress and ingress
Post isolation filtered recirculation flow		3000 cfm/train	
Floor thickness concrete shielding MCR proper from filters		50 cm	
Air intake duct radiation monitor range		1.0E-05–10 rad/hr	Nominal set point at ~~10~~3× background

311, 16-180(a)

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Table 15.0-25—SGTR Design Input
(Sheet 2 of 2)

Description		Value	References and Remarks
Chemical composition of halogens released to atmosphere	Elemental	97%	RG 1.183, Appendix F, Section 4
	Organic	3%	
Atmospheric release pathway and duration	Via condenser, while at full power	0–30 min	For the MCR doses, all atmospheric releases were conservatively assumed to be via the MSRT, which is closest to the MCR intake.
	Via MSRTs/silencers	After 30 min	
Other Variables			
Iodine appearance rates		See Table 15.0-17	
Offsite receptor variables		See Table 15.0-19	
MCR variables		See Table 15.0-18	MCR isolation actuated by high radiation signal in intake duct set at a nominal ~~10~~3 × background
MCR composite χ/Q and intake filter bypass fractions		See Table 15.0-28	

311, 16-180(a)

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3.3 INSTRUMENTATION

3.3.1 Protection System (PS)

LCO 3.3.1 The PS sensors, manual actuation switches, signal processors, and actuation devices specified in Table 3.3.1-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.1-1.

ACTIONS

---------- NOTE ----------
Separate Condition entry is allowed for each sensor, manual actuation switch, signal processor, and actuation device.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more sensors inoperable.	A.1 ----------NOTE---------- Only applicable for Table 3.3.1-1, Component A.~~24~~25. ---------- Place inoperable sensor in trip.	1 hour
	AND	
	A.2 ----------NOTE---------- Not applicable for Table 3.3.1-1, Component A.~~24~~25. ---------- Place inoperable sensor in lockout.	4 hours

311, 16-180(a)

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ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. One or more manual actuation switches inoperable.	B.1 Restore manual actuation switch to OPERABLE status.	48 hours
C. One or more Acquisition and Processing Units (APUs) inoperable due to the ~~Limiting~~ Nominal Trip Setpoint (~~LTSP~~NTSP) for one or more Trip/Actuation Functions/Permissives not met. 311, 16-129(a)	C.1 ----------NOTE---------- Only applicable for ~~APUs~~ NTSPs associated with Table 3.3.1-2, Trip/Actuation Functions B.10.a and B.10.b. ---------- Enter applicable Conditions and Required Actions of LCO 3.8.1, "AC Sources - Operating," and LCO 3.8.2, "AC Sources - Shutdown," for emergency diesel generator (EDG) made inoperable by inoperable APU. AND ----------NOTE---------- Not applicable for ~~APUs~~ NTSPs associated with Table 3.3.1-2, Trip/Actuation Functions B.10.a and B.10.b. ----------	1 hour
	C.2.1 Place the associated APU in lockout.	24 hours
	OR	
	C.2.2 Enter the applicable Condition for the Trip/Actuation Function/Permissive referenced in Table 3.3.1-2.	24 hours

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ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
U. As required by Required Action F.1 and referenced in Table 3.3.1-1.	U.1 Declare associated Rod Cluster Control Assembly Analog Position Indicator or RCCA Unit inoperable. 311, 16-131(d)	Immediately
	AND	
	U.2 Enter applicable Conditions and Required Actions of LCO 3.1.7, "Rod Control Cluster Assembly (RCCA) Position Indication".	Immediately
V. As required by Required Action F.1 and referenced in Table 3.3.1-1.	V.1 Open associated reactor trip breaker.	1 hour
W. As required by Required Action F.1 and referenced in Table 3.3.1-1.	W.1 Open all reactor trip breakers.	1 hour

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SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.6	----------NOTE---------- Neutron detectors are excluded from CALIBRATION. ---------- Perform CALIBRATION.	24 months
SR 3.3.1.7	Perform EXTENDED SELF TESTS.	24 months
SR 3.3.1.8	Perform ACTUATING DEVICE OPERATIONAL TEST.	24 months
SR 3.3.1.9	Verify ~~setpoints~~ NTSPs properly loaded in APUs.	24 months
SR 3.3.1.10	----------NOTE---------- Neutron detectors are excluded from RESPONSE TIME testing. ---------- Verify PS RESPONSE TIME is within limits.	24 months on a STAGGERED TEST BASIS

311, 16-129(a)

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Table 3.3.1-1 (page 1 of 9~~7~~)
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
A.	SENSORS					
1.	6.9 kV Bus Voltage	3 per EDG	1,2,3,4,5,6,(a)	2 per EDG	P	SR 3.3.1.5 SR 3.3.1.6[(b)(c)] SR 3.3.1.10
2.	Boron Concentration - Chemical and Volume Control System (CVCS) Charging Line	4	1,2,3,4	3	N	SR 3.3.1.4[(b)(c)] SR 3.3.1.5 SR 3.3.1.10
		4	5,6[(~~b~~d)]	2	Q	
3.	Boron Temperature - CVCS Charging Line	4	1,2,3,4	3	N	SR 3.3.1.5 SR 3.3.1.6[(b)(c)] SR 3.3.1.10
		4	5,6[(~~b~~d)]	2	Q	
4.	CVCS Charging Line Flow	4	1,2,3[(~~c~~e)],4[(~~e~~e)]	3	N	SR 3.3.1.5 SR 3.3.1.6[(b)(c)] SR 3.3.1.10
		4	5[(~~e~~e)]	2	Q	
5.	Cold Leg Temperature (Narrow Range)	4	1[(~~d~~f)]	3	H	SR 3.3.1.5 SR 3.3.1.6[(b)(c)] SR 3.3.1.10

311, 16-138(a)

311, 16-182(b)

(a) During movement of irradiated fuel assemblies.

(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 settings are specified in a document controlled under 10 CFR 50.59.

(~~b~~d) With P7 permissive ~~P7~~ validated (no RCPs in ~~O~~operation).

(~~c~~e) With P7 permissive ~~P7~~ inhibited (one or more RCPs in operation).

(~~d~~f) With P2 permissive ~~P2~~ validated.

311, 16-182(b)

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Table 3.3.1-1 (page 2 of 9~~7~~)
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[~~e~~g],3[~~(e)~~],~~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[~~(e)(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

311, 16-182(b)

311, 16-182(b)

311, 16-180(a)

311, 16-182(b)

(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 settings are specified in a document controlled under 10 CFR 50.59.

(~~e~~e) With P7 permissive ~~P7~~ inhibited (one or mor RCPs in operation).

(~~e~~g) With P5 permissive ~~P5~~ validated.

(~~f~~h) When Pressurizer Safety Relief Valve (PSRV) OPERABILITY is required by LCO 3.4.11.

311, 16-182(b)

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Table 3.3.1-1 (page 3 of 9~~7~~)
Protection System Sensors, Manual Actuation Switches,
Signal Processors, and Actuation Devices

311, 16-180(a)

311, 16-182(b)

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
10. Hot Leg Pressure (Narrow Range)	4	4[h]	3	S	SR 3.3.1.5 SR 3.3.1.6[b][c] SR 3.3.1.10
	4	5[h],6[h]	2	S	SR 3.3.1.5 SR 3.3.1.6[b][c] SR 3.3.1.10
~~10~~11. Hot Leg Pressure (Wide Range)	4	1,2,3,~~4~~	3	N~~,S~~	SR 3.3.1.5 SR 3.3.1.6[b][c] SR 3.3.1.10
	4	4	3	O	SR 3.3.1.5 SR 3.3.1.6[b][c] SR 3.3.1.10
	4	5,6	2	R~~,S~~	SR 3.3.1.5 SR 3.3.1.6[b][c] SR 3.3.1.10
~~11~~12. Hot Leg Temperature (Narrow Range)	4 per division, 4 divisions	1,2[~~e~~g]	3 per division, 3 divisions	J	SR 3.3.1.5 SR 3.3.1.6[b][c] SR 3.3.1.10

311, 16-180(a)

311, 16-182(b)

(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 settings are specified in a document controlled under 10 CFR 50.59.

(~~e~~g) With P5 permissive ~~P5~~ validated.

(~~f~~h) When Pressurizer Safety Relief Valve (PSRV) OPERABILITY is required by LCO 3.4.11.

311, 16-182(b)

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Table 3.3.1-1 (page 4 of 9~~7~~)
Protection System Sensors, Manual Actuation Switches,
Signal Processors, and Actuation Devices

311, 16-180(a)

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
~~12~~13. Hot Leg Temperature (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
	4	5,6	2	R	SR 3.3.1.5 SR 3.3.1.6[(b)(c)] SR 3.3.1.10
~~13~~14. Intermediate Range	4	1,2,3[(~~g~~i)]	3	K	SR 3.3.1.5 SR 3.3.1.6[(b)(c)]
~~14~~15. Power Range	2 per division, 4 divisions	1,2,3[(~~g~~i)]	2 per division, 3 divisions	K	SR 3.3.1.1 SR 3.3.1.5 SR 3.3.1.6[(b)(c)]
~~15~~16. Pressurizer Level (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
~~16~~17. Pressurizer Pressure (Narrow Range)	4	1,2,3,4[(~~h~~i)]	3	N	SR 3.3.1.5 SR 3.3.1.6[(b)(c)] SR 3.3.1.10

311, 16-138(a)

311, 16-182(b)

(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 settings are specified in a document controlled under 10 CFR 50.59.

(~~g~~i) With the Reactor Control, Surveillance and Limitation (RCSL) System capable of withdrawing a RCCA or one or more RCCAs not fully inserted.

(~~h~~i) With P15 permissive ~~P15~~ inhibited.

311, 16-182(b)

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Table 3.3.1-1 (page 5 of 9~~7~~)
Protection System Sensors, Manual Actuation Switches, Signal Processors, and Actuation Devices

311, 16-180(a)

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
~~17~~18. Radiation Monitor - Containment High 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
~~18~~19. Radiation Monitor - Control Room HVAC Intake Activity	4	1,2,3,4,(a)	3	T	SR 3.3.1.5 SR 3.3.1.6[(b)(c)] SR 3.3.1.10
	4	5,6,(~~i~~a)	2	T	SR 3.3.1.5 SR 3.3.1.6[(b)(c)] SR 3.3.1.10
~~19~~20. RCP Current	3 per RCP	1,2,3,4	2 per RCP	N	SR 3.3.1.5 SR 3.3.1.6[(b)(c)] SR 3.3.1.10
	3 per each of 2 RCPs	5,6	2 per each of 2 RCPs	Q,R	SR 3.3.1.5 SR 3.3.1.6[(b)(c)] SR 3.3.1.10
~~20~~21. RCP Delta Pressure	2 per RCP	1,2,3,4	1 per RCP	N	SR 3.3.1.5 SR 3.3.1.6[(b)(c)] SR 3.3.1.10
~~21~~22. RCP Speed	4	1[(~~d~~f)]	3	H	SR 3.3.1.5 SR 3.3.1.6[(b)(c)] SR 3.3.1.10

311, 16-180(a)

311, 16-182(b)

311, 16-182(b)

311, 16-182(b)

(a) During movement of irradiated fuel assemblies.

(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 settings are specified in a document controlled under 10 CFR 50.59.

(~~d~~f) With P2 permissive ~~P2~~ validated.

~~(i) During movement of irradiated fuel assemblies.~~

311, 16-182(b)

311, 16-182(b)

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Table 3.3.1-1 (page 6 of 9~~7~~)
Protection System Sensors, Manual Actuation Switches,
Signal Processors, and Actuation Devices

311, 16-180(a)

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
~~22~~23. Reactor Coolant System (RCS) Loop Flow	4 per loop	1,2[~~e~~g]	3 per loop	J	SR 3.3.1.5 SR 3.3.1.6[b][c] SR 3.3.1.10
~~23~~24. RCS Loop Level	4	4[~~j~~k]	3	O	SR 3.3.1.5 SR 3.3.1.6[b][c] SR 3.3.1.10
	4	5,6	2	R	SR 3.3.1.5 SR 3.3.1.6[b][c] SR 3.3.1.10
~~24~~25. Reactor Trip Circuit Breaker Position Indication	4	1,2[~~k~~l],3[~~k~~l]	3	K	SR 3.3.1.5 SR 3.3.1.6[b][c] SR 3.3.1.10
~~25~~26. Rod Cluster Control Assembly (RCCA) Analog Position Indicators	89	1[~~d~~f]	89	U	SR 3.3.1.5 SR 3.3.1.6[b][c]
~~26~~27. RCCA Bottom Position Indicators	89	3[~~e~~e],4[~~e~~e],~~5[e]~~	89	~~Q~~O	SR 3.3.1.5 SR 3.3.1.6[b][c]
	89	5[e]	89	Q	SR 3.3.1.5 SR 3.3.1.6[b][c]
~~27~~28. Self-Powered Neutron Detectors	72	1[~~d~~f]	67	H	SR 3.3.1.2[b][c] SR 3.3.1.5

311, 16-182(b)

311, 16-182(b)

312, 16-193(d)

311, 16-131(d)

(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 settings are specified in a document controlled under 10 CFR 50.59.

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

(~~d~~f) With P2 permissive ~~P2~~ validated.

(~~e~~g) With P5 permissive ~~P5~~ validated.

(~~j~~k) With P15 permissive ~~P15~~ validated.

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

311, 16-182(b)

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Table 3.3.1-1 (page 7 of 9~~7~~)
Protection System Sensors, Manual Actuation Switches,
Signal Processors, and Actuation Devices

311, 16-180(a)

311, 16-182(b)

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
~~28~~29. Steam Generator (SG) Level (Narrow Range)	4 per SG	1,2,3[~~k~~l]	3 per SG	M	SR 3.3.1.5 SR 3.3.1.6[b)(c)] SR 3.3.1.10
~~29~~30. SG Level (Wide Range)	4 per SG	1,2,3	3 per SG	M	SR 3.3.1.5 SR 3.3.1.6[b)(c)] SR 3.3.1.10
~~30~~31. SG Pressure	4 per SG	1,2,3,4[~~l~~m]	3 per SG	N	SR 3.3.1.5 SR 3.3.1.6[b)(c)] SR 3.3.1.10
B. MANUAL ACTUATION SWITCHES					
1. Reactor Trip	4	1,2	3	K	SR 3.3.1.~~5~~6 SR 3.3.1.8
	4	3[~~g~~i],4[~~g~~i],5[~~g~~i]	3	W	SR 3.3.1.~~5~~6 SR 3.3.1.8
2. Safety Injection System (SIS) Actuation	4	1,2,3,4	3	N	SR 3.3.1.~~5~~6 SR 3.3.1.8
	4	5,6	3	R	SR 3.3.1.6 SR 3.3.1.8
3. SG Isolation	4 per SG	1,2,3,4[~~l~~m]	3 per SG	N	SR 3.3.1.~~5~~6 SR 3.3.1.8

311, 16-138(a)

312, 16-193(d)

(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 settings are specified in a document controlled under 10 CFR 50.59.

(~~g~~i) With the Reactor Control, Surveillance and Limitation (RCSL) System capable of withdrawing a RCCA or one or more RCCAs not fully inserted.

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

(~~l~~m) When the SGs are relied upon for heat removal.

311, 16-182(b)

311, 16-182(b)

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Table 3.3.1-1 (page 8 of 9)
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
C. SIGNAL PROCESSORS					
1. Acquisition and Processing Units (APUs)	5 per division, 4 divisions	Refer to Table 3.3.1-2	Refer to Table 3.3.1-2	Refer to Table 3.3.1-2	~~SR 3.3.1.5~~ SR 3.3.1.7 SR 3.3.1.9 SR 3.3.1.10
2. Actuation Logic Units (ALUs)	4 per division, 4 divisions	1,2,3 ~~4~~(a)	3 per division, 4 divisions	N,P,~~S,~~T,V	~~SR 3.3.1.5~~ SR 3.3.1.7 SR 3.3.1.10
	4 per division, 4 divisions	4,(a)	3 per division, 4 divisions	O,P,S,T,V	SR 3.3.1.7 SR 3.3.1.10
	4 per division, 4 divisions	5,6,(a)	3 per division, 4 divisions	P,Q,R,S,T,V	~~SR 3.3.1.5~~ SR 3.3.1.7 SR 3.3.1.10
3. Remote Acquisition Units (RAUs)	2 per division, 4 divisions	1(~~d~~f)	1 per division, 4 divisions	H	~~SR 3.3.1.5~~ SR 3.3.1.7 SR 3.3.1.10
4. RCCA Units	4	1(~~d~~f)	4	U	~~SR 3.3.1.5~~ SR 3.3.1.7
	4	3(~~e~~e),4(~~e~~e),~~5(e)~~	4	~~Q~~O	SR 3.3.1.7
	4	5(e)	4	Q	SR 3.3.1.7

(a) During movement of irradiated fuel assemblies.

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

(~~d~~f) With P2 permissive ~~P2~~ validated.

311, 16-193(b)
311, 16-193(b)
312, 16-193(d)
312, 16-193(d)
312, 16-182(b)
311, 16-138(a)
311, 16-131(d)
311, 16-131(d)
311, 16-138(a)
312, 16-182(b)

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Table 3.3.1-1 (page 9 of 9)
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
D.	ACTUATION DEVICES	311, 16-182(b)		311, 16-138(a)		
1.	Reactor Coolant Pump Bus and Trip Breakers	2 per pump	1,2,3,4	1 per pump	N	SR 3.3.1.8 SR 3.3.1.10
2.	Reactor Trip Circuit Breakers	4	1,2	3	K	SR 3.3.1.3 SR 3.3.1.10
		4	3(~~g~~i),4(~~g~~i),5(~~g~~i)	3	W	SR 3.3.1.3 SR 3.3.1.10
3.	Reactor Trip Contactors	4 per set, 23 sets	1,2	3 per set, 23 sets	K	SR 3.3.1.3 SR 3.3.1.10
	311, 16-138(a)	4 per set, 23 sets	3(~~g~~i),4(~~g~~i),5(~~g~~i)	3 per set, 23 sets	W	SR 3.3.1.3 SR 3.3.1.10

(~~g~~i) With the Reactor Control, Surveillance and Limitation (RCSL) System capable of withdrawing a RCCA or one or more RCCAs not fully inserted.

311, 16-182(b)

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

----------REVIEWER'S NOTE----------

[~~Reviewers Note:~~ The values specified in brackets in the ~~Limiting~~ Nominal Trip Setpoint column are included for reviewer information only. A plant-specific setpoint study will be conducted. The values in ~~Limiting~~ the Nominal Trip Setpoint column will then be replaced after the completion of this study.]

312, 16-227

TRIP / ACTUATION FUNCTION / PERMISSIVE	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	MINIMUM REQUIRED FOR FUNCTIONAL CAPABILITY[a]	NOMINAL ~~LIMITING~~ TRIP SETPOINT ~~/ DESIGN LIMIT~~	CONDITION
A. REACTOR TRIP				
1.a. Low Departure from Nucleate Boiling Ratio (DNBR)	1[~~d~~b]	3 divisions	[(~~e~~c)[~~(b)(c)~~]]	H
1.b. Low DNBR and (Imbalance or Rod Drop (1/4))	1[~~d~~b]	3 divisions	[(~~e~~c)[~~(b)(c)~~]]	H
1.c. Low DNBR and Rod Drop (2/4)	1[~~d~~b]	3 divisions	[(~~e~~c)[~~(b)(c)~~]]	H
1.d. Low DNBR - High Quality	1[~~d~~b]	3 divisions	[(~~e~~c)[~~(b)(c)~~]]	H
1.e. Low DNBR - High Quality and (Imbalance or Rod Drop (1/4))	1[~~d~~b]	3 divisions	[(~~e~~c)[~~(b)(c)~~]]	H
2. High Linear Power Density	1[~~d~~b]	3 divisions	[(~~e~~c)[~~(b)(c)~~]]	H
3. High Neutron Flux Rate of Change (Power Range)	1,2,3[~~f~~d]	3 divisions	[11% RTP[~~(b)(c)~~]]	K
4. High Core Power Level	1,2[~~g~~e]	3 divisions	[105% RTP[~~(b)(c)~~]]	J
5. Low Saturation Margin	1,2[~~g~~e]	3 divisions	[30 Btu/lb[~~(b)(c)~~]]	J
6.a. Low-Low Reactor Coolant System (RCS) Loop Flow Rate in One Loop	1[~~h~~f]	3 divisions	[54% Nominal Flow[~~(b)(c)~~]]	G

311, 16-182(b)

(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.~~

311, 16-182(b)

(~~d~~b) With P2 permissive ~~P2~~ validated.

(~~e~~c) As specified in the COLR.

(~~f~~d) With the RCSL System capable of withdrawing a RCCA or one or more RCCAs not fully inserted.

(~~g~~e) With P5 permissive ~~P5~~ validated.

(~~h~~f) With P3 permissive ~~P3~~ validated.

311, 16-182(b)

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

312, 16-227

TRIP / ACTUATION FUNCTION / PERMISSIVE	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	MINIMUM REQUIRED FOR FUNCTIONAL CAPABILITY[a]	NOMINAL ~~LIMITING~~ TRIP SETPOINT ~~/ DESIGN LIMIT~~	CONDITION
6.b. Low RCS Loop Flow Rate in Two Loops	1[~~d~~b]	3 divisions	[90% Nominal Flow[~~(b)(c)~~]]	H
7. Low Reactor Coolant Pump (RCP) Speed	1[~~d~~b]	3 divisions	[93% Nominal Speed[~~(b)(c)~~]]	H
8. High Neutron Flux (Intermediate Range)	1[~~i~~g],2,3[~~f~~d]	3 divisions	[25% RTP[~~(b)(c)~~]]	K
9. Low Doubling Time (Intermediate Range)	1[~~i~~g],2,3[~~f~~d]	3 divisions	[20 sec.[~~(b)(c)~~]]	K
10. Low Pressurizer Pressure	1[~~d~~b]	3 divisions	[2005 psia[~~(b)(c)~~]]	H
11. High Pressurizer Pressure	1,2	3 divisions	[2415 psia[~~(b)(c)~~]]	J
12. High Pressurizer Level	1,2	3 divisions	[75% Measuring Range[~~(b)(c)~~]]	J
13. Low Hot Leg Pressure	1,2,3[~~f~~d][~~j~~h]	3 divisions	[2005 psia[~~(b)(c)~~]]	L
14. Steam Generator (SG) Pressure Drop	1,2,3[~~f~~d]	3 divisions	[29 psi/min; 102 psi < steady state; Max 1088 psia[~~(b)(c)~~]]	K
15. Low SG Pressure	1,2,3[~~f~~d][~~j~~h]	3 divisions	[725 psia[~~(b)(c)~~]]	L
16. High SG Pressure	1	3 divisions	[1385 psia[~~(b)(c)~~]]	I
17. Low SG Level	1,2	3 divisions	[20% Narrow Range[~~(b)(c)~~]]	J
18. High SG Level	1,2	3 divisions	[69% Narrow Range[~~(b)(c)~~]]	J
19. High Containment Pressure	1,2,3,4	3 divisions	[18.7 psia[~~(b)(c)~~]]	~~K~~N

311, 16-182(b)

311, 16-182(b)

311, 16-154

(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.~~

(~~d~~b) With P2 permissive ~~P2~~ validated.

(~~f~~d) With the RCSL System capable of withdrawing a RCCA or one or more RCCAs not fully inserted.

(~~i~~g) Less than or equal to 10% RTP.

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

311, 16-182(b)

311, 16-182(b)

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

312, 16-227

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311, 16-182(b)

312, 16-174(a)

311, 16-182(b)

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 SGs)	1,2[~~k~~i],3[~~k~~i]	3 divisions	[69% Narrow Range[~~b)(c)~~]]	M
2.c. Startup and Shutdown System ~~Feedwater~~ Isolation on SG Pressure Drop (Affected SGs)	1,2[~~i~~j],3[~~i~~j]	3 divisions	[29 psi/min; 247 psi < steady state; Max 943 psia[~~b)(c)~~]]	M
2.d. Startup and Shutdown System ~~Feedwater~~ Isolation on Low SG Pressure (Affected SGs)	1,2[~~i~~j],3[~~h~~i)(~~i~~j]	3 divisions	[580 psia[~~b)(c)~~]]	L
2.e. Startup and Shutdown System ~~Feedwater~~ Isolation on High SG Level for Period of Time (Affected SGs)	1,2[~~i~~j],3[~~i~~j]	3 divisions	[65% Narrow Range for 10 sec.[~~b)(c)~~]]	M
3.a. SIS Actuation on Low Pressurizer Pressure	1,2,3[~~i~~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

(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.

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Table 3.3.1-2 (page 4 of 7)
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[(~~e~~m)]	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[(~~p~~n)]	3 divisions	[1385 psia[~~(b)(c)~~]]	N
7.b. MSRT Isolation on Low SG Pressure (Affected SG)	1,2,3[(~~j~~h)]	3 divisions	[580 psia[~~(b)(c)~~]]	L
8.a. Main Steam Isolation Valve (MSIV) Isolation on SG Pressure Drop (All SGs)	1,2,3[(~~q~~o)]	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[(~~j~~h)(~~q~~o)]	3 divisions	[725 psia[~~(b)(c)~~]]	L

(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.

(~~e~~m) With P15 permissive ~~P15~~ validated.

(~~p~~n) When the SGs are relied upon for heat removal.

(~~q~~o) Except when all MSIVs are closed.

312, 16-227
311, 16-182(b)
311, 16-150(a)
312, 16-227
311, 16-182(b)
312, 16-227
311, 16-182(b)
311, 16-182(b)
311, 16-182(b)

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Table 3.3.1-2 (page 5 of 7)
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
9.a. Containment Isolation (Stage 1) on High Containment Pressure	1,2,3,4	3 divisions	[18.7 psia~~(b)(c)~~]	N
9.b. Containment Isolation (Stage 1) on SIS Actuation	1,2,3,4	3 divisions	[NA]	N
9.c. Containment Isolation (Stage 2) on High-High Containment Pressure	1,2,3,4	3 divisions	[~~<~~ 36.3 psia~~(b)(c)~~]	N
9.d. Containment Isolation (Stage 1) on High Containment Radiation	1,2,3,4	3 divisions	[≤ 100 x background~~(b)(c)~~]	N
10.a. Emergency Diesel Generator (EDG) Start on Degraded Grid Voltage	1,2,3,4,(p)	4 divisions	[≥ 6210 V and ≤ 6350 V; ≥ 7 sec. and ≤ 11 sec. w/SIS, ≥ 270 sec. and ≤ 300 sec. wo/SIS~~(b)(c)~~]	P
	5,6,(~~r~~p)	2 divisions		P
10.b. EDG Start on LOOP	1,2,3,4,(p)	4 divisions	[≥ 4830 V and ≤ 4970 V; ≥ 0.4 sec. and ≤ 0.6 sec.~~(b)(c)~~]	P
	5,6,(~~r~~p)	2 divisions		P
11.a. Chemical and Volume Control System (CVCS) Charging Line Isolation on High-High Pressurizer Level	1,2,3,4(~~s~~q)	3 divisions	[80% Measuring Range~~(b)(c)~~]	N
11.b. CVCS Isolation on Anti-Dilution Mitigation (ADM) - Shutdown Conditions (RCP not operating)	3(~~t~~r),4(~~t~~r)	3 divisions	[927 ppm~~(b)(c)~~]	O
	5(~~t~~r),6(~~r~~)	2 divisions		Q

312, 16-227

312, 16-227

311, 16-180(a)

311, 16-182(b)

311, 16-182(b)

311, 16-149(a)

(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.~~

311, 16-182(b)

(~~r~~p) During movement of irradiated fuel assemblies.

(~~s~~q) With P17 permissive ~~P17~~ inhibited.

(~~t~~r) With P7 permissive ~~P7~~ validated (no RCPs in operation).

311, 16-812(b)

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Table 3.3.1-2 (page 6 of 7)
Acquisition and Processing Unit Requirements Referenced from Table 3.3.1-1

312, 16-227

TRIP / ACTUATION FUNCTION / PERMISSIVE	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	MINIMUM REQUIRED FOR FUNCTIONAL CAPABILITY[a]	NOMINAL ~~LIMITING~~ TRIP SETPOINT ~~/ DESIGN LIMIT~~	CONDITION
11.c. CVCS Isolation on ADM - Standard Shutdown Conditions	3(~~u~~s),4(~~u~~s)	3 divisions	[(~~e~~c)(~~b)(c)~~]	O
	5(~~u~~s)	2 divisions		Q
11.d. CVCS Isolation on ADM at Power	1,2	3 divisions	[(~~e~~c)(~~b)(c)~~]	J
12.a. Pressurizer Safety Relief Valve (PSRV) Actuation - First Valve	4(~~v~~t)	3 divisions	[(~~w~~u)]	S
	5(~~v~~t),6 (~~v~~t)	2 divisions		S
12.b. PSRV Actuation - Second Valve	4(~~v~~t)	3 divisions	[(~~w~~u)]	S
	5(~~v~~t),6(~~v~~t)	2 divisions		S
13. Control Room Heating, Ventilation, and Air Conditioning Reconfiguration to Recirculation Mode on High Intake Activity	1,2,3,4,(p)	3 divisions	[≤ 3 x background(~~b)(c)~~]	T
	5,6,(~~r~~p)	2 divisions		T
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

311, 16-182(b)

311, 16-138(a)

311, 16-180(a)

311, 16-182(b)

(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.~~

311, 16-182(b)

(~~e~~c) As specified in the COLR.

(~~r~~p) During movement of irradiated fuel assemblies.

(~~u~~s) With P7 permissive ~~P7~~ inhibited (one or more RCPs in operation).

(~~v~~t) When PSRV OPERABILITY is required by LCO 3.4.11.

(~~w~~u) As specified in the Pressure Temperature Limits Report.

311, 16-182(b)

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

311, 16-182(b)

312, 16-227

TRIP / ACTUATION FUNCTION / PERMISSIVE	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	MINIMUM REQUIRED FOR FUNCTIONAL CAPABILITY[a]	NOMINAL ~~LIMITING~~ TRIP SETPOINT ~~/ DESIGN LIMIT~~	CONDITION
P7 - RCP Not in Operation	3(~~t~~r),4(~~t~~r)	3 divisions	[50% no load current]	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]	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 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, 50% no load current, and 1.5 hrs post-SI]	N
P17 - Cold Leg Temperature Lower than Threshold	4(~~v~~t)	3 divisions	[248ºF]	O,S
	5(~~v~~t),6(~~v~~t)	2 divisions		S

311, 16-180(a)

(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.~~

311, 16-182(b)

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

(~~p~~n) When the SGs are relied upon for heat removal.

(~~t~~r) With P7 permissive ~~P7~~ validated (no RCPs in operation).

(~~u~~s) With P7 permissive ~~P7~~ inhibited (one or more RCPs in operation).

(~~v~~t) When PSRV OPERABILITY is required by LCO 3.4.11.

311, 16-182(b)

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3.3 INSTRUMENTATION

3.3.2 Post Accident Monitoring (PAM) Instrumentation

LCO 3.3.2 The PAM instrumentation for each Function shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

----------NOTE----------
Separate Condition entry is allowed for each Function.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one required ~~division~~ channel inoperable.	A.1 Restore required ~~division~~ channel to OPERABLE status.	30 days
B. Required Action and associated Completion Time of Condition A not met.	B.1 Initiate action in accordance with Specification 5.6.5.	Immediately
C. One or more Functions with two required ~~divisions~~ channels inoperable.	C.1 Restore one ~~division~~ channels to OPERABLE status.	7 days
D. Required Action and associated Completion Time of Condition C not met.	D.1 Enter the Condition referenced in Table 3.3.2-1 for the ~~division~~channel.	Immediately

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Table 3.3.2-1 (page 1 of 1)
Post Accident Monitoring Instrumentation

	FUNCTION	REQUIRED ~~DIVISIONS~~ CHANNELS	CONDITION REFERENCED FROM REQUIRED ACTION D.1
1.	Cold Leg Temperature (Wide Range)	2[c]	E
2.	Containment Isolation Valve Position Indication	2[a][b]	E
3.	Containment Service Compartment Pressure (Wide Range)	2[c]	E[c]
4.	Core Outlet Thermocouples (Wide Range)	2 per quadrant	F
5.	Emergency Feedwater System Flow	2 per loop	E
6.	Hot Leg Pressure (Wide Range)	2[c]	E[c]
7.	Hot Leg Temperature (Wide Range)	2[c]	E[c]
8.	Intermediate Range	2[c]	E[c]
9.	Low Head Safety Injection Flow (Wide Range)	2 per loop	F
10.	Medium Head Safety Injection Flow (Wide Range)	2 per loop	F
11.	Pressurizer Level (Narrow Range)	2[c]	E
12.	Radiation Monitor - Annulus Ventilation System Gamma Activity	2	E
13.	Radiation Monitor - Containment High Range	2[c]	E[c]
14.	Radiation Monitor - Main Steam Line	2 per loop	E
15.	Steam Generator Level (Wide Range)	2 per SG [c]	F[c]
16.	Steam Generator Pressure	2 per SG [c]	E[c]
17.	Source Range	2	E
18.	Subcooling Margin	2	E

311, 16-199

(a) Not required for isolation valves whose associated penetration is isolated by at least one closed and deactivated automatic valve, closed manual valve, blind flange, or check valve with flow through the valve secured.

(b) Only one position indication ~~division~~ channel is required for penetration flow paths with only one installed control room indication ~~division~~channel.

(c) Note that more restrictive operability requirements for the associated components are contained in LCO 3.3.1, "Protection System" (i.e., LCO 3.3.1 requires a minimum of three channels of these sensors for functional capability. The PAM LCO only requires two channels).

311, 16-199

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SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.4	Verify each day tank contains ≥ 700 gal of fuel oil.	31 days
SR 3.8.1.5	Check for and remove accumulated water from each day tank.	31 days
SR 3.8.1.6	Verify each fuel oil transfer system operates to automatically transfer fuel oil from storage tank to the day tank.	31 days
SR 3.8.1.7	----------NOTE---------- All EDG starts may be preceded by an engine prelube period. ---------- Verify each EDG starts from standby condition and achieves: a. In ≤ 15 seconds, voltage ≥ 6555 V and frequency ≥ 58.8 Hz; and b. Steady state voltage ≥ 6555 V and ≤ 7260 V, and frequency ≥ 58.8 Hz and ≤ 61.2 Hz.	184 days
SR 3.8.1.8	----------NOTE---------- [This Surveillance shall not normally be performed in MODE 1 or 2. However, this Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR.] ---------- Verify automatic and manual transfer of AC power sources from the normal offsite circuit to the alternate offsite circuit.	24 months

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SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.9	----------NOTES---------- [1. This Surveillance shall not normally be performed in MODE 1 or 2. However, this Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR.] 2. If performed with the EDG synchronized with offsite power, it shall be performed at a power factor ≤ 0.9. However, if grid conditions do not permit, the power factor limit is not required to be met. Under this condition the power factor shall be maintained as close to the limit as practicable. ---------- Verify each EDG rejects a load greater than or equal to its associated single largest post-accident load, and: a. Following load rejection, the frequency is ≤ 63 Hz; b. Within 3 seconds following load rejection, the voltage is ≥ 6555 V and ≤ 7260 V; and c. Within 3 seconds following load rejection, the frequency is ≥ 58.8 Hz and ≤ 61.2 Hz.	24 months

313, 16-26

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SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.10	----------NOTES---------- [1. This Surveillance shall not normally be performed in MODE 1 or 2. However, this Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR.] 2. If performed with EDG synchronized with offsite power, it shall be performed at a power factor ≤ 0.9. However, if grid conditions do not permit, the power factor limit is not required to be met. Under this condition the power factor shall be maintained as close to the limit as practicable. ----------	313, 16-11
	Verify each EDG does not trip and voltage is maintained ≤ 8280 V during and following a load rejection of ≥ 8550 kW and ≤ 9500 kW.	24 months

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SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.12	----------NOTES---------- 1. All EDG starts may be preceded by prelube period. [2. This Surveillance shall not normally be performed in MODE 1 or 2. However, portions of the Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR.] ---------- Verify on an actual or simulated Safety Injection System actuation signal each EDG auto-starts from standby condition and: a. In ≤ 15 seconds after auto-start and during tests, achieves voltage ≥ 6555 V and frequency ≥ 58.8 Hz; b. Achieves steady state voltage ≥ 6555 V and ≤ 7260 V and frequency ≥ 58.8 Hz and ≤ 61.2 Hz; c. Operates for ≥ 5 minutes; ~~and~~ d. Permanently connected loads remain energized from the offsite power system; and~~.~~ e. Emergency loads are energized or autoconnected through the Protection System from the offsite power system.	24 months

313, 16-22

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SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.13	----------NOTE---------- [This Surveillance shall not normally be performed in MODE 1 or 2. However, this Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR.] ---------- Verify each EDG's noncritical automatic trips are bypassed on an actual or simulated Loss of Offsite Power signal on the emergency bus concurrent with ~~; or~~ an actual or simulated Safety Injection System actuation signal.	24 months

313, 16-23(a)

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BASES

BACKGROUND (continued)

----------REVIEWER'S NOTE----------
The term "Limiting Trip Setpoint (LTSP)" is generic terminology for the setpoint value calculated by means of the plant-specific setpoint methodology documented in a document controlled under 10 CFR 50.59. The term LTSP indicates that no additional margin has been added between the Analytical Limit and the calculated trip setting. Where margin is added between the Analytical Limit and trip setpoint, the term Nominal Trip Setpoint (NTSP) is preferred. ~~The trip setpoint (field setting) may be more conservative than the Limiting or Nominal Trip Setpoint.~~

312, 16-227

~~Where the LTSP is not included in Table 3.3.1-2 for the purpose of compliance with 10 CFR 50.36, the plant-specific term for the Limiting or Nominal Trip Setpoint must be cited in Note c of Table 3.3.1-2. The as-found and as-left tolerances will apply to the actual setpoint implemented in the Surveillance procedures to confirm division performance.~~

311, 16-182(b)

Licensees are to insert the name of the document(s) controlled under 10 CFR 50.59 that contain the ~~LTSP~~ NTSP and the methodology for calculating the as-left and as-found tolerances, for the phrase "a document controlled under 10 CFR 50.59" in the specifications.

312, 16-227

The LTSP is a predetermined setting for a protective device chosen to ensure automatic actuation prior to the process variable reaching the Analytical Limit and thus ensuring that the SL would not be exceeded. As such, the LTSP accounts for uncertainties in setting the device (e.g., CALIBRATION), uncertainties in how the device might actually perform (e.g., repeatability), changes in the point of action of the device over time (e.g., drift during surveillance intervals), and any other factors which may influence its actual performance (e.g., harsh accident environments (Ref. 6)). In this manner, the LTSP ensures that SLs are not exceeded. As such, the LTSP meets the definition of a SL-LSSS (Ref. 1). The LTSPs are determined as part of the safety analysis (Ref. 5).

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BASES

BACKGROUND (continued)

Technical Specifications contain values related to the OPERABILITY of equipment required for safe operation of the facility. OPERABLE is defined in Technical Specifications as "...being capable of performing its safety function(s)." However, use of the LTSP or sensor CALIBRATION setting value to define OPERABILITY in Technical Specifications would be an overly restrictive requirement if it were applied as an OPERABILITY limit for the "as-found" value of a protective device setting during a Surveillance. This would result in Technical Specification compliance problems, as well as reports and corrective actions required by the rule which are not necessary to ensure safety. For example, an automatic protective device with ~~a setting~~an as-found sensor CALIBRATION setting value that has been found to be different from the ~~LTSP~~ sensor CALIBRATION setting value due to some drift of the ~~setting~~ sensor may still be OPERABLE since drift is to be expected. This expected drift would have been specifically accounted for in the setpoint methodology for calculating the LTSP and thus the automatic protective action would still have ensured that the SL would not be exceeded with the "as-found" ~~setting~~ value of the sensor ~~protective device~~. Therefore, the device would still be OPERABLE since it would have performed its safety function and the only corrective action required would be to ~~reset the device to the trip setpoint~~calibrate the sensor to account for further drift during the next surveillance interval.

311, 16-182(b)

However, there is also some point beyond which the device would have not been able to perform its function due, for example, to greater than expected drift. The Allowable Value is the least conservative value of the as-found sensor CALIBRATION setting value~~setpoint~~ that a division can have when tested such that a division is OPERABLE if the as-found sensor CALIBRATION setting value~~setpoint~~ is conservative with respect to the Allowable Value during a CALIBRATION. As such, the Allowable Value differs from the ~~Nominal Trip Setpoint~~ NTSP by an amount greater than or equal to the expected instrument channel uncertainties, such as drift, during the surveillance interval. In this manner, the ~~actual setting~~CALIBRATION of the device will ensure that an SL is not exceeded at any given point of time as long as the device has not drifted beyond that expected during the surveillance interval. Note that, although the division is OPERABLE under these circumstances, the ~~setpoint~~ sensor must be left ~~adjusted to a value within~~calibrated to support the as-left tolerance, and confirmed to be operating within the statistical allowances of the uncertainty terms assigned (as-found). If the actual sensor CALIBRATION setting value ~~setting of the device~~ is found to be non-conservative with respect to the Allowable Value, the ~~device~~ sensor would be considered inoperable from a Technical Specification perspective. This requires corrective action including those actions required by 10 CFR 50.36 when automatic protective devices do not function as required.

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BASES

BACKGROUND (continued)

During AOOs, which are those events expected to occur one or more times during the plant life, the acceptable limits are:

- The departure from nucleate boiling ratio (DNBR) shall be maintained above the SL value to prevent departure from nucleate boiling (DNB),
- Fuel centerline melting shall not occur; and
- The RCS pressure SL of 2803 psia shall not be exceeded.

Maintaining the parameters within the above values ensures that the offsite dose will be within the 10 CFR 100 (Ref. 2) criteria during AOOs.

Accidents are events that are analyzed even though they are not expected to occur during the plant life. The acceptable limit during accidents is that the offsite dose shall be maintained within an acceptable fraction of 10 CFR 100 limits. Different accident categories are allowed a different fraction of these limits, based on probability of occurrence. Meeting the acceptable dose limit for an accident category is considered having acceptable consequences for that event. ~~However, these values and their associated LTSPs are not considered to be LSSS as defined in 10 CFR 50.36.~~

312, 16-219

The PS is segmented into four interconnected modules and associated LCOs for the Reactor Trips and ESF Functions. These modules are:

- Sensors, which include the associated signal conditioning;
- Manual actuation switches;
- Signal Processors, which include:
  - Remote Acquisition Units (RAU), which acquire the signals from the SPNDs and distribute these signals;
  - APUs, which perform calculations and make setpoint comparisons;
  - ALUs, which perform voting of the processing results from the redundant APUs in the different divisions and to issue actuation orders based on the voting results; and
  - Rod Cluster Control Assembly Units (RCCAUs), which acquire rod position information and distribute these signals;
- Actuation Devices, which includes the Reactor Trip Breakers and Contactors and the Reactor Coolant Pump (RCP) bus and trip breakers.

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BASES

BACKGROUND (continued)

The PS is a digital, integrated reactor protection system and engineered safety features actuation system. Individual sensors, signal processors, or the ALUs that provide the actuation signal voting function, can be associated with multiple Reactor Trips, ESF Functions, and Permissives.

Sensors

Measurement divisions, consisting of field transmitters or process sensors and associated signal conditioning, provide a measurable electronic signal based upon the physical characteristics of the parameter being measured.

311, 16-131(d)

The Incore Instrumentation System, which uses SPNDs and RAUs, provides the in-core monitoring function. The RAUs in each division are redundant. Each RAU in a division is capable of acquiring and transmitting the data from the RCCAs for that division. If both RAUs in a division fail, an automatic Reactor Trip will occur. The Power Range, Intermediate Range, and Source Range monitors provide the ex-core monitoring functions.

The instrument setpoint methodologies used for the U.S. EPR were submitted to NRC in References 1 and 4. The majority of PS trips or protection functions are based on single division inputs; therefore, the uncertainties identified in Section 3.1 of Reference 1 are applicable for the trip. Reference 4 addresses the protection system trips or protection functions that are based on multiple inputs. The uncertainty calculations for the SPNDs, incore instrumentation, high linear power density, high core power level, low saturation margin, anti-dilution, and DNBR use the statistical methodology described in Reference 4. As described therein, the LTSP is the LSSS since all known errors are appropriately combined in the total loop uncertainty calculation.

LTSPs in accordance with the Allowable Value will ensure that SLs of Chapter 2.0, "Safety Limits (SLs)," are not violated during AOOs, and the consequences of postulated accidents will be acceptable, providing the plant is operated from within the LCOs at the onset of the AOO or postulated accident and the equipment functions as designed.

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BASES

BACKGROUND (continued)

311, 16-129(a)

Note that the Allowable Value is the least conservative value of the as-found setpoint that a Trip/Actuation Function/Permissive can have during a periodic CALIBRATION or SOT, such that a Trip/Actuation Function/Permissive is OPERABLE if the as-found setpoint is conservative with respect to the Allowable Value.

Functional testing of the entire PS, from sensor input through the opening of individual sets of Reactor Trip Circuit Breakers (RTCB) or contactors, is performed each refueling cycle. Process transmitter CALIBRATION is also normally performed on a refueling basis.

Trip setpoints that directly protect against violating the reactor core or RCS pressure boundary Safety Limits during AOOs are SL-LSSS. Permissive setpoints allow bypass of trips when they are not required by the Safety Analysis. These permissives and interlocks ensure that the starting conditions are consistent with the safety analysis, before preventative or mitigating actions occur. Because these permissives or interlocks are only one of multiple conservative starting assumptions for the accident analysis, they are generally considered as nominal values without regard to measurement accuracy, (i.e., the value indicated is sufficiently close to the necessary value to ensure proper operation of the safety systems to turn the AOO). Therefore permissives and interlocks are not considered to be SL-LSSS.

Manual Actuation Switches

Manual actuation switches are provided to initiate the Reactor Trip Function from the main control room (MCR) and the remote shutdown station (RSS). The ability to manually initiate ESF systems is provided in the MCR. Manual actuation of ESF systems initiates all actions performed by the corresponding automatic actuation including starting auxiliary or supporting systems and performing required sequencing functions.

Signal Processors

The PS is a distributed, redundant computer system. It consists of four independent redundant data-processing automatic paths (divisions), each with layers of operation and running asynchronous with respect to each other. In addition to the computers associated with the automatic paths, there are two message and service interface computers to interface with each division.

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BASES

BACKGROUND (continued)

The measurement divisions or signal acquisition layer (which includes the RAUs and RCCAUs) in each division acquires analog and binary input signals from sensors in the plant (such as for temperature, pressure, and level measurements). Each signal acquisition computer distributes its acquired and preprocessed input signals to the PS logic and controls, which includes the data processing computers (APUs).

The data-processing computers (APUs) perform signal processing for plant protective functions such as signal online validation, limit value monitoring and calculations. Each PS division contains four ALUs, two assigned to each subsystem. Two ALUs of the same subsystem within a division are redundant and perform the same processing using the same inputs. The outputs of two redundant ALUs are combined in a hardwired "functional AND" logic for Reactor Trip functions and in a hardwired OR logic for ESF Functions. This avoids both unavailability of ESF Functions and spurious Reactor Trips. The data processing computers then send their outputs to two independent voter computer units (ALUs) in each division.

In the voter computers (ALUs), the outputs of the data-processing computers of redundant divisions are processed together. A voter computer controls a set of actuators. Each voter receives the actuation signal from each of the redundant data-processing computers. The voter's task is to compare this redundant information and compute a validated (voted) actuating signal, which is used for actuating the end devices.

When an APU, RAU, or RCCA Unit is placed in lockout, network outputs are marked as invalid and are disregarded in downstream processing. For example, a two out of four voting function that receives one faulty input votes two out of three on the remaining non-faulty inputs. Hardwired outputs (i.e., ALU outputs) are forced to a no output state, resulting in a "reactor trip ~~output~~signal" and no ESF actuation. No manual actions, beyond placing the signal processor in lockout, are required for the downstream processing to properly accommodate the signal processor in a lockout condition.

311, 16-129(a)

For the Reactor Trip Function, both ALUs in a subsystem, if OPERABLE, must vote for an actuation. This provides protection against spurious trips. However, if only one ALU in a subsystem is OPERABLE, the subsystem is still OPERABLE, and the single voting ALU will initiate a Reactor Trip. For the ESF Functions, an actuation will occur if either of the ALUs in a ~~division~~ subsystem votes for an actuation. This provides protection against ESF unavailability.

311, 16-129(c)

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BASES

BACKGROUND (continued)

ESF Trip Logic

The ESF trip logic senses accident situations and initiates the operation of necessary features. The ESF along with reactor trip ensure the following:

- The integrity of the reactor coolant pressure boundary;
- The capability to shut down the reactor and maintain it in a safe shutdown condition; and
- The capability to prevent or mitigate the consequences of accidents which could result in potential off-site exposures.

As with the reactor trip logic, critical plant parameters such as temperatures, pressures, and levels are sensed, acquired, and converted to electrical signals by the PS. When prohibited operating conditions exist, an ESF signal is generated from the PS. In addition to the automatic ESF actuation Functions performed by the PS, the capability to manually initiate these functions is provided in the MCR. These manual functions are implemented at the system level and perform the same actions as the automatic functions.

Single failures upstream of the ALU layer that could result in an invalid signal being used in the ESF actuation are accommodated by modifying the vote in the ALU layer. Each ESF actuation Function is evaluated on a case-by-case basis to determine whether the vote is modified toward actuation or no actuation. In cases where inappropriate actuation of an ESF Function could challenge plant safety, the function is modified toward no actuation. Otherwise, the function is modified toward actuation.

The ESF actuation signals of the redundant ALUs in each subsystem are combined in a hardwired logical OR; therefore, either of the redundant ALU in a ~~division~~ subsystem can actuate an ESF Function.

311, 16-129(c)

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Each of the analyzed transients and accidents can be detected by one or more PS Functions. Each of the PS Reactor Trip and ESF Functions included in the Technical Specifications are credited as part of the primary success path in the accident analysis. Non-credited functions are not included in the Technical Specifications. Refer to FSAR Sections 7.2 and 7.3 for a description of the Reactor Trip and ESF Functions, respectively. Credited functions are included in FSAR Tables 15.0-7, 15.0-8, and 15.0-9.

The LCO requires the PS sensors, manual actuation switches, signal processors, and specified actuation devices to be OPERABLE. The LCO ensures that each of the following requirements is met:

– A Reactor Trip or ESF Function will be initiated when necessary; and
– Sufficient redundancy is maintained to permit a component to be out of service for testing or maintenance.

Failure of any sensors, signal processors, or actuation device reduces redundancy or renders the affected division(s) inoperable.

Trip setpoints that directly protect against violating the reactor core or RCS pressure boundary SLs during AOOs are SL-LSSS. Permissive and interlock setpoints allow bypass of trips when they are not required by the Safety Analysis. These permissives and interlocks ensure that the starting conditions are consistent with the safety analysis, before preventative or mitigating actions occur. Because these permissives or interlocks are only one of multiple conservative starting assumptions for the accident analysis, they are generally considered as nominal values without regard to measurement accuracy, (i.e., the value indicated is sufficiently close to the necessary value to ensure proper operation of the safety systems to turn the AOO). Therefore permissives and interlocks are not considered to be SL-LSSS. Each ~~LTSP~~ specified NTSP is more conservative than the analytical limit assumed in the safety analysis in order to account for instrument uncertainties appropriate to the Trip Function. The methodologies for considering uncertainties are defined in References 1 and 4.

312, 16-227

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The PS sensors, manual actuation switches, signal processors, and specified actuation devices satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

312, 16-226

In general, the PS sensors, manual actuation switches, signal processors, and specified actuation devices that support Reactor Trips are required to be OPERABLE in MODES 1, 2 and/or 3 because the reactor is or can be made critical in these MODES. The automatic Reactor Trip Functions are designed to take the reactor subcritical, which maintains the SLs during AOOs and assists the ESF in providing acceptable consequences during accidents. The PS sensors, manual actuation switches, signal processors, and specified actuation devices that support ~~automatic~~ Reactor Trip Functions are not required to be OPERABLE in MODES 4 and 5 when all RCCAs are fully inserted, and only if the Reactor Control, Surveillance and Limitation (RCSL) System is placed in a configuration whereby inadvertent RCCA withdrawal is precluded. In MODES 4 and 5, the emphasis is placed on return to power events. The reactor is protected in these MODES by ensuring adequate SDM.

In general, the PS sensors, manual actuation switches, signal processors, and specified actuation devices that support ESF Functions are required to be OPERABLE in MODES 1, 2, 3 and/or 4 since there is sufficient energy in the primary and secondary systems to warrant automatic ESF System responses to:

- Close the Main Steam Isolation Valves (MSIVs) to preclude a positive reactivity addition,
- Actuate Emergency Feedwater (EFW) to preclude the loss of the Steam Generators (SG) as a heat sink (in the event the normal feedwater system is not available),
- Actuate ESF systems to prevent or limit the release of fission product radioactivity to the environment by isolating containment and limiting the containment pressure from exceeding the containment design pressure during a design basis Loss of Coolant Accident (LOCA) or Main Steam Line Break (MSLB), and
- Actuate ESF systems to ensure sufficient borated inventory to permit adequate core cooling and reactivity control during a design basis LOCA or MSLB accident.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

In MODES 5 and 6, automatic actuation of the ESF Functions is not normally required because adequate time is available to evaluate plant conditions and respond by manually operating the ESF components if required. Exceptions to this are:

- ESF 3.c: SIS Actuation on Low RCS Loop Level,
- ESF 10.a: Emergency Diesel Generator (EDG) Start on Degraded Grid Voltage,
- ESF 10.b: EDG Start on Loss of Offsite Power (LOOP),
- ESF 11.b: Chemical and Volume Control System (CVCS) Isolation on Anti-Dilution Mitigation (ADM) at Shutdown Condition (RCP not operating),
- ESF 11.c: CVCS Isolation on ADM - Standard Shutdown Conditions,
- ESF 12.a and 12.b: PSRV Actuation - First and Second Valve, and
- ESF 13: Control Room Heating, Ventilation and Air Conditioning (HVAC) Reconfiguration to Recirculation Mode on High Intake Activity.

These ESF Functions are required to be OPERABLE in MODES 5 and 6, and during movement of irradiated fuel assemblies to ensure that:

- Systems to provide adequate coolant inventory makeup are available for the irradiated fuel assemblies in the core;
- Systems needed to mitigate a fuel handling accident are available; and
- Systems necessary to mitigate the effects of events that can lead to core damage during shutdown are available.

311, 16-145(a)

The specific safety analysis and OPERABILITY requirements applicable to each PS protective function ~~is~~ are identified below. Permissives that enable a credited function when the permissives are validated will be included in the Technical Specifications. Permissives that disable a Reactor Trip or ESF Function are not part of a primary success path of a safety sequence analysis. While their failure may lead to a spurious reactor trip or ESF actuation, their functioning is not credited to mitigate an accident of anticipated operational occurrence, nor to keep the plant in an analyzed condition.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

A. REACTOR TRIPS

1. Low DNBR (Includes High Outlet Quality)

This function protects the fuel against the risk of departure from nucleate boiling during AOOs that lead to a decrease of the DNBR value. There are five Low DNBR trips:

a. Low DNBR,
b. Low DNBR and (Imbalance or Rod Drop (1/4)),
c. Low DNBR and Rod Drop (2/4),
d. Low DNBR - High Quality, and
e. Low DNBR - High Quality and (Imbalance or Rod Drop (1/4)).

Together, these five trips protect against the following AOOs:

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

The Low DNBR (1.a) and Low DNBR-High Quality (1.d) trips require four divisions of the following sensors and processors to be OPERABLE in MODE 1 when the reactor power level is greater than ~~or equal to~~ approximately 10% RTP:

311, 16-138(a)

- SPNDs,
- RCP Speed sensor,
- Pressurizer Pressure (Narrow Range) sensor,
- Cold Leg Temperature (Narrow Range) sensor,
- RCS Loop Flow sensors,
- RAU,
- APUs, and
- ALUs.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The Low DNBR and (Imbalance or Rod Drop (1/4)) (1.b), Low DNBR and Rod Drop (2/4) (1.c), and Low DNBR-High Quality and (Imbalance or Rod Drop (1/4)) (1.e) trips require four divisions of the following sensors and processors to be OPERABLE in MODE 1 when the reactor power level is greater than ~~or equal to~~ approximately 10% RTP:

311, 16-138(a)

- SPNDs,
- Rod Cluster Control Assembly (RCCA) Analog Position indicators,
- RCP Speed sensor,
- Pressurizer Pressure (Narrow Range) sensor,
- Cold Leg Temperature (Narrow Range) sensor,
- RCS Loop Flow sensors,
- RAU,
- RCCA Unit,
- APUs, and
- ALUs.

312, 16-227

The ~~LTSPs~~ NTSPs are low enough to provide an operating envelope that prevents an unnecessary low DNBR reactor trip. The ~~LTSPs~~ NTSPs are high enough for the system to maintain a margin to unacceptable fuel cladding damage for AOOs that leads to an uncontrolled decrease of the DNBR value.

311, 16-138(a)

~~Validating~~ Validation of the P2 permissive automatically enables the five Low DNBR trip signals when the neutron flux, as measured by the power range, is greater than ~~or equal to~~ approximately 10% RTP. When nuclear power is ~~below~~ less than or equal to this threshold, the trips are ~~also~~ automatically disabled by ~~inhibiting~~ inhibition of the P2 permissive ~~P2~~.

2. High Linear Power Density

This function protects the fuel against the risk of melting at the center of the fuel pellet, during AOOs that lead to an uncontrolled increase of the linear power density. This trip protects against the following postulated accidents or AOOs:

- Increase in heat removal by the secondary system, and
- Reactivity and power distribution anomalies.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The High Linear Power Density trip requires four divisions of the following sensors and processors to be OPERABLE in MODE 1 when the reactor power level is greater than ~~or equal to~~ approximately 10% RTP:

311, 16-138(a)

- SPNDs,
- RAU,
- APUs, and
- ALUs.

312, 16-227

The ~~LTSPs~~ NTSPs are high enough to provide an operating envelope that prevents unnecessary High Linear Power reactor trips. The ~~LTSPs~~ NTSPs are low enough for the system to maintain a margin to unacceptable fuel centerline melt for any AOOs that lead to an uncontrolled increase of the linear power density.

Validation~~ng~~ of the P2 permissive automatically enables the reactor trip signal when the neutron flux, as measured by the power range, is greater than ~~or equal to~~ approximately 10% RTP. When nuclear power is ~~below~~ less than or equal to this threshold, the trip is ~~also~~ automatically disabled by inhibition~~ng~~ of the P2 permissive ~~P2~~.

311, 16-138(a)

3. High Neutron Flux Rate of Change (Power Range)

This function limits the consequences of an excessive reactivity increase from a range in power levels, including RTP. This trip protects against reactivity and power distribution anomalies.

The High Neutron Flux Rate of Change trip requires four divisions of the following sensors and processors to be OPERABLE in MODES 1 and 2 and MODE 3 with the RCSL System capable of withdrawing a RCCA or one or more RCCAs not fully inserted:

- Power Range sensors,
- APUs, and
- ALUs.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

312, 16-227

The ~~LTSP~~ NTSP is high enough to provide an operating envelope that prevents unnecessary Excore High Neutron Flux Rate of Change reactor trips. The ~~LTSP~~ NTSP is low enough for the system to maintain a margin to unacceptable fuel cladding damage due to an excessive reactivity increase.

There are no permissives associated with this trip.

4. High Core Power Level

This function limits the consequences of an excessive reactivity increase from a range in power levels, including RTP. This trip protects against the following postulated accidents or AOOs:

- Increase in heat removal by the secondary system, and
- Reactivity and power distribution anomalies.

The High Core Power Level trip requires four divisions of the following sensors and processors to be OPERABLE in MODES 1 and in MODE 2 when the nuclear power level is greater than ~~or equal to~~ approximately 10^{-5}% power as indicated on the Intermediate Range monitors:

311, 16-138(a)

- Cold Leg Temperature (Wide Range) sensors,
- Hot Leg Temperature (Narrow Range) sensors,
- Hot Leg Pressure (Wide Range) sensors,
- RCS Loop Flow sensors,
- APUs, and
- ALUs.

312, 16-227

The ~~LTSP~~ NTSP is high enough to provide an operating envelope that prevents an unnecessary High Core Power Level reactor trip. The ~~LTSP~~ NTSP is low enough for the system to maintain a margin to unacceptable fuel cladding damage due to an excessive reactivity increase from a range in power levels, including RTP.

311, 16-138(a)

~~Validating~~ Validation of the P5 permissive automatically enables the High Core Power Level trip when the nuclear power level is greater than ~~or equal to~~ approximately 10^{-5}% power. ~~Inhibiting~~ Inhibition of the P5 permissive ~~also~~ automatically disables the High Core Power Level trip when less than or equal to~~below~~ this power.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

5. Low Saturation Margin

311, 16-190(g)

The Low Saturation Margin trip function provides a reactor trip before saturation occurs in a hot leg. The High Core Power Level trip function relies on loop temperature measurements as part of the calculation of thermal and hydraulic conditions. The High Core Power Level calculation would not be valid if saturation were to occur in a hot leg. Therefore, the Low Saturation Margin reactor trip function is introduced because, in case of saturation occurring in a hot leg, the thermal core power level calculation becomes invalid.~~assures that the High Core Power Level trip function is not invalidated.~~

The Low Saturation Margin trip requires four divisions of the following sensors and processors to be OPERABLE in MODE 1 and MODE 2 when the nuclear power level is greater than ~~or equal to~~ approximately 10^{-5}% power as indicated on the Intermediate Range Detectors:

311, 16-138(a)

- Cold Leg Temperature (Wide Range) sensors,
- Hot Leg Temperature (Narrow Range) sensors,
- Hot Leg Pressure (Wide Range) sensors,
- RCS Loop Flow sensors,
- APUs, and
- ALUs.

312, 16-227

The ~~LTSP~~ NTSP is low enough to provide an operating envelope that prevents an unnecessary Low Saturation Margin reactor trip. The ~~LTSP~~ NTSP is high enough for the system to maintain a margin to unacceptable fuel cladding damage during AOOs.

~~Validating~~ Validation of the P5 permissive automatically enables the Low Saturation Margin trip when the nuclear power level is greater than ~~or equal to~~ approximately 10^{-5}% RTP. ~~Inhibiting~~ Inhibition of the P5 permissive ~~also~~ automatically disables the Low Saturation Margin trip ~~below~~ when less than or equal to this power.

311, 16-138(a)

6. RCS Loop Flow Rate

This function initiates a reactor trip and is inhibited below a certain level of nuclear power under which the protection is not necessary because DNB is no longer a risk in this condition. There are two trips:

a. Low-Low RCS Loop Flow Rate in One Loop, and
b. Low RCS Loop Flow Rate in Two Loops.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

These trips protect against the following postulated accidents or AOOs:

- Decrease in heat removal by the secondary system, and
- Decrease in RCS flow rate.

The Low-Low RCS Loop Flow in One Loop (6.a) trip requires four divisions of the following sensors and processors to be OPERABLE in MODE 1 when the reactor power level is greater than ~~or equal to~~ approximately 70% RTP:

311, 16-138(a)

- RCS Loop Flow sensors,
- APUs, and
- ALUs.

312, 16-227

The ~~LTSP~~ NTSP is low enough to provide an operating envelope that prevents unnecessary Low-Low Loop Flow Rate reactor trips. The ~~LTSP~~ NTSP is high enough for the system to maintain a margin to ensure DNBR limits are met for AOOs and bounded for postulated accidents.

311, 16-138(a)

~~Validating~~ Validation of the P3 permissive automatically enables the Low-Low RCS Loop Flow Rate (One Loop) when the nuclear power level is greater than ~~or equal to~~ approximately 70% RTP. ~~Inhibiting~~ Inhibition of the P3 permissive ~~also~~ automatically disables the Low-Low RCS Loop Flow Rate (One Loop) trip ~~below~~ when less than or equal to this power.

The Low RCS Loop Flow Rate in Two Loops (6.b) trip requires four divisions of the following sensors and processors to be OPERABLE when the reactor power level is greater than ~~or equal to~~ approximately 10% RTP:

- RCS Loop Flow sensors,
- APUs, and
- ALUs.

312, 16-227

The ~~LTSP~~ NTSP is low enough to provide an operating envelope that prevents unnecessary Low Loop Flow Rate reactor trips. The ~~LTSP~~ NTSP is high enough for the system to maintain a margin to ensure DNBR limits are met for AOOs.

311, 16-138(a)

~~Validating~~ Validation of the P2 permissive automatically enables the Low RCS Loop Flow Rate (Two Loops) trip when the nuclear power level is greater than ~~or equal to~~ approximately 10% RTP. ~~Inhibiting~~ Inhibition of the P2 permissive ~~also~~ automatically disables the Low RCS Loop Flow Rate (Two Loops) trip when the ~~nuclear power level is below~~ less than or equal to this power.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

7. Low RCP Speed

Due to electrical transients that may affect the RCPs, a specific protection function is required. This function initiates a reactor trip and is inhibited below a low level of reactor power under which the protection is not necessary because DNB is no longer a risk. This trip protects against the following postulated accidents or AOOs:

– Decrease in heat removal by the secondary system, and
– Decrease in RCS flow rate.

The Low RCP Speed trip requires four divisions of the following sensors and processors to be OPERABLE in MODE 1 when the reactor power level is greater than ~~or equal to~~ approximately 10% RTP:

311, 16-138(a)

– RCP Speed sensors,
– APUs, and
– ALUs.

312, 16-227

The ~~LTSP~~ NTSP is low enough to provide an operating envelope that prevents unnecessary Low RCP Speed reactor trips. The ~~LTSP~~ NTSP is high enough for the system to maintain a margin to ensure DNBR limits are met for AOOs.

~~Validating~~ Validation of the P2 permissive automatically enables the Low RCP Speed trip when the power level is greater than ~~or equal to~~ approximately 10% RTP. When nuclear power is ~~below~~ less than or equal to this threshold, the trip is ~~also~~ automatically disabled by ~~inhibiting~~ inhibition of the P2 permissive ~~P2~~.

311, 16-138(a)

8. High Neutron Flux (Intermediate Range)

This function limits the consequences of an excessive reactivity increase when the reactor is started up from a sub-critical or low power start-up condition. This trip protects against reactivity and power distribution anomalies.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The High Neutron Flux trip requires four divisions of the following sensors and processors to be OPERABLE in MODE 1 when RTP is less than or equal to approximately 10%, MODE 2, and in MODE 3 when RCSL is capable of withdrawing a RCCA or one or more RCCAs not fully inserted:

– Intermediate Range sensors,
– APUs, and
– ALUs.

312, 16-227

The ~~LTSP~~ NTSP is high enough to provide an operating envelope that prevents an unnecessary High Neutron Flux reactor trip. The ~~LTSP~~ NTSP is low enough for the system to maintain a margin to unacceptable fuel cladding damage for AOOs that leads to an uncontrolled increase of the linear power density.

311, 16-138(a)

~~Inhibiting~~ Inhibition of the P6 permissive automatically enables the High Neutron Flux (Intermediate Range) reactor trip when the power level is less than or equal to approximately 10% RTP. When nuclear power is ~~below~~ above this threshold, the trip is disabled by ~~validating~~ manual validation of the P6 permissive ~~P6~~.

9. Low Doubling Time (Intermediate Range)

This function limits the consequences of an excessive reactivity increase when the reactor is started up from a sub-critical or low power start-up condition. This trip protects against reactivity and power distribution anomalies.

The Low Doubling Time trip requires four divisions of the following sensors and processors to be OPERABLE in MODE 1 when RTP is less than or equal to approximately 10%, MODE 2, and in MODE 3 with the RCSL System capable of withdrawing a RCCA or one or more RCCAs not fully inserted:

– Intermediate Range sensors,
– APUs, and
– ALUs.

312, 16-227

The ~~LTSP~~ NTSP is high enough to provide an operating envelope that prevents an unnecessary Low Doubling Time reactor trip. The ~~LTSP~~ NTSP is low enough for the system to maintain a margin to unacceptable fuel cladding damage for any postulated event that leads to an uncontrolled increase of the linear power density.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

~~Inhibiting~~ Inhibition of the P6 permissive automatically enables the Low Doubling Time reactor trip when the power level is less than or equal to approximately 10% RTP. When nuclear power is ~~below~~ above this threshold, the trip is disabled by ~~validating~~ manual validation of the P6 permissive ~~P6~~.

311, 16-138(a)

10. Low Pressurizer Pressure

A RCS depressurization may lead to a risk of excessive boiling, thus a reactor trip is required to ensure fuel rod integrity and to adapt reactor power to the capacity of the safety systems. This trip protects against a decrease in reactor coolant inventory.

The Low Pressurizer Pressure trip requires four divisions of the following sensors and processors to be OPERABLE when the reactor power level is greater than ~~or equal to~~ approximately 10% RTP:

311, 16-138(a)

- Pressurizer Pressure (Narrow Range) sensors,
- APUs, and
- ALUs.

A RCS depressurization may lead to a risk of excessive boiling, thus a reactor trip is required to ensure fuel rod integrity and to adapt reactor power to the capacity of the safety systems. The ~~LTSP~~ NTSP is sufficiently below the full load operating value for RCS pressure so as not to interfere with normal plant operation, but still high enough to provide the required protection in the event of an RCS depressurization.

312, 16-227

311, 16-138(a)

~~Validating~~ Validation of the P2 permissive automatically enables the Low Pressurizer Pressure trip when the power level is greater than ~~or equal to~~ approximately 10% RTP. When nuclear power is ~~below~~ less than or equal to this threshold, the trip is automatically disabled by ~~inhibiting~~ inhibition of the P2 permissive ~~P2~~.

11. High Pressurizer Pressure

In case of a RCS overpressure, a reactor trip is required in order to:

- Adapt the reactor power to the capacity of the safety systems,
- Ensure RCS integrity, and
- Avoid opening of the Pressurizer safety valves in certain primary side overpressure transients.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

This trip protects against a decrease in heat removal by the secondary system.

The High Pressurizer Pressure trip requires four divisions of the following sensors and processors to be OPERABLE in MODES 1 and 2:

- Pressurizer Pressure (Narrow Range) sensors,
- APUs, and
- ALUs.

312, 16-227

The ~~LTSP~~ NTSP is set below the nominal lift setting of the Pressurizer Safety Relief Valves (PSRV), and its operation avoids the undesirable operation of these valves during normal plant operation. In the event of a complete loss of electrical load from 100% power, this setpoint ensures the reactor trip will take place, thereby limiting further heat input to the RCS and consequent pressure rise. The PSRVs may lift to prevent overpressurization of the RCS.

There are no permissives associated with this trip.

12. High Pressurizer Level

In case of increasing Pressurizer level, a reactor trip is required in order to avoid Pressurizer overfilling. This trip protects against increases in reactor coolant inventory.

The High Pressurizer Level trip requires four divisions of the following sensors and processors to be OPERABLE in MODES 1 and 2:

- Pressurizer Level (Narrow Range) sensors,
- APUs, and
- ALUs.

312, 16-227

The ~~LTSP~~ NTSP is set below the point where the associated transient would reach the nominal lift setting of the PSRVs, and its operation avoids the undesirable operation of these valves during normal plant operation. In the event of a CVCS malfunction, this setpoint ensures a timely reactor trip will take place in order to avoid filing the pressurizer. The PSRVs may lift to prevent overpressurization of the RCS.

311, 16-138(a)

~~Inhibiting~~ Inhibition of the P12 permissive automatically enables the High Pressurizer Level trip when the pressure is greater than or equal to approximately 2005 psia. When below this threshold, the trip is disabled by ~~validating~~ manual validation of the P12 permissive ~~P12~~.

DRAFT

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

13. Low Hot Leg Pressure

A RCS depressurization may lead to a risk of excessive boiling, thus a reactor trip is required to ensure fuel rod integrity and to adapt reactor power to the capacity of the safety systems. This trip protects against a decrease in reactor coolant inventory.

311, 16-138(a)

The Low Hot Leg Pressure trip requires four divisions of the following sensors and processors to be OPERABLE in MODES 1 and 2, and in MODE 3 with the pressurizer pressure is greater than or equal to approximately 2005 psia, and when the RCSL System is capable of withdrawing a RCCA or one or more RCCAs are not fully inserted.

- Hot Leg Pressure (Wide Range) sensors,
- APUs, and
- ALUs.

A RCS depressurization may lead to a risk of excessive boiling, thus a reactor trip is required to ensure fuel rod integrity and to adapt reactor power to the capacity of the safety systems. The ~~LTSP~~ NTSP is sufficiently below the full load operating value so as not to interfere with normal plant operation, but still high enough to provide the required protection in the event of abnormal conditions.

312, 16-227

311, 16-138(a)

~~Inhibiting~~ Inhibition of the P12 permissive automatically enables the Low Hot Leg Pressure trip when the pressure is greater than or equal to approximately 2005 psia. When below this threshold, the trip is disabled by ~~validating~~ manual validation of the P12 permissive ~~P12~~.

14. Steam Generator Pressure Drop

In case of steam or feedwater system piping failure, the affected Steam Generator (SG) depressurizes leading to a RCS cooldown or heatup. A reactor trip is required in order to ensure the fuel rod 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 the secondary system, and
- Decrease in heat removal by the secondary system.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The SG Pressure Drop trip requires four divisions of the following sensors and processors to be OPERABLE in MODES 1 and 2, and in MODE 3 with the RCSL System capable of withdrawing a RCCA or one or more RCCAs not fully inserted:

- SG Pressure sensors,
- APUs, and
- ALUs.

In case of steam or feedwater system piping failure, the affected SG depressurizes leading to a RCS cooldown or heatup. A reactor trip is required in order to ensure the fuel rod integrity and to adapt the reactor power to the capacity of the safety systems.

311, 16-141(a)

The condition to be detected is an SG pressure drop greater than a specified value ~~(Max1p)~~. This is accomplished by using a variable ~~low setpoint~~ pressure setpoint tracking the steam line pressure with a constant offset. The setpoint has a limitation on its maximum pressure and its maximum rate of decrease. If the steam line pressure increases, the setpoint will increase until the limitation on maximum pressure is reached. If the steam line pressure decreases, the setpoint will follow the decrease as long as the rate is less than or equal to the limitation on maximum rate of decrease. If the steam line pressure decreases more rapidly than the limitation on the maximum rate of decrease, the margin between the actual pressure and the setpoint will decrease until the steam line pressure equals the setpoint and protective action occurs.~~The value of the variable setpoint is maintained lower than the measured pressure by a fixed amount, with a limitation placed on the rate of decrease of the setpoint value. The measured pressure will only fall below the setpoint if it decreases at a rate greater than that of the rate-limited setpoint for a given amount of time.~~

312, 16-227

The ~~LTSP~~ NTSP is sufficiently below the full load operating value so as not to interfere with normal plant operation, but still high enough to provide the required protection in the event of a pipe break.

There are no permissives associated with this trip.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

15. Low SG Pressure

In case of steam or feedwater system piping failure, the affected SG depressurizes leading to a RCS cooldown or heatup. For small breaks, the setpoint of the reactor trip on SG Pressure Drop may not be reached. Therefore, a reactor trip on Low SG Pressure is introduced in order to ensure fuel rod integrity and to adapt the reactor power to the capacity of safety systems. This trip protects against the following postulated accidents or AOOs:

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

The Low SG Pressure trip requires four divisions of the following sensors and processors to be OPERABLE in MODES 1 and 2, and in MODE 3 with the pressurizer pressure greater than or equal to approximately 2005 psia and the RCSL System capable of withdrawing a RCCA or one or more RCCAs not fully inserted:

- SG Pressure sensors,
- APUs, and
- ALUs.

In case of steam or feedwater system piping failure, the affected SG depressurizes leading to a RCS cooldown or heatup. For small breaks, the setpoint of the reactor trip on SG Pressure Drop may not be reached. Therefore, a reactor trip on Low SG Pressure is introduced in order to ensure fuel rod integrity and to adapt the reactor power to the capacity of safety systems. The ~~LTSP~~ NTSP is sufficiently below the full load operating value so as not to interfere with normal plant operation, but still high enough to provide the required protection in the event of a pipe break.

312, 16-227

311, 16-138(a)

~~Inhibiting~~ Inhibition of the P12 permissive automatically enables the Low SG Pressure trip when the pressure is greater than or equal to approximately 2005 psia. When below this threshold, the trip is disabled by ~~validating~~ manual validation of the P12 permissive ~~P12~~.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

16. High SG Pressure

In case of a loss of the main heat sink, the reactor has to be tripped in order to:

- Ensure fuel rods integrity at power,
- Adapt the reactor power to the capacity if safety systems, and
- Ensure SG integrity.

This trip protects against a decrease in heat removal by the secondary system.

The High SG Pressure trip requires four divisions of the following sensors and processors to be OPERABLE in MODE 1:

- SG Pressure sensors,
- APUs, and
- ALUs.

312, 16-227

The ~~LTSP~~ NTSP is set high enough to avoid spurious operation. In case of a loss of the main heat sink, the ~~setpoint~~ NTSP is set low enough to trip the reactor in order to:

- Ensure fuel rod integrity at power,
- Adapt the reactor power to the capacity of safety systems, and
- Ensure SG integrity.

There are no permissives associated with this trip.

17. Low SG Level

This trip protects the reactor from a loss of heat sink in case of SG steam/feedwater flow mismatch. This trip protects against a decrease in heat removal by the secondary system.

The Low SG Level trip requires four divisions of the following sensors and processors to be OPERABLE in MODES 1 and 2:

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

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

312, 16-227

The purpose of this trip is to protect the reactor from a loss of heat sink in case of SG steam/feedwater flow mismatch. The ~~LTSP~~ NTSP is sufficiently below the full load operating value so as not to interfere with normal plant operation, but still high enough to provide the required protection in the event of a flow mismatch.

311, 16-138(a)

~~Inhibiting~~ Inhibition of the P13 permissive automatically enables the Low 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~~.

18. High SG Level

This trip protects the turbine against moisture carryover ~~an excessive humidity~~ in case of a Main Feedwater (MFW) malfunction causing an increase in feedwater flow or in case of SG level increase. This reactor trip ensures core integrity during these transients since an increase in feedwater flow leads to a RCS overcooling event and hence a reactivity insertion. This trip protects against an increase in heat removal by the secondary system.

The High SG Level trip requires the following sensors and processors to be OPERABLE in MODES 1 and 2:

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

312, 16-227

This reactor trip ensures core integrity during transients involving a MFW malfunction that results in an increase in feedwater flow or in case of an SG level increase. The ~~LTSP~~ NTSP is sufficiently above the full load operating value so as not to interfere with normal plant operation, but still low enough to provide the required protection in the event of an abnormal condition.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

311, 16-138(a)

~~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.

This function is also necessary to actuate the Containment Isolation (Stage1) 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.

312, 16-227

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.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The automatic MFW Full Load Isolation on Reactor Trip function is required to be OPERABLE in:

- MODE 1, and
- MODES 2 and 3, except when all MFW full load lines are isolated.

The MFW Full Load Isolation on Reactor Trip function requires four divisions of the following sensors and processors to be OPERABLE:

- RTCB Position Indication sensor,
- APUs, and
- ALUs.

There are no permissives associated with this function.

b. MFW Full Load Isolation on High SG Level (Affected SG)

In the case of an increasing SG level event, the MFW supply to the affected SG is isolated in order to avoid filling the SG, and subsequently introducing water into Main Steam line and Main Steam Relief Train (MSRT).

This function mitigates an increase in heat removal from the secondary system.

The automatic MFW Full Load Isolation on High SG Level function is required to be OPERABLE in:

- MODE 1, and
- MODES 2 and 3, except when all MFW full load lines are isolated.

The MFW Full Load Isolation on High SG Level function requires four divisions of the following sensors and processors to be OPERABLE:

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

312, 16-227

The MFW Full Load Isolation on High SG Level ~~LTSP~~ NTSP is set high enough to avoid spurious actuation but low enough in order to prevent water level in the SG from rising and entering the steam line.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

311, 16-138(a)

~~Inhibiting~~ Inhibition of the P13 permissive automatically enables the MFW Full Load Isolation on High SG Level 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~~.

311, 16-169

c. Startup and Shutdown ~~Feedwater~~ System Isolation on SG Pressure Drop (Affected SG)

The affected SG depressurizes for excessive increase in secondary steam flow, steam system piping failure, and ~~Feedwater System~~feedwater system piping failure. Also, the Startup and Shutdown System (SSS) isolation and control valves close in the affected SG.

A complete ~~Feedwater~~ feedwater system isolation in the affected SG limits the coolant provided into the affected SG by the MFW/SSS. This action minimizes the mass and energy released into the containment and RCS cooldown.

This function mitigates the following postulated accidents or AOOs:

- Excessive increase in secondary steam flow,
- Steam system piping failure, and
- Feedwater system piping failure.

The SSS Isolation on SG Pressure Drop function is required to be OPERABLE in:

- MODE 1, and
- MODES 2 and 3, except when all MFW full and low load lines are isolated.

The SSS Isolation on SG Pressure Drop function requires four divisions of the following sensors and processors to be OPERABLE:

- SG Pressure sensors,
- APUs, and
- ALUs.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

312, 16-227

The ~~LTSP~~ NTSP is low enough to preclude spurious operation but high enough to terminate feedwater flow before overcooling of the primary system or depletion of secondary inventory.

311, 16-167

The condition to be detected is an SG pressure drop greater than a specified value ~~(Max1p)~~. This is accomplished by using a variable pressure setpoint tracking the steam line pressure with a constant offset. The setpoint has a limitation on its maximum pressure and its maximum rate of decrease. If the steam line pressure increases, the setpoint will increase until the limitation on maximum pressure is reached. If the steam line pressure decreases, the setpoint will follow the decrease as long as the rate is less than or equal to the limitation on maximum rate of decrease. If the steam line pressure decreases more rapidly than the limitation on the maximum rate of decrease, the margin between the actual pressure and the setpoint will decrease until the steam line pressure equals the setpoint and protective action occurs.~~low setpoint. The value of the variable setpoint is maintained lower than the measured pressure by a fixed amount, with a limitation placed on the rate of decrease of the setpoint value. The measured pressure will only fall below the setpoint if it decreases at a rate greater than that of the rate-limited setpoint for a given amount of time.~~

There are no permissives associated with this function.

312, 16-169(b)

d. SSS Isolation on Low SG Pressure (Affected SGs)

The affected SG depressurizes in the event of a steam line or ~~Feedwater~~ feedwater pipe failure. In the event of a small secondary side break for which the SG Pressure Drop signal is never reached, this function also isolates the SSS supply to the affected SG. This action minimizes the mass and energy released into the containment.

This function mitigates the following postulated accidents or AOOs:

- Excessive increase in secondary steam flow,
- Steam system piping failure, and
- Feedwater system piping failure.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The automatic SSS Isolation on Low SG Pressure function is required to be OPERABLE in:

- MODE 1,
- MODE 2, except when all MFW full load and low load lines are isolated, and
- MODE 3 when the pressurizer pressure is greater than or equal to approximately 2005 psia, except when all MFW full load and low load lines are isolated.

The automatic SSS Isolation on Low SG Pressure function requires four divisions of the following sensors and processors to be OPERABLE:

- SG Pressure sensors,
- APUs, and
- ALUs.

312, 16-227

The ~~LTSP~~ NTSP is low enough to preclude spurious operation but high enough to terminate feedwater flow before overcooling of the primary system or depletion of secondary inventory.

311, 16-138(a)

~~Inhibiting~~ Inhibition of the P12 permissive automatically enables the SSS Isolation on Low SG Pressure function when the pressurizer pressure is greater than or equal to approximately 2005 psia. When below ~~the~~ this threshold, the function is disabled by ~~validating~~ manual validation of the P12 permissive ~~P12~~.

e. SSS Isolation on High SG Level for Period of Time (Affected SGs)

During an increase in SG level after a reactor trip, the SSS systems are isolated in the affected SG in order to avoid the SG filling up and thus carryover of water into Main Steam line and subsequent water discharge by MSRT. This function mitigates Increase in ~~Feedwater~~ feedwater flow.

312, 16-169(b)

The automatic SSS Isolation on High SG Level for Period of Time function is required to be OPERABLE in:

- MODE 1, and
- MODES 2 and 3, except when all MFW full load and low load lines are isolated.

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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.

312, 16-227

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.

311, 16-138(a)

~~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~~.

3. Safety Injection System Actuation

a. Low Pressurizer Pressure

In the event of a decrease in RCS water inventory, the makeup is supplied by the Medium Head Safety Injection (MHSI) in the high pressure phase of the event and the Low Head Safety Injection (LHSI) in the low pressure phase. For a potential overcooling event, the reactivity insertion is limited by the boron injection via the MHSI. Even if the boron injection is not required, MHSI injection is needed to stabilize the RCS pressure.

The Safety Injection System (SIS) Actuation on Low Pressurizer Pressure function mitigates the following postulated accidents or AOOs:

- Excessive increase in secondary steam flow,
- MSLB,
- Feedwater Line Break,
- Inadvertent opening of a pressurizer pilot operated safety valve,
- Small break LOCA,
- Steam system piping failure, and
- Large break LOCA.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The SIS Actuation on Low Pressurizer Pressure function requires four divisions of the following sensors and processors to be OPERABLE in MODES 1 and 2, and in MODE 3 with the pressurizer pressure greater than or equal to approximately 2005 psia:

- Pressurizer Pressure (Narrow Range) sensors,
- APUs, and
- ALUs.

312, 16-227

The ~~LTSP~~ NTSP for this function is set below the full load operating value for RCS pressure so as not to interfere with normal plant operation. However, the ~~setting~~ NTSP is high enough to provide an SIS actuation during an RCS depressurization.

311, 16-138(a)

~~Inhibiting~~ Inhibition of the P12 permissive automatically enables the SIS Actuation on Low Pressurizer Pressure function when the pressurizer pressure is greater than or equal to approximately 2005 psia. When below this threshold, the function is disabled by ~~validating~~ manual validation of the P12 permissive ~~P12~~.

The capability for manual initiation of the SIS is provided to the operator in the MCR. This manual initiation starts the four trains of SI. Four manual initiation controls are provided, any two of which will start the four SIS trains.

b. Low Delta P_{sat}

This function ensures SIS actuation with LHSI / Residual Heat Removal (RHR) in operation and at least one RCP operating.

This function mitigates the following postulated accidents or AOOs:

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

The automatic SIS Actuation on Low Delta P_{sat} function requires four divisions of the following sensors and processors to be OPERABLE in MODE 3 when the pressurizer pressure is less than approximately 2005 psia, and in MODE 4 when at least one RCP is running, the hot leg pressure is greater than or equal to approximately 464 psia, ~~and~~ or the hot leg temperature is greater than or equal to approximately 350°F:

311, 16-150(b)

DRAFT

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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

This function ensures SIS actuation with LHSI/RHR in operation and at least one of the RCPs ~~are~~ operating.

312, 16-227

The ~~LTSP~~ NTSP for the Low Delta P_{sat} function is set low enough to avoid spurious operation but high enough to maintain core coverage in the event of an RCS pipe break.

311, 16-138(a)

~~Validating~~ Manual validation of the P12 permissive enables the SIS Actuation on Low Delta P_{sat} function when the pressurizer pressure is less than ~~or equal to~~ approximately 2005 psia. ~~Inhibiting~~ Manual validation of the P15 permissive disables the SIS Actuation on Low Delta P_{sat} function when no RCPs are running, the hot leg pressure is less than approximately 464 psia, ~~or~~ and the hot leg temperature is less than approximately 350ºF.

311, 16-150(a)

311, 16-150(b)

For loss of RHR scenarios with RCPs running, the RCS inventory would be essentially full with the pressurizer at normal level. The secondary side (steam generator) would also be available if RCPs were in operation. Under these conditions, a loss of RHR event would result in a minor heat-up until decay heat is removed through the secondary side. Thus, Safety Injection on Low Delta P_{sat} would not be required if RCPs were in operation.

The capability for manual initiation of the SIS is provided to the operator in the MCR. This manual initiation starts the four trains of SI. Four manual initiation controls are provided, any two of which will start the four SIS trains.

c. Low RCS Loop Level

The SIS Actuation on Low RCS Loop Level function mitigates the following postulated accidents or AOOs:

- Loss of Residual Heat Removal during mid-loop operations,
- Uncontrolled loss of RCS inventory,
- Small break LOCA, and
- Large break LOCA.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The automatic SIS Actuation on Low RCS Loop Level function is required to be OPERABLE in:

311, 16-150(a)

- MODE 4 when no RCPs are running, the hot leg pressure is less than approximately 464 psia, and the hot leg temperature is less than approximately 350ºF, ~~and~~
- MODES 5 ~~and 6.~~when no RCPs are running, and
- MODE 6 when no RCPs are running.

The SIS Actuation on Low RCS Loop Level function requires four divisions of the following sensors and processors:

- RCS Loop Level sensors,
- APUs, and
- ALUs.

312, 16-227

The NTSP for the SIS Actuation on Low RCS Loop Level function is set low enough to avoid spurious operation but high enough to ensure core cooling is maintained.

311, 16-150(a)

In Mode 5 and 6, safety injection requirements are based on loss of RHR events during reduced inventory (mid-loop) conditions. Before entering mid-loop operation, the RCPs are secured and the RCS is vented. Two MHSI pumps are available and automatic injection is available on low loop level. In the event of a loss of RHR under these conditions, the MHSI pumps would automatically inject on low loop level to maintain the core covered and replace the inventory that boils-off.

311, 16-138(a)

~~Validating~~ Manual validation of the P15 ~~P~~permissive enables the SIS Actuation on Low RCS Loop Level function when no RCPs are running, the hot leg pressure is less than approximately 464 psia, and the hot leg temperature is less than approximately 350ºF.

4. RCP Trip on Low Delta Pressure across RCP with SIS Actuation

In case of LOCA in combination with a SIS actuation, the RCPs are tripped to prevent their operation in scenarios where timing of the pump trip is related to maintaining core cooling.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

This function mitigates the following postulated accidents or AOOs:

- Inadvertent opening of a PSRV, and
- Small break LOCA.

The RCP Trip on Low Delta Pressure across RCP with SIS Actuation function requires four divisions of the following sensors and processors to be OPERABLE in MODES 1, 2, 3, and 4:

- RCP Delta Pressure sensors,
- RCP Current sensors,
- APUs, and
- ALUs.

The sensors required to generate the SIS actuation signal are identified under each separate ESF function: SIS on Low Pressurizer Pressure (Function B.3.a), SIS on Low Delta P_{sat} (Function B.3.b), and SIS Actuation on Low RCS Loop Level (Function B.3.c).

312, 16-227

The ~~LTSP~~ NTSP for the RCP Trip on Low Delta Pressure across RCP with SIS Actuation function is set low enough to avoid spurious operation but high enough to ensure core cooling is maintained.

There are no ~~automatic~~ permissives associated with this function.

311, 16-150(c)

5. Partial Cooldown on SIS Actuation

The partial cooldown consists of lowering the MSRT setpoint down to allow depressurization of the RCS by heat removal of the SGs. This function mitigates the following postulated accidents or AOOs:

- Excessive increase in secondary steam flow,
- MSLB,
- Inadvertent opening of a Pressurizer pilot operated safety valve, and
- Small break LOCA.

The automatic Partial Cooldown on SIS Actuation function requires four divisions of the following processors to be OPERABLE in MODES 1, 2, and 3:

- APUs, and
- ALUs.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

311, 16-162(a)

The sensors required to generate the SIS Actuation signal are identified under each separate ESF function: SIS on Low Pressurizer Pressure (Function B.3.a)~~,~~ and SIS on Low Delta P_{sat} (Function B.3.b)~~, and SIS Actuation on Low RCS Loop Level (Function B.3.c)~~.

311, 16-138(a)

~~Inhibiting~~ Manual inhibition of the P14 permissive enables the Partial Cooldown on SIS Actuation function when the hot leg pressure is greater than or equal to approximately 464 psia or the hot leg temperature is greater than or equal to approximately 350°F. ~~Validating~~ Manual validation of the P14 permissive disables the function when the hot leg pressure is less than approximately 464 psia and the hot leg temperature is less than approximately 350°F.

6. Emergency Feedwater System

a. Actuation on Low-Low SG Level (Affected SGs)

In case of loss of MFW, the Emergency Feedwater System (EFWS) is actuated to remove residual heat via secondary side. With an EFWS actuation signal, SG blowdown is also isolated to conserve SG inventory.

This function mitigates the following postulated accidents or AOOs:

- Loss of normal feedwater flow,
- Feedwater system piping failure, and
- LOOP.

The automatic EFWS Actuation on Low-Low SG Level function requires four divisions of the following sensors and processors to be OPERABLE in MODES 1, 2 and 3:

- SG Level (Wide Range) sensors,
- APUs, and
- ALUs.

312, 16-227

This function ensures heat is removed from the primary system through the SGs in the event of a loss of MFW or feedwater line break, as indicated by low SG level. The ~~LTSP~~ NTSP is low enough to provide an operating envelope that prevents unnecessary actuations but high enough to ensure sufficient make-up is provided to the SGs.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

311, 16-138(a)

~~Inhibiting~~ Inhibition of the P13 permissive automatically enables the EFWS Actuation on Low-Low SG Level 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~~.

b. Actuation on LOOP and SIS Actuation (All SGs)

The LOOP results in a trip of the turbine, RCPs, and MFW pumps. The MFW and SSS supply cut off leads to a decrease in secondary side heat removal and the primary flow coast down further reduces the capacity of the primary coolant to remove heat from the core. As a result, primary and secondary pressures and temperatures increase. The heat is removed via MSRT and EFWS. With an EFWS actuation signal, SG blowdown is also isolated to conserve SG inventory.

This function mitigates the consequences of a Small Break LOCA.

The automatic EFWS Actuation on LOOP and SIS function requires four divisions of the following processors to be OPERABLE in MODES 1 and 2:

- APUs, and
- ALUs.

The sensors required to generate the SIS Actuation signal are identified under each separate ESF function: SIS on Low Pressurizer Pressure (Function B.3.a), SIS on Low Delta P_{sat} (Function B.3.b), and SIS Actuation on Low RCS Loop Level (Function B.3.c).

This function ensures heat is removed from the primary system through the SGs in the event of a LOCA concurrent with a LOOP.

311, 16-138(a)

~~Inhibiting~~ Inhibition of the P13 permissive automatically enables the EFWS Actuation on LOOP and SIS Actuation 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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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

7. Main Steam Relief Train (Affected SG)

a. Actuation on High SG Pressure

In the event of a loss of the secondary side heat sink, the residual heat is removed through the steam relief valves to the atmosphere. This is done by the MSRT. The MSRT also ensures SG overpressure protection, minimizes the actuation of the Main Steam Safety Valves (MSSVs), which reduces the risk of a stuck open safety relief valve.

This function mitigates the following postulated accidents or AOOs:

- Total loss of load and/or turbine trip,
- Loss of main heat sink (condenser),
- Inadvertent closure of a MSIV,
- RCP seizure (locked rotor) or RCP shaft break, and
- Feedwater system piping failure.

The automatic MSRT Actuation on High SG Pressure function requires four divisions of the following sensors and processors to be OPERABLE in MODES 1, 2, 3, and in MODE 4 when the SGs are relied upon for heat removal:

- SG Pressure sensors,
- Hot Leg Temperature (Wide Range) sensors (for setpoint control),
- Hot Leg Pressure (Wide Range) sensors (for setpoint control),
- APUs, and
- ALUs.

312, 16-227

The ~~LTSP~~ NTSP for the MSRT Actuation on High SG Pressure function is set high enough to avoid spurious operation and low enough to open and relieve SG pressure before overpressurization limits are reached.

The P14 permissive ~~P14~~ is utilized for setpoint selection.

b. Isolation on Low SG Pressure

The Main Steam Relief Isolation Valves (MSRIVs) are opened during events in order to control pressure in the SGs. In order to prevent a stuck open Main Steam Relief Control Valve from causing an RCS cooldown and a risk of return to critical conditions, the MSRT is isolated.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

This function mitigates the following postulated accidents or AOOs:

- Excessive increase in secondary steam flow,
- Loss of main heat sink (condenser),
- Inadvertent Opening of SG Safety or Relief Valve, and
- MSLB.

The automatic MSRT Isolation on Low SG Pressure function requires four divisions of the following sensors and processors to be OPERABLE in MODES 1 and 2, and in MODE 3 with the pressurizer pressure is greater than or equal to approximately 2005 psia:

- SG Pressure sensors,
- APUs, and
- ALUs.

312, 16-227

The ~~LTSP~~ NTSP for the MSRT Isolation on Low SG Pressure function is set low enough to avoid spurious operation and high enough to limit the rate of RCS cooldown.

311, 16-138(a)

~~Inhibiting~~ Inhibition of the P12 permissive automatically enables the MSRT Isolation on Low SG Pressure function when the pressure is greater than or equal to approximately 2005 psia. When below this threshold, the function is disabled by ~~validating~~ manual validation of the P12 permissive ~~P12~~.

8. MSIV Isolation

312, 16-169(b)

a. Isolation on SG Pressure Drop (All SGs)

In case of a secondary side Steam Line or ~~Feedwater~~ feedwater system pipe break, the affected SG depressurizes. This function isolates all four SGs in order to:

- Prevent draining of unaffected SG,
- Limit return to criticality conditions due to a overcooling transient,
- Limit the release of radioactivity, and
- Limit mass and energy releases into the containment.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

This function mitigates the following postulated accidents or AOOs:

- Excessive increase in secondary steam flow,
- Spurious opening of one SG safety or relief valve,
- Steam system piping failure, and
- Feedwater system piping failure.

The MSIV Isolation on SG Pressure Drop function requires four divisions of the following sensors and processors to be OPERABLE in MODES 1 and 2, and in MODE 3 except when all MSIVs are closed:

- SG Pressure sensors,
- APUs, and
- ALUs.

312, 16-227

The ~~LTSP~~ NTSP for the MSIV Isolation on SG Pressure Drop function is set low enough to avoid SG pressure fluctuations during normal operation and high enough to isolate an SG and limit the blowdown to the value assumed in the safety analysis.

311, 16-166

The condition to be detected is an SG pressure drop greater than a specified value. This is accomplished by using a variable pressure setpoint tracking the steam line pressure with a constant offset. The setpoint has a limitation on its maximum pressure and its maximum rate of decrease. If the steam line pressure increases, the setpoint will increase until the limitation on maximum pressure is reached. If the steam line pressure decreases, the setpoint will follow the decrease as long as the rate is less than or equal to the limitation on maximum rate of decrease. If the steam line pressure decreases more rapidly than the limitation on the maximum rate of decrease, the margin between the actual pressure and the setpoint will decrease until the steam line pressure equals the setpoint and protective action occurs.~~An 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.~~

There are no ~~automatic~~ permissives associated with this function.

311, 16-150(c)

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

b. Isolation on Low SG Pressure (All SGs)

For most Main Steam Line or Feedwater pipe breaks, the affected SG depressurizes. For small breaks, the setpoint for MSIV Isolation on SG Pressure Drop may not be reached. This function isolates all four SG on the main steam side in the event of a secondary side break in order to:

- Prevent draining of unaffected SGs,
- Limit the return to critical conditions due to a overcooling transient,
- Limit the release of radioactivity, and
- Limit mass and energy releases into the containment.

This function mitigates the following postulated accidents or AOOs:

- Excessive increase in secondary steam flow,
- Spurious opening of one SG safety or relief valve,
- Steam system piping failure, and
- Feedwater system piping failure.

The automatic MSIV Isolation on Low SG Pressure function requires four divisions of the following sensors and processors to be OPERABLE in MODES 1 and 2, and in MODE 3 when the pressurizer pressure is greater than or equal to approximately 2005 psia except when all MSIVs are closed:

- SG Pressure sensors,
- APUs, and
- ALUs.

312, 16-227

The ~~LTSP~~ NTSP for the MSIV Isolation on Low SG Pressure function is set low enough to avoid SG pressure fluctuations during normal operation and high enough to isolate an SG and limit the blowdown to the value assumed in the safety analysis.

311, 16-138(a)

~~Inhibiting~~ Inhibition of the P12 permissive automatically enables the MSIV Isolation on Low SG Pressure function when the pressurizer pressure is greater than or equal to approximately 2005 psia. When below this threshold, the function is disabled by ~~validating~~ manual validation of the P12 permissive ~~P12~~.

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

311, 16-154

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

312, 16-227

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 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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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The sensors required to generate the SIS Actuation signal are identified under each separate ESF function: SIS on Low Pressurizer Pressure (Function B.3.a), SIS on Low Delta P_{sat} (Function B.3.b), and SIS Actuation on Low RCS Loop Level (Function B.3.c).

There are no permissives associated with this function.

c. Isolation (Stage 2) on High-High Containment Pressure

In case of a LOCA, 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 2 Containment Isolation on High-High Containment Pressure function requires four divisions of the following sensors and processors to be OPERABLE in MODES 1, 2, 3 and 4:

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

312, 16-227

The ~~LTSP~~ NTSP for the Stage 2 Containment Isolation on High-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.

311, 16-153

d. Isolation (Stage 1) on High Containment Radiation

In case of a LOCA, the containment has to be isolated in order to prevent release of radioactivity to the environment.~~significant release of radioactivity into the containment, the containment is isolated to ensure 10 CFR 50.34 and 10 CFR 100.21 limits are not exceeded.~~

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

This function mitigates the following postulated accidents or AOOs:

- Rod ejections,
- LOCA,
- MSLB inside containment, and
- Feedwater line break inside containment.

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

- Containment High Range Radiation monitors,
- APUs, and
- ALUs.

312, 16-227

The ~~LTSP~~ NTSP for the Stage 1 Containment Isolation on High Containment Radiation 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.

10. Emergency Diesel Generator

a. Start on Degraded Grid Voltage

Following the detection of degraded voltage for a period of time on one 6.9 kV bus, the EDG associated with that bus is automatically started. This function mitigates a LOOP, which is assumed to occur independently or concurrently with postulated accidents and AOOs.

The automatic EDG Start on Degraded Grid Voltage requires four divisions of the following sensors and processors to be OPERABLE in MODES 1, 2, 3, 4, 5, and 6, and during movement of irradiated fuel assemblies:

- 6.9 kV Bus Voltage sensors,
- APUs, and
- ALUs.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

This function ensures AC Power is available to mitigate a postulated concurrent design basis event.

312, 16-227

The ~~LTSP~~ NTSP for the EDG Start on Degraded Grid Voltage is set low enough to avoid spurious operation but high enough to ensure that power is provided to ESF functions in the time-frame assumed in the accident analyses.

There are no permissives associated with this function.

b. Start on LOOP

Following a LOOP on one 6.9 kV bus, the EDG associated with that bus is automatically started. This function mitigates a LOOP, which is assumed to occur independently or concurrently with postulated accidents and AOOs.

The automatic EDG Start on LOOP requires four divisions of the following sensors and processors to be OPERABLE in MODES 1, 2, 3, 4, 5, and 6, and during movement of irradiated fuel assemblies:

- 6.9 kV Bus Voltage sensors,
- APUs, and
- ALUs.

This function ensures AC Power is available to mitigate a postulated concurrent design basis event.

312, 16-227

The ~~LTSP~~ NTSP for the EDG Start on LOOP is set low enough to avoid spurious operation but high enough to ensure that power is provided to ESF functions in the time-frame assumed in the accident analyses.

311, 16-182(a)

There are no permissives associated with this function.

11. Chemical and Volume Control System ~~Isolation~~

a. Charging Line Isolation on High-High Pressurizer Level

The isolation of the CVCS Charging Line on High-High Pressurizer Level is required to avoid filling of the pressurizer and subsequent water overflow through the safety valves.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

This function protects against a CVCS malfunction that causes an increase in RCS water inventory.

311, 16-138(a)

The automatic CVCS Charging Line Isolation on High-High Pressurizer Level function requires the following sensors and processors to be OPERABLE in MODES 1, 2, 3, and MODE 4 when the cold leg temperature is greater than or equal to 248°F:

- Pressurizer Level (Narrow Range) sensors (4 divisions),
- APUs (4 divisions), and
- ALUs (Divisions 1 and 4).

312, 16-227

The ~~LTSP~~ NTSP is low enough to initiate appropriate mitigative actions in time to prevent the pressurizer from overfilling during the CVCS Malfunction event that may increases RCS inventory, but high enough to prevent spurious operations.

311, 16-138(a)

~~Inhibiting~~ Inhibition of the P17 permissive ~~disables~~ automatically enables the CVCS Charging Line Isolation on High-High Pressurizer Level function when the cold leg temperature is ~~less~~ greater than or equal to approximately 248°F. When ~~above~~ below this threshold, the function is disabled by ~~validating~~ manual validation of the P17 permissive ~~P12~~.

b. Isolation on ADM - Shutdown Condition (RCP not operating)

The ADM function in the Shutdown Condition mitigates a dilution event where no RCPs are in operation. This function ensures that:

- The dilution is stopped when the protection is actuated, and
- The core remains sub-critical.

311, 16-149(a)

The automatic CVCS Isolation on ADM - Shutdown Condition (RCP not operating) function is required to be OPERABLE in MODES 3, 4, ~~and~~ 5, and 6 with no RCPs in operation~~, and in MODE 6~~.

The automatic CVCS Isolation on ADM - Shutdown Condition (RCP not operating) function requires the following sensors and processors:

- Boron Concentration - CVCS Charging Line sensors (4 divisions),
- Boron Temperature - CVCS Charging Line sensors (4 divisions),
- APUs (4 divisions), and
- ALUs (Divisions 1 and 4).

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

312, 16-227

The ~~LTSP~~ NTSP is low enough to provide an operating envelope that prevents unnecessary isolations but high enough to mitigate a dilution event in the shutdown condition where the RCPs are not in operation.

311, 16-138(a)

~~Validating~~ Validation of the P7 permissive automatically enables the CVCS Isolation on ADM - Shutdown Condition (RCP not operating) function when all RCPs are not in operation. When any RCP is operating, the function is automatically disabled by ~~inhibiting~~ inhibition of the P7 permissive ~~P7~~.

c. Isolation on ADM - Standard Shutdown Conditions

This function mitigates a homogeneous dilution event in the standard shutdown states where the RCPs are in operation. This function ensures that:

- The dilution is stopped when the protection is actuated, and
- The core remains sub-critical.

The automatic CVCS Isolation on ADM - Standard Shutdown Conditions function is required to be OPERABLE in MODES 3, 4, and 5 with one or more RCPs in operation.

The automatic CVCS Isolation on ADM - Standard Shutdown Conditions function requires the following sensors and processors:

- Boron Concentration - CVCS Charging Line sensors (4 divisions),
- Boron Temperature - CVCS Charging Line sensors (4 divisions),
- CVCS Charging Line Flow sensors (4 divisions),
- Cold Leg Temperature (Wide Range) sensors (4 divisions),
- APUs (4 divisions), and
- ALUs (Divisions 1 and 4).

312, 16-227

The ~~LTSP~~ NTSP is low enough to provide an operating envelope that prevents unnecessary isolations but high enough to mitigate a dilution event in the shutdown condition where the RCPs are in operation.

311, 16-138(a)

~~Validating~~ Validation of the P8 permissive automatically enables the CVCS Isolation on ADM - Standard Shutdown Conditions function when all RCCA Bottom Position Indicators show the RCCAs are inserted. When all RCPs are not operating, the function is automatically disabled by ~~inhibiting~~ validation of the P7 permissive ~~P7~~.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

d. Isolation on ADM at Power

This function mitigates a homogeneous dilution event at power conditions. This function ensures that the dilution is stopped when the protection is actuated.

The automatic CVCS Isolation on ADM at Power function requires the following sensors and processors in MODES 1 and 2:

- Boron Concentration - CVCS Charging Line sensors (4 divisions),
- Boron Temperature - CVCS Charging Line sensors (4 divisions),
- CVCS Charging Line Flow sensors (4 divisions),
- APUs (4 divisions), and
- ALUs (Divisions 1 and 4).

312, 16-227

The ~~LTSP~~ NTSP is low enough to provide an operating envelope that prevents unnecessary isolations but high enough to mitigate a dilution event at power.

311, 16-138(a)

~~Inhibiting~~ Inhibition of the P8 permissive automatically enables the CVCS Isolation on ADM at Power function when any of the RCCA Bottom Position Indicators show an RCCA is not inserted.

12.a and 12.b. PSRV Actuation - First and Second Valve

The integrity of the reactor pressure vessel must be ensured under all plant conditions. At low coolant temperature, the cylindrical part of the vessel could fail by brittle fracture before the design pressure of the RCS is reached. Therefore the low-temperature overpressure protection (LTOP) is ensured by opening of the PSRVs.

311, 16-138(a)

This function mitigates a low temperature overpressure event.

The automatic PSRVs Actuation function requires four divisions of the following sensors and processors to be OPERABLE in MODE 3, 4 and 5 when the PSRVs are required to be OPERABLE by LCO 3.4.11, "Low Temperature Overpressure Protection (LTOP)":

- Hot Leg Pressure (~~Wide~~ Narrow Range) sensors,
- APUs, and
- ALUs.

311, 16-180(a)

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

312, 16-227

The ~~LTSPs~~ NTSPs for the PSRV Actuation function are high enough to prevent spurious operation but low enough to prevent RCS overpressurization.

311, 16-138(a)

~~Validating~~ Manual validation of the P17 permissive enables the PSRV Actuation function when the cold leg temperature is less than ~~or equal to~~ approximately 248°F. When ~~above~~ greater than or equal to this threshold, the function is automatically disabled by ~~inhibiting~~ inhibition of the P17 permissive ~~P17~~.

13. Control Room HVAC Reconfiguration to Recirculation Mode on High Intake Activity

In case of a significant release of radioactivity, the Control Room HVAC is reconfigured to ensure 10 CFR 50.34 limits are not exceeded.

This function mitigates the following postulated accidents or AOOs:

- Rod ejections,
- LOCA, and
- Line breaks outside containment.

The automatic Control Room HVAC Reconfiguration to Recirculation Mode on High Intake Activity function requires four divisions of the following sensors and processors to be OPERABLE in MODES 1, 2, 3, 4, 5, 6, and during the movement of irradiated fuel assemblies:

- Control Room HVAC Intake Activity Radiation monitors,
- APUs, and
- ALUs.

312, 16-227

The ~~LTSP~~ NTSP for the Control Room HVAC Reconfiguration to Recirculation Mode on High Intake Activity function is set high enough to avoid spurious operation but low enough to ensure offsite dose consequences are maintained below 10 CFR 50.34 limits.

There are no permissives associated with this function.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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:

1. P2 - Flux (Power Range) Measurement Higher than First Threshold

The P2 permissive is representative of Power Range Detector (PRD) neutron flux measurements higher than a low-power setpoint value. The P2 setpoint value corresponds to the value below which transients do not lead to risk of DNB (approximately 10% RTP).

The P2 permissive is utilized in the following reactor trips or ESF functions:

- Reactor Trip 1.a: Low DNBR,
- Reactor Trip 1.b: Low DNBR and (Imbalance or Rod Drop (1/4)),
- Reactor Trip 1.c: Low DNBR and Rod Drop (2/4),
- Reactor Trip 1.d: Low DNBR - High Quality,
- Reactor Trip 1.e: Low DNBR - High Quality and (Imbalance or Rod Drop (1/4)),
- Reactor Trip 2: High Linear Power Density,
- Reactor Trip 6.b: Low RCS Flow Rate in Two Loops,
- Reactor Trip 7: Low RCP Speed, and
- Reactor Trip 10: Low Pressurizer Pressure.

The P2 permissive requires four divisions of the following sensors and processors to be OPERABLE in MODE 1 when the reactor power level is greater than ~~or equal to~~ approximately 10% RTP:

311, 16-138(a)

- Power Range Detectors,
- APUs, and
- ALUs.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

To generate the permissive, neutron flux measurements from the PRDs are compared to the setpoint. When two out of four measurements are greater than the setpoint, the permissive is validated. Otherwise, it is inhibited.

The value of the permissive was selected such that AOOs do not challenge the DNBR or centerline melt limits when they occur at a core power level below the permissive value.

2. P3 - Flux (Power Range) Measurement Higher than Second Threshold

The P3 permissive is representative of PRD neutron flux measurements higher than an intermediate power setpoint value. The P3 setpoint value corresponds to the value below which loss of one reactor coolant pump does not lead to risk of DNB (approximately 70% RTP).

The P3 permissive is utilized in Reactor Trip 6.a: Low-Low RCS Flow Rate in One Loop.

The P3 permissive requires four divisions of the following sensors and processors to be OPERABLE in MODE 1 when the reactor power level is greater than ~~or equal to~~ approximately 70% RTP:

311, 16-138(a)

- Power Range Detectors,
- APUs, and
- ALUs.

To generate the permissive, neutron flux measurements from the PRDs are compared to the setpoint. When two out of four measurements are greater than the setpoint, the permissive is validated.

The value of the permissive was selected such that AOOs and postulated accidents that consider a loss of one RCP do not challenge the DNBR limit when they occur at a core power level below the permissive value (approximately 70% RTP).

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

3. P5 - Flux (Intermediate Range) Measurement Higher than Threshold

The P5 permissive is representative of Intermediate Range Detector (IRD) neutron flux measurements above a low-power setpoint value. The P5 setpoint value corresponds to the boundary between the operating ranges of the source range detectors and intermediate range detectors (greater than ~~or equal to~~ approximately 10^{-5}% power as shown on the IRDs).

311, 16-138(a)

The P5 permissive is utilized in the following reactor trips or ESF functions:

- Reactor Trip 4: High Core Power Level, and
- Reactor Trip 5: Low Saturation Margin.

The P5 permissive requires four divisions of the following sensors and processors to be OPERABLE in MODE 1 and in MODE 2 when the reactor power level is greater than ~~or equal to~~ approximately 10^{-5}% RTP:

311, 16-138(a)

- Intermediate Range Detectors,
- APUs, and
- ALUs.

To generate the permissive, neutron flux measurements from the IRDs are compared to the setpoint. When two out of four of the measurements are greater than the setpoint, the permissive is validated.

The value of the permissive defines the boundary between the operating range of the source range detectors and the operating range of the intermediate range detectors.

4. P6 - Thermal Core Power Higher than Threshold

The P6 permissive is representative of core THERMAL POWER above a low-power setpoint value corresponding to the boundary between the operating ranges of the IRDs and the PRDs (approximately 10% RTP).

The P6 permissive is utilized to disable the following reactor trips or ESF functions:

- Reactor Trip 8: High Neutron Flux (Intermediate Range), and
- Reactor Trip 9: Low Doubling Time (Intermediate Range).

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Hot leg pressure measurements, hot leg temperature measurements, and cold leg temperature measurements are used to calculate core THERMAL POWER. These calculated core THERMAL POWER levels are compared to the setpoint. When three out of four of the calculated core THERMAL POWER levels are greater than the setpoint, the operator is prompted to manually validate the permissive.

The value of the permissive was selected at the boundary between the operating range of the intermediate range detectors and the power range detectors.

311, 16-145(a)

Permissives that disable a reactor trip or ESF function when the permissives are validated are not part of a primary success path of a safety sequence analysis. While their failure may lead to a spurious reactor trip or ESF actuation, their functioning is not credited to mitigate an accident or anticipated operational occurrence, nor to keep the plant in an analyzed condition. Since the P6 permissive ~~P6~~ only disables functions when the permissive is validated, it is not within the scope of 10 CFR 50.36, Criterion 3.

5. P7 - RCP Not in Operation

The P7 permissive facilitates plant heat-up and cooldown by disabling certain ESF functions. The P7 permissive is utilized in the following reactor trips or ESF functions:

- ESF 11.b: CVCS Isolation on ADM - Shutdown Condition (RCP not operating), and
- ESF 11.c: CVCS Isolation on ADM - Standard Shutdown Conditions.

The P7 permissive requires four divisions of the following sensors and processors to be OPERABLE in MODES 3, 4, 5, and 6 with no RCPs in operation:

- RCP Current sensors,
- APUs, and
- ALUs.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

7. P12 - Pressurizer Pressure Lower than Threshold

The P12 permissive facilitates plant heat-up and cooldown by disabling certain ESF functions. The P12 permissive is utilized in the following reactor trips or ESF functions:

- Reactor Trip 12: High Pressurizer Level,
- Reactor Trip 13: Low Hot Leg Pressure,
- Reactor Trip 15: Low SG Pressure,
- ESF 2.d: SSS Isolation on Low SG Pressure (Affected SGs),
- ESF 3.a: SIS Actuation on Low Pressurizer Pressure,
- ESF 3.b: SIS Actuation on Low Delta P_{sat},
- ESF 7.b: MSRT Isolation on Low SG Pressure (Affected SG), and
- ESF 8.b: MSIV Isolation on Low SG Pressure (All SGs).

311, 16-138(a)

The P12 permissive requires four divisions of the following sensors and processors to be OPERABLE in MODE 3 with RCS pressure less than ~~or equal to~~ approximately 2005 psia, and in MODE 4 when at least one RCP is running, the hot leg pressure is greater than or equal to approximately 464 psia, or the hot leg temperature is greater than or equal to approximately 350ºF:

- Pressurizer Pressure (Narrow Range) sensors,
- APUs, and
- ALUs.

The P12 permissive ~~P12~~ facilitates plant heatup or cooldown by disabling certain ESF functions. The P12 permissive allows cooling by Main Steam Bypass or MSRT down to the LHSI/RHR connection temperature and to be able to depressurize the reactor coolant system to LHSI/RHR connection pressure without actuation of SIS.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

8. P13 - Hot Leg Temperature Lower than Threshold

The P13 permissive defines when steam generator draining and filling operations are allowed. The P13 permissive is utilized in the following reactor trips or ESF functions:

- Reactor Trip 17: Low SG Level,
- Reactor Trip 18: High SG Level,
- ESF 2.b: MFW Full Load Isolation on High SG Level (Affected SGs),
- ESF 2.e: SSS Isolation on High SG Level for Period of Time (Affected SGs),
- ESF 6.a: EFWS Actuation on Low-Low SG Level (Affected SGs), and
- ESF 6.b: EFWS Actuation on LOOP and SIS Actuation (All SGs).

Hot Leg Temperature (WR) measurements are compared to the P13 setpoint (approximately 200°F).

311, 16-145(a)

The value of the permissive was selected in order to permit draining and filling operations during shutdown and LHSI/RHR in operation without generating protection signals.

Permissives that disable a reactor trip or ESF function when the permissives are validated are not part of a primary success path of a safety sequence analysis. While their failure may lead to a spurious reactor trip or ESF actuation, their functioning is not credited to mitigate an accident or anticipated operational occurrence, nor to keep the plant in an analyzed condition. Since the P13 permissive ~~P13~~ only disables functions when the permissive is validated, it is not within the scope of 10 CFR 50.36.

9. P14 - Hot Leg Pressure and Hot Leg Temperature Lower than Thresholds

The P14 permissive defines when the residual heat removal system is allowed to be connected to the RCS.

The P14 permissive is utilized in the following reactor trip or ESF functions:

- ESF 5 - Partial Cooldown Actuation on SIS Actuation, and
- ESF 7.a - MSRT Actuation on High SG Pressure (Affected SG) (for setpoint control).

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

At pressures and temperatures below the setting of the P14 permissive (approximately 464 psia and approximately 350 ºF), operation of the LHSI/RHR system is allowed.

The P14 permissive requires four divisions of the following sensors and processors to be OPERABLE in MODES 1, 2, 3, and in MODE 4 when the SGs are relied upon for heat removal:

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

This permissive is manually controlled.

10. P15 - Hot Leg Pressure and Hot Leg Temperature Lower than Thresholds and RCPs Shutdown

The P15 permissive defines when SI actuation due to Delta P_{sat} is disabled and SI actuation due to Low RCS Loop Level is enabled.

The P15 permissive is utilized in the following reactor trips or ESF functions:

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

The P15 permissive requires four divisions of the following sensors and processors to be OPERABLE in MODES 4, 5, and 6:

- Hot Leg Temperature (Wide Range) sensors,
- Hot Leg Pressure (Wide Range) sensors,
- RCP Current sensors,
- APUs, and
- ALUs.

311, 16-138(a)

The value for the P15 permissive ~~P15~~ (RCS temperature less than ~~or equal to~~ approximately 350ºF, RCS pressure less than ~~or equal to~~ approximately 464 psia, and less than ~~or equal to~~ approximately 50% no load current on all RCPs) represents the threshold for switching from the SIS Actuation on Low Delta P_{sat} protection to protection via the SIS Actuation on Low RCS Loop Level.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

4. CVCS Charging Line Flow

Four CVCS Charging Line Flow sensors are required to be OPERABLE in MODES 1 and 2, and in MODES 3, 4, and 5 with one or more RCPs in operation. These sensors support the following functions:

- ESF 11.c: CVCS Isolation on ADM - Standard Shutdown Conditions, and
- ESF 11.d: CVCS Isolation on ADM At Power.

5. Cold Leg Temperature (Narrow Range)

Four Cold Leg Temperature (Narrow Range) sensors are required to be OPERABLE in MODE 1 when RTP is greater than ~~or equal to~~ approximately 10%. These sensors support the following functions and Permissives:

311, 16-138(a)

- Reactor Trip 1.a: Low DNBR,
- Reactor Trip 1.b: Low DNBR and (Imbalance or Rod Drop (1/4)),
- Reactor Trip 1.c: Low DNBR and Rod Drop (2/4),
- Reactor Trip 1.d: Low DNBR - High Quality,
- Reactor Trip 1.e: Low DNBR - High Quality and (Imbalance or Rod Drop (1/4)), and
- P6 permissive ~~P6~~: Thermal Core Power Higher than Threshold.

6. Cold Leg Temperature (Wide Range)

Four Cold Leg Temperature (Wide Range) sensors are required to be OPERABLE in:

311, 16-138(a)

311, 16-180(a)

- MODE 1,
- MODE 2, when power is greater than ~~or equal to~~ approximately 10^{-5}% as shown on the Intermediate Range Detectors,
- MODE 3, with one or more RCPs in operation,
- MODES 4 and 5, with one or more RCPs in operation or when LTOP OPERABILITY is required by LCO 3.4.11, and
- MODE 6, when LTOP OPERABILITY is required by LCO 3.4.11.
- ~~MODES 3, 4, and 5 with one or more RCPs in operation, and~~
- ~~When PSRV OPERABILITY is required by LCO 3.4.11, "Low Temperature Overpressure Protection (LTOP)".~~

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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 Reactor Trip 19: High Containment Pressure function, which in turn supports ESF 9a: Containment Isolation (Stage 1) on High Containment Pressure.

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 Reactor Trip 19: High Containment Pressure function, which in turn supports ESF 9a: Containment Isolation (Stage 1) on High Containment Pressure.

9. Containment Service Compartment Pressure (Wide Range)

311, 16-154

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)

311, 16-180(a)

10. Hot Leg Pressure (Narrow Range)

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

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

311, 16-180(a)

~~10~~11. 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 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, RCP Not in Operation, and Time Elapsed since Safety Injection Start.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

311, 16-180(a)

12~~11~~. Hot Leg Temperature (Narrow Range)

Four Hot Leg Temperature (Narrow Range) sensors in each of four divisions (16 total) are required to be OPERABLE in MODE 1 and MODE 2 when power is greater than ~~or equal to~~ approximately 10^{-5}% as shown on the intermediate range detectors. These sensors support the following functions and Permissives:

311, 16-138(a)

- Reactor Trip 4: High Core Power Level,
- Reactor Trip 5: Low Saturation Margin, and
- P6 permissive ~~P6~~: Thermal Core Power Higher than Threshold.

13~~12~~. Hot Leg Temperature (Wide Range)

Four Hot Leg Temperature (Wide Range) sensors are required to be OPERABLE in MODES 1, 2, 3, 4, 5, and 6. These sensors support the following functions and Permissives:

- ESF 3.b: SIS Actuation on Low Delta P_{sat},
- ESF 7.a: MSRT Actuation on High SG Pressure (Affected SG) (for setpoint control),
- P13 permissive ~~P13~~: Hot Leg Temperature Lower 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, RCP Not in Operation, and Time Elapsed since Safety Injection Start.

14~~13~~. Intermediate Range

Four Intermediate Range sensors are required to be OPERABLE in:

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

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

These sensors support the following functions and Permissives:

- Reactor Trip 8: High Neutron Flux (Intermediate Range),
- Reactor Trip 9: Low Doubling Time (Intermediate Range), and
- P5 permissive ~~P5~~: Flux (Intermediate Range) Measurement Higher than Threshold.

15~~14~~. Power Range

311, 16-180(a)

Two Power Range sensors per division (8 total) are required to be OPERABLE in MODES 1 and 2, and in MODE 3 with the RCSL System capable of withdrawing a RCCA or one or more RCCAs not fully inserted. These sensors support the following functions and Permissives:

- Reactor Trip 3: High Neutron Flux Rate of Change,
- P2 permissive ~~P2~~: Flux (Power Range) Measurement Higher than First Threshold, and
- P3 permissive ~~P3~~: Flux (Power Range) Measurement Higher than Second Threshold.

16~~15~~. Pressurizer Level (Narrow Range)

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

- Reactor Trip 12: High Pressurizer Level, and
- ESF 11.a: CVCS Charging Line Isolation on High-High Pressurizer Level.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

17~~16~~. Pressurizer Pressure (Narrow Range)

Four Pressurizer Pressure (Narrow Range) sensors are required to be OPERABLE in MODES 1, 2, 3, and in MODE 4 with RCS temperature greater than or equal to approximately 350ºF, RCS pressure greater than or equal to approximately 464 psia, or at least one RCP is operating. ~~greater than approximately 50% no load current on all RCPs.~~ These sensors support the following functions and Permissives:

311, 16-147(a)

- Reactor Trip 1.a: Low DNBR,
- Reactor Trip 1.b: Low DNBR and (Imbalance or Rod Drop (1/4)),
- Reactor Trip 1.c: Low DNBR and Rod Drop (2/4),
- Reactor Trip 1.d: Low DNBR - High Quality,
- Reactor Trip 1.e: Low DNBR - High Quality and (Imbalance or Rod Drop (1/4)),
- Reactor Trip 10: Low Pressurizer Pressure,
- Reactor Trip 11: High Pressurizer Pressure,
- ESF 3.a: SIS Actuation on Low Pressurizer Pressure, and
- P12 permissive ~~P12~~: Pressurizer Pressure Lower than Threshold.

311, 16-180(a)

18~~17~~. Radiation Monitor - Containment High Range

Four Containment High Range Radiation monitors are required to be OPERABLE in MODES 1, 2, 3, and 4. These sensors support ESF 9.d: Containment Isolation (Stage 1) on High Containment Radiation function.

19~~18~~. Radiation Monitor - Control Room HVAC Intake Activity

Four Control Room HVAC Intake Activity Radiation monitors are required to be OPERABLE in MODES 1, 2, 3, 4, 5, 6, and during movement of irradiated fuel assemblies. The monitors are not required to be OPERABLE when the associated train is in the recirculation mode. These sensors support ESF 13: Control Room HVAC Reconfiguration to Recirculation Mode on High Intake Activity function.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

20~~19~~. RCP Current

Three RCP Current sensors per RCP (12 total) are required to be OPERABLE in MODES 1, 2, 3, 4, 5, and 6. These sensors support the following functions and Permissives:

- ESF 4: RCP Trip on Low Delta Pressure across RCP with SIS Actuation,
- P7 permissive ~~P7~~: RCP Not in Operation, and
- P15 permissive ~~P15~~: Hot Leg Pressure and Hot Leg Temperature Lower than Thresholds and RCPs Shutdown.

311, 16-180(a)

21~~20~~. RCP Delta Pressure

Two RCP Delta Pressure sensors per pump (8 total) are required to be OPERABLE in MODES 1, 2, 3, and 4. These sensors support ESF 4: RCP Trip on Low Delta Pressure across RCP with SIS Actuation function.

22~~21~~. RCP Speed

Four RCP Speed sensors are required to be OPERABLE in MODE 1 when RTP is greater than ~~or equal to~~ approximately 10%. These sensors support the following functions:

311, 16-138(a)

- Reactor Trip 1.a: Low DNBR,
- Reactor Trip 1.b: Low DNBR and (Imbalance or Rod Drop (1/4)),
- Reactor Trip 1.c: Low DNBR and Rod Drop (2/4),
- Reactor Trip 1.d: Low DNBR - High Quality,
- Reactor Trip 1.e: Low DNBR - High Quality and (Imbalance or Rod Drop (1/4)), and
- Reactor Trip 7: Low RCP Speed.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

23~~22~~. RCS Loop Flow

Four RCS Loop Flow sensors per loop (16 total) are required to be OPERABLE in MODE 1, and in MODE 2 when RTP is greater than ~~or equal to~~ approximately 10^{-5}% as shown on the intermediate range detectors. These sensors support the following functions and Permissives:

311, 16-138(a)

- Reactor Trip 1.a: Low DNBR,
- Reactor Trip 1.b: Low DNBR and (Imbalance or Rod Drop 1/4)),
- Reactor Trip 1.c: Low DNBR and Rod Drop (2/4),
- Reactor Trip 1.d: Low DNBR - High Quality,
- Reactor Trip 1.e: Low DNBR - High Quality and (Imbalance or Rod Drop (1/4)),
- Reactor Trip 4: High Core Power Level,
- Reactor Trip 5: Low Saturation Margin,
- Reactor Trip 6a: Low-Low RCS Loop Flow Rate in One Loop,
- Reactor Trip 6b: Low RCS Loop Flow Rate in Two Loops, and
- P8 permissive ~~P6~~: Thermal Core Power Higher than Threshold.

311, 16-180(a)

24~~23~~. RCS Loop Level

Four RCS Loop Level sensors are required to be OPERABLE in:

- MODE 4 when no RCPs are running, the hot leg pressure is less than approximately 464 psia, and the hot leg temperature is less than approximately 350ºF, and
- MODES 5 and 6.

These sensors support ESF 3.c: SIS Actuation on Low RCS Loop Level function.

25~~24~~. RTCB Position Indication

Four RTCB Position Indication sensors are required to be OPERABLE in MODE 1, and in MODES 2 and 3 except when all MFW Full Load and Low Load lines are isolated. These sensors support the following functions:

- ESF 1: Turbine Trip on Reactor Trip,
- ESF 2.a: MFW Full Load Isolation on Reactor Trip (All SGs), and
- ESF 2.e: SSS Isolation on High SG Level for Period of Time (Affected SGs).

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

311, 16-180(a)

26~~25~~. Rod Cluster Control Assembly (RCCA) Analog Position Indicator

Eighty-nine RCCA Analog Position Indicator sensors are required to be OPERABLE in MODE 1 when RTP is greater than ~~or equal to~~ approximately 10%. These sensors support the following functions:

311, 16-138(a)

- Reactor Trip 1.b: Low DNBR and (Imbalance or Rod Drop (1/4)),
- Reactor Trip 1.c: Low DNBR and Rod Drop (2/4), and
- Reactor Trip 1.e: Low DNBR - High quality and (Imbalance or Rod Drop (1/4)).

27~~26~~. RCCA Bottom Position Indicator

Eighty-nine RCCA Bottom Position Indicator sensors are required to be OPERABLE in:

- MODE 3, with one or more RCPs in operation,
- MODE 4, with one or more RCPs in operation, and
- MODE 5, with one or more RCPs in operation.

These sensors support P8 permissive ~~P8~~: Shutdown RCCA Position Lower than Threshold.

28~~27~~. Self-Powered Neutron Detectors

Seventy-two SPNDs are required to be OPERABLE in MODE 1 when RTP is greater than ~~or equal to~~ approximately 10%. These sensors support the following functions:

311, 16-138(a)

- Reactor Trip 1.a: Low DNBR,
- Reactor Trip 1.b: Low DNBR and (Imbalance or Rod Drop (1/4)),
- Reactor Trip 1.c: Low DNBR and Rod Drop (2/4),
- Reactor Trip 1.d: Low DNBR - High Quality,
- Reactor Trip 1.e: Low DNBR - High Quality and (Imbalance or Rod Drop (1/4)), and
- Reactor Trip 2: High Linear Power Density.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

311, 16-180(a)

29~~28~~. SG Level (Narrow Range)

Four SG Level (Narrow Range) sensors per SG (16 total) are required to be OPERABLE in MODES 1 and 2, and in MODE 3 except when all MFW full load and low load lines are isolated. These sensors support the following functions:

- Reactor Trip 17: Low SG Level,
- Reactor Trip 18: High SG Level,
- ESF 2.b: MFW Full Load Isolation on High SG Level (Affected SGs), and
- ESF 2.e: SSS Isolation on High SG Level for Period of Time (Affected SGs).

30~~29~~. SG Level (Wide Range)

Four SG Level (Wide Range) sensors per SG (16 total) are required to be OPERABLE in MODES 1, 2, and 3. These sensors support ESF 6.a: EFWS Actuation on Low-Low SG Level (Affected SGs).

31~~30~~. SG Pressure

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

- Reactor Trip 14: SG Pressure Drop,
- Reactor Trip 15: Low SG Pressure,
- Reactor Trip 16: High SG Pressure,
- ESF 2.c: SSS Isolation on SG Pressure Drop (Affected SGs),
- ESF 2.d: SSS Isolation on Low SG Pressure (Affected SGs),
- ESF 7.a: MSRT Actuation on High SG Pressure (Affected SGs),
- ESF 7.b: MSRT Isolation on Low SG Pressure (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).

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

SIGNAL PROCESSORS

1. Acquisition and Processing Units

Five APUs per division (20 total) are required to be OPERABLE in accordance with the supported functions as shown in Table 3.3.1-2. These signal processors support the reactor trip, ESF functions, and Permissives.

2. Actuation Logic Units

Four ALUs per division (16 total) are required to be OPERABLE in MODES 1, 2, 3, 4, 5, 6, and during movement of irradiated fuel assemblies. These signal processors support the reactor trip, ESF functions and Permissives.

3. Remote Acquisition Units

Two RAUs per division (8 total) are required to be OPERABLE in MODE 1 when RTP is greater than ~~or equal to~~ approximately 10%. 311, 16-138(a)
These signal processors support the following functions:

- Reactor Trip 1.a: Low DNBR,
- Reactor Trip 1.b: Low DNBR and (Imbalance or Rod Drop (1/4)),
- Reactor Trip 1.c: Low DNBR and Rod Drop (2/4),
- Reactor Trip 1.d: Low DNBR - High Quality,
- Reactor Trip 1.e: Low DNBR - High Quality and (Imbalance or Rod Drop (1/4)), and
- Reactor Trip 2: High Linear Power Density.

4. Rod Cluster Control Assembly Units 311, 16-138(a)

Four RCCA Units are required to be OPERABLE in:

- MODE 1 when RTP is greater than ~~or equal to~~ approximately 10%, and
- MODES 3, 4, and 5 with one or more RCPs in operation.

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BASES

ACTIONS

The most common causes of division inoperability are outright failure or drift of the sensor sufficient to exceed the tolerance allowed by the plant specific setpoint analysis. Typically, the drift is found to be small and results in a delay of actuation rather than a total loss of function. This determination is generally made during the performance of a CALIBRATION when the sensor is set up for adjustment to bring it to within specification. If the as-found sensor calibration setting value is outside its predefined as-found tolerance, ~~trip setpoint is non-conservative with respect to the Allowable Value~~, the sensor~~division~~ is declared inoperable immediately, and the appropriate Condition(s) must be entered immediately.

311, 16-182(b)

In the event that the as-found sensor calibration setting values are outside their predefined as-found tolerance~~a functions trip setpoint is found non-conservative with respect to the Allowable Value~~, or the sensors, signal processors, Actuation Signal Voting processors, or actuation devices are found inoperable, then all affected functions provided by that division must be declared inoperable, and the unit must enter any applicable Condition for the particular protection Function affected.

When the number of inoperable sensors or signal processors in a reactor trip or ESF function exceeds that specified in any related Condition, redundancy is lost and actions must be taken to restore the required redundancy.

A Note has been added to the ACTIONS. The Note has been added to clarify the application of the Completion Time rules. The Conditions of this Specification may be entered independently for each PS sensor, manual actuation switch, signal processor, and actuation device. The Completion Times of each inoperable sensor, manual actuation switch, signal processor, and actuation device will be tracked separately, starting from the time the Condition was entered for that sensor, manual actuation switch, signal processor, and actuation device.

A.1 and A.2

Condition A applies to the failure of one or more sensors. Condition A.1 applies only to the RTCB Position Indication sensors. If one or more of these sensors is inoperable, the inoperable sensor(s) must be placed in the tripped condition in 1 hour. The Completion Time of 1 hour is based on operating experience and the minimum amount of time allowed for manual operator action. Condition A.2 applies to all other PS sensors. If one or more of these sensors is inoperable, the inoperable sensor is placed in lockout in 4 hours. The 4 hour allotted timeframe is sufficient to allow the operator to take all appropriate actions for the failed sensor and still ensures that the risk involved in operating with the failure is acceptable.

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BASES

ACTIONS (continued)

B.1

Condition B applies to the failure of one or more manual actuation switches. In this condition, the minimum functional capability for manual actuation may not maintained. Restoring the manual initiation capability to OPERABLE status within 48 hours is reasonable considering the availability of automatic actuation, the low probability of an AOO or postulated accident occurring during this time, and the time necessary for repairs.

C.1 and C.2

311, 16-129(a)

Condition C applies to one or more APUs inoperable due to the NTSP~~LTSP~~ for one or more Trip/Actuation Function Permissives not met. In this condition, the hardware is still functional. The sensors have been calibrated and the ADOTs and SOTs have checked the function from sensor to actuation device. The manual actuation capability would be unaffected.

If the inoperability affects the NTSP~~LTSP~~ for either the EDG Start on Degraded Grid Voltage or the EDG Start on LOOP (Trip/Actuation Function/Permissives B.10.a or B.10.b), Required Action C.1 directs entry into the applicable Conditions and Required Actions of LCO 3.8.1, "AC Sources - Operating," and LCO 3.8.2, "AC Sources - Shutdown." Note that the EDG Start on Degraded Grid Voltage and the EDG Start on LOOP functions reside on redundant APUs within each division. Therefore, if the NTSP for the EDG Start on Degraded Grid Voltage or the EDG Start on LOOP functions is entered incorrectly on only one APU in a division, that division is still capable of performing the EDG Start on Degraded Grid Voltage or the EDG Start on LOOP functions. However, single failure protection for the start of the EDG in that division is not maintained. The Completion Time of 1 hour is a reasonable time to allow the operator to diagnose and potentially correct the issue that caused the inoperability prior to entering LCO 3.8.1 or LCO 3.8.2. Restoring the NTSP~~LTSP~~ to OPERABLE status within 24 hours for all other Trip/Actuation Function/Permissives is a reasonable timeframe considering the time necessary to change the setpoint parameter, load corrected software, or replace the unit. If the NTSP~~LTSP~~ cannot be restored ~~to OPERABLE status~~, the associated APU must be placed in lockout or the Condition referenced in Table 3.3.1-2 for the associated function must be entered. If only one APU that performs the EDG Start on Degraded Grid Voltage or the EDG Start on LOOP functions in a division is placed in lockout, the division is still capable of performing the EDG Start on Degraded Grid Voltage or the EDG Start on LOOP functions.

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BASES

ACTIONS (continued)

D.1 and D.2

311, 16-129(a)

Condition D applies to one or more signal processors inoperable for reasons other than Condition C. If the inoperability affects the APU or ALU associated with the EDG Start on Degraded Grid Voltage or the EDG Start on LOOP (~~Trip/Actuation~~ Function~~s~~ B.10.a or B.10.b), Required Action D.1 directs entry into the applicable Conditions and Required Actions of LCO 3.8.1, "AC Sources - Operating," and LCO 3.8.2, "AC Sources - Shutdown." The Completion Time of 1 hour is a reasonable time to allow the operator to diagnose and potentially correct the issue that caused the inoperability prior to entering LCO 3.8.1 or LCO 3.8.2. Restoring the signal processor to OPERABLE status within 4 hours is a reasonable timeframe considering the time necessary to restore the signal processor to OPERABLE status. If the signal processor cannot be restored to OPERABLE status, the signal processor must be placed in lockout.

E.1

Condition E applies to the RCP Bus and Trip Breakers, RTCBs, and Reactor Trip Contactors. With one ore more actuation devices inoperable, the actuation device must be restored to OPERABLE status within 48 hours. The Completion Time of 48 hours is reasonable considering that there are two automatic actuation divisions and the low probability of an event occurring during this interval.

F.1

If the Required Action and associated Completion Time of Condition A, B, C, D, or E or if the minimum functional capability (the value where the supported functions would not actuate during an AOO or postulated event coupled with a single failure) of the sensors, manual actuation switches, signal processors or actuation devices specified in Table 3.3.1-1 are not met, then the unit must be brought to a MODE in which the supported reactor trips or ESF functions are not required to be OPERABLE and any other specified actions must be taken. The applicable Condition referenced in the table is sensor, manual actuation switch, signal processor, actuation device, and MODE dependent. Condition F is entered to provide for transfer to the appropriate subsequent Condition. Required Action F.1 directs entry into the appropriate Condition referenced in Table 3.3.1-1.

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BASES

ACTIONS (continued)

G.1

311, 16-129(a)

If Table 3.3.1-2 directs entry into Condition G, the unit must be brought to a condition in which the Low-Low RCS Loop Flow Rate in One Loop function (~~Trip/Actuation~~ Function A.6.a) or associated P3 permissive ~~P3~~ are not required to be OPERABLE. The allowed Completion Time of 2 hours is reasonable, based on operating experience, to reduce THERMAL POWER from full power to less than 70% RTP in an orderly manner and without challenging plant systems.

H.1

If Table 3.3.1-1 or Table 3.3.1-2 directs entry into Condition H, the unit must be brought to a condition in which the supported reactor trips or Permissives are not required to be OPERABLE. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reduce THERMAL POWER from full power to less than 10% RTP in an orderly manner and without challenging plant systems.

I.1

If Table 3.3.1-1 or Table 3.3.1-2 directs entry into Condition I, the unit must be brought to a MODE in which the supported reactor trips are not required to be OPERABLE. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 2 from full power conditions in an orderly manner and without challenging plant systems.

J.1

If Table 3.3.1-1 or Table 3.3.1-2 directs entry into Condition J, the unit must be brought to a MODE in which the supported reactor trips, ESF functions, or Permissives are not required to be OPERABLE. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging plant systems.

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BASES

ACTIONS (continued)

R.1

If Table 3.3.1-1 or Table 3.3.1-2 directs entry into Condition R, the automatic mitigation of events in MODES 5 and 6 that could result in a decrease in RCS inventory may have been impacted. Operations that could reduce RCS inventory shall be suspended immediately. The Completion Time of immediately is consistent with the required times for actions requiring prompt attention.

S.1 and S.2

If Table 3.3.1-1 or Table 3.3.1-2 directs entry into Condition S, the associated PSRVs are immediately declared inoperable. The actions of LCO 3.4.11, "Low Temperature Overpressure Protection (LTOP)," provide adequate compensatory actions to assure unit safety.

T.1 and T.2

If Table 3.3.1-1 or Table 3.3.1-2 directs entry into Condition T, the associated Control Room Emergency Filtration trains are immediately declared inoperable. The actions of LCO 3.7.10, "Control Room Emergency Filtration (CREF)," provide adequate compensatory actions to assure unit safety.

U.1 and U.2

311, 16-131(d)

If Table 3.3.1-1 directs entry into Condition U, the RCCA Analog Position Indicator sensors or RCCA Units are immediately declared inoperable. ~~.~~ ~~During power operations, t~~The actions of LCO 3.1.7, "Rod Control Cluster Assembly (RCCA) Position Indication," provide adequate compensatory actions to assure unit safety.

V.1

If Table 3.3.1-1 directs entry into Condition V, actions must be taken to ensure the reactor trip functions remain OPERABLE. This is accomplished by opening the associated division's reactor trip breaker. The Completion Time of 1 hour is based on operating experience and the minimum amount of time allowed for manual operator action.

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BASES

ACTIONS (continued)

W.1

If Table 3.3.1-1 directs entry into Condition W, the manual Reactor Trip switches or trip actuation devices are inoperable. If the switches or trip actuation devices cannot be returned to OPERABLE status within one hour, actions must be taken to ensure all RCCAs are inserted and the reactor must be placed in a condition where the RCCA can not be withdrawn. This is accomplished by opening the reactor trip breakers. The Completion Time of 1 hour is based on operating experience and the minimum amount of time allowed for manual operator action.

SURVEILLANCE REQUIREMENTS

The SRs for any particular PS sensor, manual actuation switch, signal processor, or actuation device are found in the SR column of Table 3.3.1-1 for that sensor, manual actuation switch, signal processor, or actuation device.

----------REVIEWER'S NOTE----------
In order for a plant to take credit for topical reports as the basis for justifying Frequencies, topical reports must be supported by an NRC staff SER that establishes the acceptability of each topical report for that unit.

311, 16-182(b)

~~----------REVIEWER'S NOTE----------~~
~~Notes b and c are applied to the setpoint verification Surveillances for all SL-LSSS Functions unless one or more of the following exclusions apply:~~

~~1. Notes b and c are not applied to SL-LSSS Functions which utilize mechanical components to sense the trip setpoint or to manual initiation circuits (the latter are not explicitly modeled in the accident analysis). Examples of mechanical components are limit switches, float switches, proximity detectors, manual actuation switches, and other such devices that are normally only checked on a "go/no go" basis. Note 1 requires a comparison of the periodic surveillance requirement results to provide an indication of Trip/Actuation Function (or individual device) performance. This comparison is not valid for most mechanical components. While it is possible to verify that a limit switch functions at a point of travel, a change in the surveillance result probably indicates that the switch has moved, not that the input/output relationship has changed. Therefore, a comparison of surveillance requirement results would not provide an indication of the Trip/Actuation Function or component performance.~~

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311, 16-182(b)

BASES

SURVEILLANCE REQUIREMENTS (continued)

~~2. Notes b and c are not applied to Technical Specifications associated with mechanically operated safety relief valves. The performance of these components is already controlled (i.e., trended with as-left and as-found limits) under the ASME Section XI testing program.~~

~~3. Notes b and c are not applied to SL-LSSS Functions and Surveillances which test only digital components. For purely digital components, such as actuation logic circuits and associated relays, there is no expected change in result between surveillance performances other than measurement and test errors (M&TE) and, therefore, comparison of Surveillance results does not provide an indication of Trip/Actuation Function or component performance.~~

~~An evaluation of the potential SL-LSSS Functions resulted in Notes b and c being applied to the Functions shown in the TS markups. Each licensee proposing to fully adopt this TSTF must review the potential SL-LSSS Functions to identify which of the identified functions are SL-LSSS according to the definition of SL-LSSS and their plant specific safety analysis. The two TSTF Notes are not required to be applied to any of the listed Functions which meet any of the exclusion criteria or are not SL-LSSS based on the plant specific design and analysis.~~

~~The Limiting Trip Setpoint column for reactor trip functions is~~ Surveillance Requirements for some sensors are modified by two footnotes~~Notes~~ as identified in Table 3.3.1-1~~2~~. ~~The selected Functions are those Functions that are LSSS for protection system instrument functions that protect reactor core or RCS pressure boundary SLs.~~ These footnotes apply to both the sensors and any associated signal conditioning components that are subject to drift. Some components (e.g., mechanical devices which have an on or off output or an open/close position such as limit switches, float switches, and proximity detectors) are not calibrated in the traditional sense and do not have as-left or as-found conditions that would indicate drift of the component setpoint. These devices are considered not trendable and the requirements of the footnotes~~Notes~~ are not required to be applied to the mechanical portion of the functions. Where a non-trendable component provides signal input to other Trip/Actuation Function/Permissive components that can be trended, the remaining components must be evaluated in accordance with the footnotes~~Notes~~.

Footnote (b)~~The first Note~~ requires evaluation of sensor~~Trip/Actuation Function's~~ performance for the condition where the as-found sensor calibration setting values are~~setting for the setpoint is~~ outside its as-found tolerance but conservative with respect to the Allowable Value. For digital components, the as-found tolerance may be identical to the as-left tolerance since drift may not be an expected error. In these cases a

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BASES

SURVEILLANCE REQUIREMENTS (continued)

311, 16-182(b)

~~Trip/Actuation Function's~~sensor's as-found value outside the as-left condition may be cause for component assessment. Evaluation of instrument performance will verify that the instrument will continue to behave in accordance with design-basis assumptions. The purpose of the assessment is to ensure confidence in the instrument performance prior to returning the instrument to service. These conditions will also be identified in the Corrective Action Program. Entry into the Corrective Action Program will ensure required review and documentation of the condition for continued OPERABILITY.

311, 16-182(b)

Footnote (c)~~The second Note~~ requires that the sensor shall be calibrated such that the division is within the as-left tolerance around the supported NTSP at the completion of the surveillance~~as-left setting for the instrument be returned to within the as-left tolerance of the LTSP~~. Where a setpoint more conservative than the NTSP~~LTSP~~ is used in the plant surveillance procedures, the as-left and as-found tolerances, as applicable, will be applied to the surveillance procedure setpoint. This will ensure that sufficient margin to the SL and/or Analytical Limit is maintained. If the as-left instrument setting cannot be returned to a setting within the as-left tolerance, then the sensor~~Trip/Actuation Function~~ shall be declared inoperable. The ~~second Note~~ footnote also requires that the ~~LTSP and the~~ methodologies for calculating the as-left and the as-found tolerances be in a document controlled under 10 CFR 50.59.

The digital PS provides continual online automatic monitoring of each of the input signal in each division, perform software limit checking (signal online validation) against required acceptance criteria, and provide hardware functional validation so that a division check is continuously being performed. If any PS input signal is identified to be in a failure status, this condition is alarmed in the Control Room. As such, a periodic "channel check" is no longer necessary.

The Surveillances are modified by a Note to indicate that when a sensor, manual actuation switch, signal processor, or actuation device is placed in an inoperable status solely for performance of required Surveillances, entry into associated Conditions and Required Actions may be delayed for up to 6 hours provided the associated Trip/Actuation Function/Permissive maintains functional capability. Upon completion of the Surveillance, or expiration of the 6 hour allowance, the sensor, manual actuation switch, signal processor, or actuation device must be returned to OPERABLE status or the applicable Condition entered and Required Actions taken. This Note is based on the overall system reliability and an assumption of the average time required to perform a Surveillance. The 6 hour testing allowance does not significantly reduce the probability that the PS will actuate when required.

311, 16-129(a)

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BASES

SURVEILLANCE REQUIREMENTS (continued)

The Note clarifies that 12 hours are allowed for performing the first Surveillance after reaching 20% RTP. A power level of 20% RTP is chosen based on plant stability, (i.e., automatic rod control capability and turbine generator synchronized to the grid).

SR 3.3.1.3

SR 3.3.1.3 is the performance of a ADOT every 31 days. This test shall verify OPERABILITY by actuation of the Reactor Trip Circuit Breakers and Reactor Trip Contactors. The ADOT may be performed by means of any series of sequential, overlapping, or total steps.

SR 3.3.1.4

The online boron meters are a half shell design and are not in contact with the reactor coolant. The concentration of boron is measured by using the neutron absorption effect of B-10. The boron concentration is calculated using the measured count rate. To improve the accuracy of the measurement, the temperature of the reactor coolant at the measuring point is used to adjust the boron concentration. The temperature instruments are not included as part of this Surveillance. The frequency of the boron meter CALIBRATION is conservative considering instrument reliability.

311, 16-193(b)

SR 3.3.1.5

A SOT ~~on each required reactor trip actuation device~~ is performed every 24 months to ensure the devices will perform their intended function when needed. A SOT shall be the injection of a simulated or actual signal into the division as close to the sensor as practicable to verify OPERABILITY of all devices in the division required for sensor OPERABILITY. The SOT shall include the verification of the accuracy and time constants of the analog input modules.

The SOT may be performed by means of any series of sequential, overlapping, or total steps.

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BASES

SURVEILLANCE REQUIREMENTS (continued)

311, 16-193(c)

SR 3.3.1.6

A CALIBRATION of each PS sensor ~~(except neutron detectors)~~ every 24 months ensures that each instrument division is reading accurately and within tolerance. This SR is modified by a Note stating that neutron detectors are excluded from the CALIBRATION. The CALIBRATION for the power range neutron detectors consists of a normalization of the detectors based on a power calorimetric and flux map performed at or above 20% RTP. The CALIBRATION for the intermediate range neutron detectors consists of obtaining the detector plateau or preamp discriminator curves, evaluating those curves, and comparing the curves to the manufacturer's data. This Surveillance is not required for the power range detectors for entry into MODE 2 or 1, and is not required for the intermediate range detectors for entry into MODE 2, because the unit must be in at least MODE 2 to perform the test for the intermediate range detectors and MODE 1 for the power range detectors. A CALIBRATION shall be the adjustment, as necessary, of the sensor output such that it responds within the necessary range and accuracy to known values of the parameter that the division monitors. The CALIBRATION shall encompass all devices in the division required for sensor OPERABILITY. CALIBRATION of instrument divisions with resistance temperature detector (RTD) or thermocouple sensors may consist of an in-place qualitative assessment of sensor behavior and normal CALIBRATION of the remaining adjustable devices in the division. The CALIBRATION may be performed by means of any series of sequential, overlapping, or total steps.

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SR 3.3.1.7

The features of continuous self-monitoring of the PS system are described in Reference 8. Additional tests, which require the processor to be inoperable are not normally performed during operation. These EXTENDED SELF TESTS are performed at start-up of a computer each cycle. The startup sequence is as follows:

- Hardware basic test using the internal diagnosis monitor,
- Start-up self test of the operating system, and
- Switch over to normal operation after approximately two minutes.

Additional information is provided in Section 3 of Reference 8.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.8

SR 3.3.1.8 is the performance of an ADOT every 24 months. The ADOT may be performed by means of any series of sequential, overlapping, or total steps.

311, 16-129(a)

312, 16-227

311, 16-129(a)

SR 3.3.1.9

SR 3.3.1.9 verifies that the Nominal~~Limiting~~ Trip Setpoint, ~~Design Limits,~~ ~~and~~ including the Permissive values, have been properly loaded into the applicable APU.

SR 3.3.1.10

SR 3.3.1.10 verifies that the individual division actuation response times are less than or equal to the maximum values assumed in the accident analysis. Response time testing acceptance criteria are included in a document controlled under 10 CFR 50.59. Individual component response times are not modeled in the analyses.

The analyses model the overall or total elapsed time, from the point at which the parameter exceeds the trip setpoint value at the sensor to the point at which the equipment reaches the required functional state (i.e., control and shutdown rods fully inserted in the reactor core, pumps at rated discharge pressure, or valves in full open or closed position).

For divisions that include dynamic transfer functions (e.g., lag, lead/lag, rate/lag, etc.), the response time test may be performed with the transfer function set to one, with the resulting measured response time compared to the appropriate FSAR response time. Alternately, the response time test can be performed with the time constants set to their nominal value, provided the required response time is analytically calculated assuming the time constants are set at their nominal values. The response time may be measured by a series of overlapping tests such that the entire response time is measured.

----------REVIEWER'S NOTE----------
Applicable portions of NRC approved Topical Reports may be utilized to modify the requirements for response time surveillance testing. These applicable portions of NRC approved Topical Reports should be referenced and discussed.

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Table B 3.3.1-1 (page 1 of 11)
Protection System (PS) Functional Dependencies

311, 16-129(a)

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
REACTOR TRIP FUNCTIONS						
A.1. Low Departure from Nucleate Boiling Ration (DNBR) a. Low DNBR d. Low DNBR - High Quality	1 (~~d~~b)	3	A total of 67 Self-Powered Neutron Detectors (SPND) in any of the four divisions Pressurizer Pressure (NR) Cold Leg Temperature (NR) Reactor Coolant Pump (RCP) Speed RCS Loop Flow (3 of 4 per loop) / Remote Acquisition Unit (1 of 2) Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	A total of 67 Self-Powered Neutron Detectors (SPND) in any of the four divisions Pressurizer Pressure (NR) Cold Leg Temperature (NR) Reactor Coolant Pump (RCP) Speed RCS Loop Flow (3 of 4 per loop) / Remote Acquisition Unit (1 of 2) Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	A total of 67 Self-Powered Neutron Detectors (SPND) in any of the four divisions Pressurizer Pressure (NR) Cold Leg Temperature (NR) Reactor Coolant Pump (RCP) Speed RCS Loop Flow (3 of 4 per loop) / Remote Acquisition Unit (1 of 2) Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	A total of 67 Self-Powered Neutron Detectors (SPND) in any of the four divisions Pressurizer Pressure (NR) Cold Leg Temperature (NR) Reactor Coolant Pump (RCP) Speed RCS Loop Flow (3 of 4 per loop) / Remote Acquisition Unit (1 of 2) Acquisition and Processing Unit Actuation Logic Unit (3 of 4)

311, 16-182(b)

(~~d~~b) With P2 permissive ~~P2~~ validated

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Table B 3.3.1-1 (page 2 of 11)
Protection System (PS) Functional Dependencies

311, 16-129(a)

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
A.1. Low Departure from Nucleate Boiling Ration (DNBR) b. Low DNBR and (Imbalance or Rod Drop (1/4)) c. Low DNBR and Rod Drop (2/4) e. High Quality and (Imbalance or Rod Drop (1/4))	1 (~~d~~b)	3	22 RCCA Analog Position Indicators A total of 67 Self-Powered Neutron Detectors (SPND) in any of the four divisions Pressurizer Pressure (NR) Cold Leg Temperature (NR) RCP Speed RCS Loop Flow (3 of 4 per loop) / RCCA Unit Remote Acquisition Unit (1 of 2) Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	22 RCCA Analog Position Indicators A total of 67 Self-Powered Neutron Detectors (SPND) in any of the four divisions Pressurizer Pressure (NR) Cold Leg Temperature (NR) RCP Speed RCS Loop Flow (3 of 4 per loop) / RCCA Unit Remote Acquisition Unit (1 of 2) Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	22 RCCA Analog Position Indicators A total of 67 Self-Powered Neutron Detectors (SPND) in any of the four divisions Pressurizer Pressure (NR) Cold Leg Temperature (NR) RCP Speed RCS Loop Flow (3 of 4 per loop) / RCCA Unit Remote Acquisition Unit (1 of 2) Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	23 RCCA Analog Position Indicators A total of 67 Self-Powered Neutron Detectors (SPND) in any of the four divisions Pressurizer Pressure (NR) Cold Leg Temperature (NR) RCP Speed RCS Loop Flow (3 of 4 per loop) / RCCA Unit Remote Acquisition Unit (1 of 2) Acquisition and Processing Unit Actuation Logic Unit (3 of 4)

311, 16-190(d)

311, 16-190(a)

311, 16-182(b)

(~~d~~b) With P2 permissive ~~P2~~ validated.

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Table B 3.3.1-1 (page 3 of 11)
Protection System (PS) Functional Dependencies

311, 16-129(a)

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
A.2. High Linear Power Density	1 (~~d~~b)	3	A total of 67 Self-Powered Neutron Detectors (SPND) in any of the four divisions / Two Remote Acquisition Units (1 of 2) Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	A total of 67 Self-Powered Neutron Detectors (SPND) in any of the four divisions / Two Remote Acquisition Units (1 of 2) Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	A total of 67 Self-Powered Neutron Detectors (SPND) in any of the four divisions / Two Remote Acquisition Units (1 of 2) Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	A total of 67 Self-Powered Neutron Detectors (SPND) in any of the four divisions / Two Remote Acquisition Units (1 of 2) Acquisition and Processing Unit Actuation Logic Unit (3 of 4)
A.4. High Core Power Level	1,2 (~~e~~e)	3	Cold Leg Temperature (WR) Hot Leg Temperature (NR) (3 of 4) Hot Leg Pressure (WR) RCS Loop Flow (3 of 4 per loop) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Cold Leg Temperature (WR) Hot Leg Temperature (NR) (3 of 4) Hot Leg Pressure (WR) RCS Loop Flow (3 of 4 per loop) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Cold Leg Temperature (WR) Hot Leg Temperature (NR) (3 of 4) Hot Leg Pressure (WR) RCS Loop Flow (3 of 4 per loop) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Cold Leg Temperature (WR) Hot Leg Temperature (NR) (3 of 4) Hot Leg Pressure (WR) RCS Loop Flow (3 of 4 per loop) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)

311, 16-182(b)

311, 16-131(d)

311, 16-190(a)

(~~d~~b) With P2 permissive ~~P2~~ validated.
(~~e~~e) With P5 permissive ~~P5~~ validated.

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Table B 3.3.1-1 (page 4 of 11)
Protection System (PS) Functional Dependencies

311, 16-129(a)

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
A.5. Low Saturation Margin	1,2 (~~g~~e)	3	Cold Leg Temperature (WR) Hot Leg Temperature (NR) (3 of 4) Hot Leg Pressure (WR) RCS Loop Flow (3 of 4 per loop) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Cold Leg Temperature (WR) Hot Leg Temperature (NR) (3 of 4) Hot Leg Pressure (WR) RCS Loop Flow (3 of 4 per loop) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Cold Leg Temperature (WR) Hot Leg Temperature (NR) (3 of 4) Hot Leg Pressure (WR) RCS Loop Flow (3 of 4 per loop) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Cold Leg Temperature (WR) Hot Leg Temperature (NR) (3 of 4) Hot Leg Pressure (WR) RCS Loop Flow (3 of 4 per loop) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)

311, 16-182(b)

(~~g~~e) With P5 permissive ~~P5~~ validated.

311, 16-190(a)

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Table B 3.3.1-1 (page 5 of 11)
Protection System (PS) Functional Dependencies

311, 16-129(a)

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
A.19. High Containment Pressure	1,2,3,4	3	Containment Equipment Compartment Pressure Containment Service Compartment Pressure (NR) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Containment Equipment Compartment Pressure Containment Service Compartment Pressure (NR) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Containment Equipment Compartment Pressure Containment Service Compartment Pressure (NR) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Containment Equipment Compartment Pressure Containment Service Compartment Pressure (NR) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)
B. ENGINEERED SAFETY FEATURES ACTUATION SYSTEM (ESFAS) FUNCTIONS						
2.e. Startup and Shutdown ~~Feedwater~~ System Isolation on Steam Generator Level High for Period of Time (Affected SGs)	1 2[(i)],3[(i)]	3	Steam Generator Level (NR) Reactor Trip Circuit Breaker Position Indication / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Steam Generator Level (NR) Reactor Trip Circuit Breaker Position Indication / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Steam Generator Level (NR) Reactor Trip Circuit Breaker Position Indication / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Steam Generator Level (NR) Reactor Trip Circuit Breaker Position Indication / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)

311, 16-174(a)

311, 16-182(b)

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

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Table B 3.3.1-1 (page 6 of 11)
Protection System (PS) Functional Dependencies

311, 16-129(a)

311, 16-182(b)

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
3.b. SIS Actuation on Low Delta P_{sat}	3(~~m~~k),4(~~n~~l)	3	Hot Leg Pressure (WR) Hot Leg Temperature (WR) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Hot Leg Pressure (WR) Hot Leg Temperature (WR) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Hot Leg Pressure (WR) Hot Leg Temperature (WR) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Hot Leg Pressure (WR) Hot Leg Temperature (WR) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)
4. Reactor Coolant Pump (RCP) Trip on Low Delta P across RCP with Safety Injection System Actuation	1,2,3,4	3	RCP Delta P (1 of 2) RCP 1 Current #1 RCP 3 Current #1 RCP 4 Current #1 / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	RCP Delta P (1 of 2) RCP 1 Current #2 RCP 2 Current #1 RCP 4 Current #2 / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	RCP Delta P (1 of 2) RCP 1 Current #3 RCP 2 Current #2 RCP 3 Current #2 / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	RCP Delta P (1 of 2) RCP 2 Current #3 RCP 3 Current #3 RCP 4 Current #3 / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)

(~~m~~k) With P12 permissive ~~P12~~ validated.
(~~n~~l) With P15 permissive ~~P15~~ inhibited.

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Table B 3.3.1-1 (page 7 of 11)
Protection System (PS) Functional Dependencies

311, 16-129(a)

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
7.a. MSRT Actuation on High SG Pressure (Affected SG)	1,2,3,4 (~~p~~n)	3	SG Pressure Hot Leg Temperature (WR) Hot Leg Pressure (WR) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	SG Pressure Hot Leg Temperature (WR) Hot Leg Pressure (WR) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	SG Pressure Hot Leg Temperature (WR) Hot Leg Pressure (WR) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	SG Pressure Hot Leg Temperature (WR) Hot Leg Pressure (WR) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)
11.a. CVCS Charging Line Isolation on High-High Pressurizer Level	1,2,3,4 (q)	3	Pressurizer Level / Acquisition and Processing Unit	Pressurizer Level / Acquisition and Processing Unit	Pressurizer Level / Acquisition and Processing Unit	Pressurizer Level / Acquisition and Processing Unit
	1,2,3,4	2	Actuation Logic Unit (3 of 4)			Actuation Logic Unit (3 of 4)

311, 16-182(b)

311, 16-182(a)

(~~p~~n) When the SGs are relied upon for heat removal.

(q) With P17 permissive inhibited.

311, 16-182(a)

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Table B 3.3.1-1 (page 8 of 11)
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
11.b. CVCS Isolation on Anti-Dilution Mitigation (ADM) at Shutdown Condition (RCP not operating)	$3^{(\cancel{s}r)}$,$4^{(\cancel{s}r)}$ ~~$5^{(s)}$,6~~	3	Boron Concentration Boron Temperature / Acquisition and Processing Unit	Boron Concentration Boron Temperature / Acquisition and Processing Unit	Boron Concentration Boron Temperature / Acquisition and Processing Unit	Boron Concentration Boron Temperature / Acquisition and Processing Unit
	$5^{(r)}$, 6 ~~$^{(r)}$~~	2				
	$3^{(\cancel{s}r)}$,$4^{(\cancel{s}r)}$, $5^{(\cancel{s}r)}$ $6^{(r)}$	2	Actuation Logic Unit (3 of 4)			Actuation Logic Unit (3 of 4)
11.c. CVCS Isolation on ADM - Standard Shutdown Conditions	$3^{(\cancel{s}t)}$,$4^{(\cancel{s}t)}$ ~~$5^{(t)}$~~	3	Boron Concentration Boron Temperature CVCS Charging Line Flow Cold Leg Temperature (WR) / Acquisition and Processing Unit	Boron Concentration Boron Temperature CVCS Charging Line Flow Cold Leg Temperature (WR) / Acquisition and Processing Unit	Boron Concentration Boron Temperature CVCS Charging Line Flow Cold Leg Temperature (WR) / Acquisition and Processing Unit	Boron Concentration Boron Temperature CVCS Charging Line Flow Cold Leg Temperature (WR) / Acquisition and Processing Unit
	$5^{(s)}$	2				
	$3^{(\cancel{s}t)}$,$4^{(\cancel{s}t)}$, $5^{(\cancel{s}t)}$	2	Actuation Logic Unit (3 of 4)			Actuation Logic Unit (3 of 4)

(~~s~~r) With P7 permissive ~~P7~~ validated (no RCPs in operation).
(~~t~~s) With P7 permissive ~~P7~~ inhibited (one or more RCPs in operation).

311, 16-129(a)
311, 16-182(a)
311, 16-149(a)
311, 16-182(a)
311, 16-182(b)
311, 16-182(a)

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Table B 3.3.1-1 (page 9 of 11)
Protection System (PS) Functional Dependencies

311, 16-129(a)

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
11.d. CVCS Isolation on ADM At Power	1,2	3	Boron Concentration Boron Temperature CVCS Charging Line Flow / Acquisition and Processing Unit	Boron Concentration Boron Temperature CVCS Charging Line Flow / Acquisition and Processing Unit	Boron Concentration Boron Temperature CVCS Charging Line Flow / Acquisition and Processing Unit	Boron Concentration Boron Temperature CVCS Charging Line Flow / Acquisition and Processing Unit
	1,2	2	Actuation Logic Unit (3 of 4)			Actuation Logic Unit (3 of 4)
C. PERMISSIVES						
P8 permissive ~~P8~~ - Shutdown RCCA Position Lower than Threshold	3(ts),4(ts), 5(ts)	3 2	~~22~~ 89 RCCA Bottom Position Indicators / RCCA Unit~~Two Remote Acquisition Units per division~~ Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	~~22~~ 89 RCCA Bottom Position Indicators / RCCA Unit~~Two Remote Acquisition Units per division~~ Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	~~22~~ 89 RCCA Bottom Position Indicators / RCCA Unit~~Two Remote Acquisition Units per division~~ Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	~~23~~ 89 RCCA Bottom Position Indicators / RCCA Unit~~Two Remote Acquisition Units per division~~ Acquisition and Processing Unit Actuation Logic Unit (3 of 4)

311, 16-131(d)

311, 16-182(b)

~~(d) With Permissive P2 validated.~~
(~~t~~s) With P7 permissive ~~P7~~ inhibited (one or more RCPs in operation).

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Table B 3.3.1-1 (page 10 of 11)
Protection System (PS) Functional Dependencies

311, 16-129(a)

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
P14 permissive ~~P14~~ - Hot Leg Pressure and Hot Leg Temperature Lower than Thresholds	1,2,3,4 (~~p~~n)	3	Hot Leg Pressure (WR) Hot Leg Temperature (WR) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Hot Leg Pressure (WR) Hot Leg Temperature (WR) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Hot Leg Pressure (WR) Hot Leg Temperature (WR) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Hot Leg Pressure (WR) Hot Leg Temperature (WR) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)
P15 permissive ~~P15~~ - Hot Leg Pressure and Hot Leg Temperature Lower than Thresholds and RCPs Shutdown	4 5,6	3 2	Hot Leg Pressure (WR) Hot Leg Temperature (WR) RCP 1 Current #1 RCP 3 Current #1 RCP 4 Current #1 / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Hot Leg Pressure (WR) Hot Leg Temperature (WR) RCP 1 Current #2 RCP 2 Current #1 RCP 4 Current #2 / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Hot Leg Pressure (WR) Hot Leg Temperature (WR) RCP 1 Current #3 RCP 2 Current #2 RCP 3 Current #2 / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Hot Leg Pressure (WR) Hot Leg Temperature (WR) RCP 2 Current #3 RCP 3 Current #3 RCP 4 Current #3 / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)

311, 16-182(b)

(~~p~~n) When the SGs are relied upon for heat removal.

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Table B 3.3.1-1 (page 11 of 11)
Protection System (PS) Functional Dependencies

311, 16-129(a)

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
P16 permissive ~~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	Hot Leg Pressure (WR) Hot Leg Temperature (WR) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Hot Leg Pressure (WR) Hot Leg Temperature (WR) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Hot Leg Pressure (WR) Hot Leg Temperature (WR) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	Hot Leg Pressure (WR) Hot Leg Temperature (WR) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)

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B 3.3 INSTRUMENTATION

B 3.3.2 Post Accident Monitoring (PAM) Instrumentation

BASES

BACKGROUND

The primary purpose of the PAM instrumentation is to provide operators with information that is needed during accidents.

The OPERABILITY of PAM instrumentation ensures that there is sufficient information available on selected plant parameters to monitor and assess plant status and behavior following accidents and transients when the use of the Emergency Operating Procedures (EOPs) is required as discussed in NUREG-0737, Supplement 1 (TMI Action Plan) (Reference 1).

312, 16-212(b)

The PAM instruments are required for the following reasons:

1. Perform the diagnosis specified in the emergency operating procedures (these variables are restricted to preplanned actions for the primary success path of DBAs), e.g., loss of coolant accident (LOCA);

2. Take the specified, pre-planned, manually controlled actions, for which no automatic control is provided, and that are required for safety systems to accomplish their safety function;

3. Provide information to indicate whether plant safety functions are being accomplished for reactivity control, core cooling, maintaining reactor coolant system integrity, and maintaining containment integrity (including radioactive effluent control);

4. Provide information to indicate the potential for being breached or the actual breach of the barriers to fission product releases (i.e., fuel cladding, primary coolant pressure boundary, and containment); and

5. Enable the operator to recognize which heat transfer symptom is occurring: 1) loss of subcooling margin, 2) lack of heat transfer, 3) excessive heat transfer, and 4) Steam Generator Tube Rupture.

The PAM instrumentation is displayed through the Safety Information and Control Systems (SICS), which includes the Qualified Display System (QDS). The Safety Automation System (SAS) communication with the QDS (as part of SICS) is realized through the Monitoring and Service Interfaces (MSI), and the Panel Interfaces (PI). The PIs are part of the SICS, the MSIs are part of the SAS. The SAS also provides outputs for analog meters, illuminated buttons etc., and receives inputs from Conventional Instrumentation and Controls which is included in the SICS.

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BASES

BACKGROUND (continued)

As long as adequate subcooling margin exists, core cooling is ensured. If subcooling margin is lost, actions are required to ensure core cooling and restore adequate subcooling margin.

311, 16-199

----------REVIEWER'S NOTE----------

Table 3.3.2-1 provides a list of ~~variables~~ Functions identified by the unit specific Regulatory Guide 1.97 analyses. Table 3.3.2-1 in unit specific Technical Specifications (TS) shall list all Types A, B, and C ~~variables~~ Functions identified by the unit specific Regulatory Guide 1.97 analyses, as amended by the NRC's Safety Evaluation Report (SER).

The following PAM instrumentation is included in LCO 3.3.2, however, more restrictive operability requirements for the associated components are contained in LCO 3.3.1, "Protection System":

311, 16-199

- Cold Leg Temperature (Wide Range),
- Containment Service Compartment Pressure (Wide Range),
- Hot Leg Pressure (Wide Range),
- Hot Leg Temperature (Wide Range),
- Intermediate Range,
- Pressurizer Level (Narrow Range).
- Radiation Monitor - Containment High Range,
- Steam Generator (SG) Level (Wide Range),
- SG Pressure~~.~~;

The specific instrument Functions listed in Table 3.3.2-1 are discussed in the LCO section.

APPLICABLE SAFETY ANALYSES

The PAM instrumentation ensures the OPERABILITY of ~~certain~~ Regulatory Guide 1.97 (Reference 2) / IEEE Standard 497-2002 (Reference 3) Type A, B, and C variables, so that the control room operating staff can:

312, 16-212(a)

- Recognize when a heat transfer symptom is occurring that would require performance of the appropriate section in the emergency operating procedures.

- Perform the diagnosis specified in the emergency operating procedures (these variables are restricted to preplanned actions for the primary success path of postulated accidents), e.g., loss of coolant accident (LOCA);

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BASES

APPLICABLE SAFETY ANALYSIS (continued)

- Take the specified, pre-planned, manually controlled actions, for which no automatic control is provided, and that are required for safety systems to accomplish their safety function;
- Determine whether systems important to safety are performing their intended functions for reactivity control, core cooling, maintaining reactor coolant system integrity and maintaining containment integrity,
- Determine the likelihood of a gross breach of the barriers to radioactivity release;
- Determine if a gross breach of a barrier has occurred; and
- Initiate action necessary to protect the public and to estimate the magnitude of any impending threat.

PAM instrumentation used to support pre-planned, manually controlled actions satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii)(C). The other PAM instrumentation that perform certain functions related to verification of key safety functions and monitoring key barriers for potential breach must be retained in TS because it is intended to assist operators in minimizing the consequences of accidents. Therefore, these variables are important for reducing public risk.

LCO

The PAM instrumentation LCO provides OPERABILITY requirements for Regulatory Guide 1.97 monitors that provide information required by the control room operators to perform certain manual actions specified in the unit Emergency Operating Procedures. These manual actions ensure that a system can accomplish its safety function, and are credited in the safety analyses. Additionally, this LCO addresses Regulatory Guide 1.97 instruments that perform certain functions related to verification of key safety functions and monitoring key barriers for potential breach.

The OPERABILITY of the PAM instrumentation ensures there is sufficient information available on selected unit parameters to monitor and assess unit status following an accident.

311, 16-199

LCO 3.3.2 requires two OPERABLE ~~divisions~~ channels for most Functions. Two OPERABLE ~~divisions~~ channels ensure no single failure prevents operators from getting the information necessary for them to determine the safety status of the unit, and to bring the unit to and maintain it in a safe condition following an accident.

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BASES

LCO (continued)

311, 16-199

Furthermore, OPERABILITY of two ~~divisions~~ channels allows for a comparison during the post accident phase to confirm the validity of displayed information.

The exception to the two ~~division~~ channel requirement is Containment Isolation Valve (CIV) Position Indication. In this case, the important information is the status of the containment penetrations. The LCO requires one position indicator for each active CIV. This is sufficient to redundantly verify the isolation status of each isolable penetration either via indicated status of the active valve and prior knowledge of a passive valve, or via system boundary status. If a normally active CIV is known to be closed and deactivated, position indication is not needed to determine status. Therefore, the position indication for valves in this state is not required to be OPERABLE.

~~PAM variables are required to meet design and qualification requirements for seismic and environmental qualification, single failure criterion, utilization of emergency standby power, immediately accessible display, continuous readout, and recording of display.~~

Table 3.3.2-1 provides a list of ~~variables~~ Functions identified by the Regulatory Guide 1.97 (Ref. 1) analyses. Type A, B, and C variables are required to meet Regulatory Guide 1.97 design and qualification requirements for seismic and environmental qualification, single failure criterion, utilization of emergency standby power, immediately accessible display, continuous readout, and recording of display.

Listed below are discussions of the specified instrument Functions listed in Table 3.3.2-1:

1. Cold Leg Temperature (Wide Range)

The Cold Leg Temperature (Wide Range) instrumentation is used to support a credited operator manual action to control the extended partial cooldown during a Steam Generator Tube Rupture (SGTR) event when forced flow exists. It is also used to initiate actions to prevent violating reactor coolant system pressure-temperature limits and low temperature overpressure protection limits.

Four ~~divisions~~ channels of wide range cold leg temperature are provided with a range of 32°F to 662°F.

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BASES

LCO (continued)

2. Containment Isolation Valve Position Indication

The Containment Isolation Valve (CIV) position indication is used to assess containment integrity.

311, 16-199

In the case of CIV position, the important information is the isolation status of the containment penetration. One ~~division~~ channel of valve position indication is required to be available in the control room for each active CIV in a containment penetration flow path, (i.e., two total ~~divisions~~ channels of CIV position indication for a penetration flow path with two active valves). For penetrations with only one active CIV having control room indication, Note (b) of Table 3.3.2-1 requires a single ~~division~~ channel of valves position indication. This is to redundantly verify the isolation status of each isolable penetration via indicated status of the active valve, as applicable, and prior knowledge of passive or system boundary status. If a penetration flow path is isolated, position indication for the CIV(s) in the associated penetration flow path is not needed to determine status. Therefore, the position indication for valves in an isolated penetration flow path is not required. Each penetration is treated separately and each penetration flow path is considered a separate function. Therefore, separate Condition entry is allowed for each inoperable penetration flow path.

3. Containment Service Compartment Pressure (Wide Range)

Containment service compartment pressure indication is used to assess the potential challenge to containment integrity and for verification of adequate containment cooling function.

311, 16-199

Four channels of containment wide range pressure indications are available and have a range of -5 to 220 psig.

4. Core Outlet Thermocouples (Wide Range)

Core Outlet Thermocouples are provided for monitoring RCS temperature at the outlet of the core. These thermocouples are used to evaluate the status of reactor core cooling and to indicate the potential for breach of the fuel cladding.

311, 16-199

Three channels of thermocouples are provided for each core quadrant and each have a range of 32°F to 2300°F.

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BASES

LCO (continued)

8. Intermediate Range

Intermediate range nuclear instrumentation is used to detect Anticipated Transient Without Scram events to support contingency actions to manually actuate the Extra Boration System within 30 minutes. This instrumentation is also used post-trip to verify the reactor is shut down.

Four channels of Intermediate Range Detectors are available. They provide an indication of reactor power over a range of $5X10^{-6}$ to 60% RTP.

9. Low Head Safety Injection Flow (Wide Range)

Low Head Safety Injection (LHSI) flow is the primary indicator of LHSI performance; it is used for initiation of contingency actions for insufficient LHSI flow. Safety Injection performance is the only valid indication of sufficient core cooling during loss of subcooling margin.

Two wide range flow indications are available for each of the four LHSI trains. They have a range of 0 to ~~530 lb_m/sec~~3800 gpm.

311, 16-199

10. Medium Head Safety Injection Flow (Wide Range)

Medium Head Safety Injection (MHSI) flow is the primary indicator of MHSI performance; it is used for initiation of contingency actions for insufficient MHSI flow. Safety Injection performance is the only valid indication of sufficient core cooling during loss of subcooling margin.

Two wide range flow indications are available for each of the four MHSI trains. These indications have a range of 0 to ~~180 lb_m /sec~~1300 gpm.

11. Pressurizer Level (Narrow Range)

Pressurizer level indication is used to support credited operator manual actions to manage MHSI during a SGTR, and to detect an RCS inventory control upset during the Extra Boration System malfunction event. Pressurizer level is also used to provide information to the operator on the magnitude of an RCS pressure boundary breach in order to support Safety Injection management actions.

Four ~~divisions~~ channels of pressurizer level ~~(1 per division)~~ are available and have a range of 0 to 100%.

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BASES

LCO (continued)

12. Radiation Monitor - Annulus Ventilation System Gamma Activity

These monitors are used to determine the activity present in the exhaust air from the annulus extraction system downstream of the filters to detect a breach of the containment building. This monitor is used for fission product barrier breach detection.

Two channels of monitors with gamma-sensitive detectors are provided with a range of 1E-4 to 1E+4 rad/hr.

311, 16-199

13. Radiation Monitor - Containment High Range

Containment high range radiation monitors support the Radioactive Effluent Control Critical Safety Function by providing indication of the potential release source. Containment high range radiation monitors also indicate the potential for breach or the actual breach of the fuel cladding and primary coolant boundary.

Four channels of containment high range radiation monitors are available and have a range of 1E-1 to 1E+7 rad/hr.

14. Radiation Monitor - Main Steam Line

These monitors are used to detect a SGTR at power and to identify the affected SG in order to support credited operator manual actions for SGTR mitigation.

Four channels of radiation monitors are provided for each steam line and have a range of 1E-4 to 1E+4 μCi/cc.

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BASES

LCO (continued)

15. Steam Generator Level (Wide Range)

SG Level (Wide Range) is used to detect SG overfill and to initiate actions to prevent liquid relief through the Main Steam Safety Valves and Main Steam Relief Trains during a SGTR event. This indication is also one of the instruments utilized to detect a loss of secondary heat sink, which requires the operator to initiate feed and bleed cooling.

SG Level (Wide Range) is also provided to aid in the monitoring of primary to secondary heat transfer, to determine the need for EFW actuation, and to monitor the performance of SG level control. This instrumentation is also used to initiate actions to mitigate upsets in these functions.

Four wide range level indications are available per SG and have a range of 0 to 100%.

16. Steam Generator Pressure

SG Pressure indication is used to support manual operator actions during a Feedwater Line Break (FWLB). This instrument is also used to determine required SG pressure and to control SG pressure, when establishing SGs as a heat sink. SG Pressure instrumentation is also provided to aid in the monitoring and control of primary to secondary heat transfer, in the verification that the SG is available as a heat sink, and to determine when SG isolation is required.

Four SG Pressure indications are available per SG and have a range of 0 to 1600 psig.

17. Source Range

Source Range Detectors provide for long term surveillance of core reactivity to assess: 1) whether a return to criticality is approached during plant Cooldown, 2) the need for mitigation efforts to maintain the reactor in a shutdown condition.

311, 16-199

The Source Range Detectors consist of 3 channels~~divisions~~. They provide an indication of neutron flux over a range of 0.05 to 5E+4 n/cm^2-s.

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BASES

LCO (continued)

18. Subcooling Margin

Subcooling margin instrumentation supports manual actions to align hot leg injection after a Loss of Coolant Accident and to manage MHSI after a SGTR. Subcooling margin is also used to determine when conditions requiring full MHSI are present, and to determine if the conditions that require hot leg injection exist.

311, 16-199

Four channels ~~divisions~~ of Subcooling Margin monitoring instrumentation are provided with a range of 611°F Subcooling Margin to 2088°F Superheat.

APPLICABILITY

The PAM instrumentation LCO is applicable in MODES 1, 2, and 3. These variables are related to the diagnosis and preplanned actions required to mitigate postulated accidents. The applicable postulated accidents are assumed to occur in MODES 1, 2, and 3. In MODES 4, 5, and 6, plant conditions are such that the likelihood of an event occurring that would require PAM instrumentation is low; therefore, PAM instrumentation is not required to be OPERABLE in these MODES.

ACTIONS

A Note has been added in the ACTIONS to clarify the application of Completion Time rules. The Conditions of this Specification may be entered independently for each Function. The Completion Time(s) of the inoperable division(s) of a Function will be tracked separately for each Function starting from the time the Condition was entered for that Function.

311, 16-199

A.1

When one or more Functions have one required channel ~~division~~ that is inoperable, the required inoperable channel ~~division~~ must be restored to OPERABLE status within 30 days. The 30 day Completion Time is based on operating experience and takes into account the remaining OPERABLE channel ~~division~~ (or in the case of a Function that has only one required channel~~division~~, other non-Regulatory Guide 1.97 instrument channels ~~divisions~~ to monitor the Function), the passive nature of the instrument (no critical automatic action is assumed to occur from these instruments), and the low probability of an event requiring PAM instrumentation during this interval.

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BASES

ACTIONS (continued)

B.1

This Required Action specifies initiation of actions in accordance with Specification 5.6.5, which requires a written report to be submitted to the Nuclear Regulatory Commission. This report discusses the results of the root cause evaluation of the inoperability and identifies proposed restorative Required Actions. This Required Action is appropriate in lieu of a shutdown requirement, given the likelihood of plant conditions that would require information provided by this instrumentation. Also, alternative Required Actions are identified before a loss of functional capability condition occurs.

311, 16-199

C.1

When one or more Functions have two required channels ~~divisions~~ inoperable (i.e., two channels ~~divisions~~ inoperable in the same Function), one channel ~~division~~ in the Function should be restored to OPERABLE status within 7 days. The Completion Time of 7 days is based on the relatively low probability of an event requiring PAM instrumentation operation and the availability of alternate means to obtain the required information. Continuous operation with two required channels ~~divisions~~ inoperable in a Function is not acceptable because the alternate indications may not fully meet all performance qualification requirements applied to the PAM instrumentation. Therefore, requiring restoration of one inoperable channel ~~division~~ of the Function limits the ACTIONS risk that the PAM Function will be in a degraded condition should an accident occur.

D.1

Condition D applies when the Required Action and associated Completion Time of Condition C is not met. Required Action D.1 requires entering the appropriate Condition referenced in Table 3.3.2-1 for the channel ~~division~~ immediately. The applicable Condition referenced in the Table is Function dependent. Each time an inoperable channel ~~division~~ has not met the Required Action of Condition C, and the associated Completion Time has expired, Condition D is entered for that channel ~~division~~ and provides for transfer to the appropriate subsequent Condition.

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BASES

ACTIONS (continued)

E.1 and E.2

If the Required Action and associated Completion Time of Condition C is not met and Table 3.3.2-1 directs entry into Condition E, 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 4 within 12 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.

F.1

311, 16-199

For this plant, Core Outlet Thermocouples (Wide Range), EFW Flow, LHSI Flow, MHSI Flow, SG Pressure, SG Level (Wide Range), and Subcooling Margin provide means of monitoring core cooling. The remaining instrumentation may be temporarily utilized if a normal PAM channel ~~division~~ of the Core Outlet Thermocouples (Wide Range), LHSI Flow, or MHSI Flow cannot be restored to OPERABLE status within the allotted time. If these temporary means are used, the Required Action is not to shut down the unit but rather to follow the directions of Specification 5.6.5 in the Administrative Controls section of the TS. The report provided to the NRC should discuss the means used, describe the degree to which the means are equivalent to the installed PAM channels~~divisions~~, justify the areas in which they are not equivalent, and provide a schedule for restoring the normal PAM channels~~divisions~~.

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BASES

SURVEILLANCE REQUIREMENTS

A Note at the beginning of the SR Table specifies that the following SR applies to each PAM instrumentation Function.

312, 16-234(a)

SR 3.3.2.1

312, 16-234(a)

A CALIBRATION is performed every 24 months or approximately every refueling. CALIBRATION is a complete check of the instrument division including the sensor. The Surveillance verifies the sensor output ~~function~~ responds to the measured parameter within the necessary range and accuracy. This SR is modified by a Note ~~that excludes neutron detectors. The calibration method for neutron detectors is specified in the Bases of LCO 3.3.1, "Protection System (PS)."~~stating that neutron detectors are excluded from the CALIBRATION. The CALIBRATION for the source range and intermediate range neutron detectors consists of obtaining the detector plateau or preamp discriminator curves, evaluating those curves, and comparing the curves to the manufacturer's data. This Surveillance is not required for the power range detectors for entry into MODE 2 or 1, and is not required for the intermediate range detectors for entry into MODE 2, because the unit must be in at least MODE 2 to perform the test for the intermediate range detectors and MODE 1 for the power range detectors.

Whenever a sensing element is replaced, the next required ~~CHANNEL~~ CALIBRATION of the Core Exit Thermocouple sensors is accomplished by an inplace cross calibration that compares the other sensing elements with the recently installed sensing element.

312, 16-234(b)

The Frequency is based upon operating experience and consistency with the typical industry refueling cycle and is justified by the assumption of a 24 month CALIBRATION interval for the determination of the magnitude of equipment drift.

REFERENCES

1. NUREG 0737, Supplement 1 (TMI Action Plan).

312, 16-212(b)

2. Regulatory Guide 1.97, Revision 4, June 2006.

3. IEEE 497-2002.

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BASES

SURVEILLANCE REQUIREMENTS (continued)

313, 16-26

This SR is modified by ~~a Note.~~ two Notes. The reason for Note 1 is that during operation with the reactor critical, performance of this SR could cause perturbations to the electrical distribution systems that could challenge continued steady state operation and, as a result, plant safety systems. This restriction from normally performing the Surveillance in MODE 1 or 2 is further amplified to allow the Surveillance to be performed for the purpose of reestablishing OPERABILITY (e.g., post work testing following corrective maintenance, corrective modification, deficient or incomplete surveillance testing, and other unanticipated OPERABILITY concerns) provided an assessment determines plant safety is maintained or enhanced. This assessment shall, as a minimum, consider the potential outcomes and transients associated with a failed Surveillance, a successful Surveillance, and a perturbation of the offsite or onsite system when they are tied together or operated independently for the Surveillance; as well as the operator procedures available to cope with these outcomes. These shall be measured against the avoided risk of a plant shutdown and startup to determine that plant safety is maintained or enhanced when the Surveillance is performed in MODE 1 or 2. Risk insights or deterministic methods may be used for this assessment. Credit may be taken for unplanned events that satisfy this SR.

~~The~~ Note 2 ensures that the EDG is tested under load conditions that are as close to design basis conditions as possible. When synchronized with offsite power, testing should be performed at a power factor of ≤ 0.9. This power factor is representative of the actual inductive loading an EDG would see under postulated accident conditions. Under certain conditions, however, the Note allows the Surveillance to be conducted at a power factor other than ≤ 0.9. These conditions occur when grid voltage is high, and the additional field excitation needed to get the power factor to ≤ 0.9 results in voltages on the emergency busses that are too high. Under these conditions, the power factor should be maintained as close as practicable to 0.9 while still maintaining acceptable voltage limits on the emergency busses. In other circumstances, the grid voltage may be such that the EDG excitation levels needed to obtain a power factor of 0.9 may not cause unacceptable voltages on the emergency busses, but the excitation levels are in excess of those recommended for the EDG. In such cases, the power factor shall be maintained as close as practicable to 0.9 without exceeding the EDG excitation limits.

DRAFT

BASES

SURVEILLANCE REQUIREMENTS (continued)

313, 16-26

----------REVIEWER'S NOTE----------
The above MODE restrictions may be deleted if it can be demonstrated to the staff, on a plant specific basis, that performing the SR with the reactor in any of the restricted MODES can satisfy the following criteria, as applicable:

a. Performance of the SR will not render any safety system or component inoperable,

b. Performance of the SR will not cause perturbations to any of the electrical distribution systems that could result in a challenge to steady state operation or to plant safety systems, and

c. Performance of the SR, or failure of the SR, will not cause, or result in, an AOO with attendant challenge to plant safety systems.

SR 3.8.1.10

This Surveillance demonstrates the EDG capability to reject a full load without overspeed tripping or exceeding the predetermined voltage limits. The EDG full load rejection may occur because of a system fault or inadvertent breaker tripping. This Surveillance ensures proper engine and generator load response under the simulated test conditions. This test simulates the loss of the total connected load that the EDG experiences following a full load rejection and verifies that the EDG does not trip upon loss of the load. These acceptance criteria provide for EDG damage protection. While the EDG is not expected to experience this transient during an event and continues to be available, this response ensures that the EDG is not degraded for future application, including reconnection to the bus if the trip initiator can be corrected or isolated.

The 24 month Frequency is consistent with the recommendation of Regulatory Guide 1.9 (Ref. 3) and is intended to be consistent with expected fuel cycle lengths.

DRAFT

BASES

SURVEILLANCE REQUIREMENTS (continued)

313, 16-11

This SR has been modified by two Notes~~a Note~~. The reason for Note 1 is that during operation with the reactor critical, performance of this SR could cause perturbations to the electrical distribution systems that could challenge continued steady state operation and, as a result, plant safety systems. This restriction from normally performing the Surveillance in MODE 1 or 2 is further amplified to allow the Surveillance to be performed for the purpose of reestablishing OPERABILITY (e.g., post work testing following corrective maintenance, corrective modification, deficient or incomplete surveillance testing, and other unanticipated OPERABILITY concerns) provided an assessment determines plant safety is maintained or enhanced. This assessment shall, as a minimum, consider the potential outcomes and transients associated with a failed Surveillance, a successful Surveillance, and a perturbation of the offsite or onsite system when they are tied together or operated independently for the Surveillance; as well as the operator procedures available to cope with these outcomes. These shall be measured against the avoided risk of a plant shutdown and startup to determine that plant safety is maintained or enhanced when the Surveillance is performed in MODE 1 or 2. Risk insights or deterministic methods may be used for this assessment. Credit may be taken for unplanned events that satisfy this SR.

~~The~~ Note 2 ensures that the EDG is tested under load conditions that are as close to design basis conditions as possible. When synchronized with offsite power, testing should be performed at a power factor of ≤ 0.9. This power factor is representative of the actual inductive loading an EDG would see under postulated accident conditions. Under certain conditions, however, the Note allows the Surveillance to be conducted at a power factor other than ≤ 0.9. These conditions occur when grid voltage is high, and the additional field excitation needed to get the power factor to ≤ 0.9 results in voltages on the emergency busses that are too high. Under these conditions, the power factor should be maintained as close as practicable to 0.9 while still maintaining acceptable voltage limits on the emergency busses. In other circumstances, the grid voltage may be such that the EDG excitation levels needed to obtain a power factor of 0.9 may not cause unacceptable voltages on the emergency busses, but the excitation levels are in excess of those recommended for the EDG. In such cases, the power factor shall be maintained as close as practicable to 0.9 without exceeding the EDG excitation limits.

DRAFT

BASES

SURVEILLANCE REQUIREMENTS (continued)

313, 16-11

----------REVIEWER'S NOTE----------
The above MODE restrictions may be deleted if it can be demonstrated to the staff, on a plant specific basis, that performing the SR with the reactor in any of the restricted MODES can satisfy the following criteria, as applicable:

a. Performance of the SR will not render any safety system or component inoperable,

b. Performance of the SR will not cause perturbations to any of the electrical distribution systems that could result in a challenge to steady state operation or to plant safety systems, and

c. Performance of the SR, or failure of the SR, will not cause, or result in, an AOO with attendant challenge to plant safety systems.

SR 3.8.1.11

As required by Regulatory Guide 1.9 (Ref. 3), Section 2.2.5, this Surveillance demonstrates the as designed operation of the standby power sources during loss of the offsite source. This test verifies all actions encountered from the loss of offsite power, including shedding of the nonessential loads and energization of the emergency buses and respective loads from the EDG. It further demonstrates the capability of the EDG to automatically achieve the required voltage and frequency within the specified time.

The EDG autostart time of 15 seconds is derived from requirements of the accident analysis to respond to a postulated large break LOCA. The Surveillance should be continued for a minimum of 5 minutes in order to demonstrate that all starting transients have decayed and stability is achieved.

The requirement to verify the connection and power supply of permanent and autoconnected loads is intended to satisfactorily show the relationship of these loads to the EDG loading logic. In certain circumstances, many of these loads cannot actually be connected or loaded without undue hardship or potential for undesired operation. For instance, the Low Head Safety Injection valves are not desired to be stroked open, or residual heat removal (RHR) systems performing a decay heat removal function are not desired to be realigned. In lieu of actual demonstration of connection and loading of loads, testing that adequately shows the capability of the EDG systems to perform these functions is acceptable. This testing may include any series of sequential, overlapping, or total steps so that the entire connection and loading sequence is verified.

DRAFT

BASES

SURVEILLANCE REQUIREMENTS (continued)

The Frequency of 24 months is consistent with the recommendations of Regulatory Guide 1.9 (Ref. 3), Table 1, takes into consideration unit conditions required to perform the Surveillance, and is intended to be consistent with expected fuel cycle lengths.

This SR is modified by two Notes. The reason for Note 1 is to minimize wear and tear on the EDGs during testing. For the purpose of this testing, the EDGs must be started from standby conditions, that is, with the engine coolant and oil continuously circulated and temperature maintained consistent with manufacturer recommendations. The reason for Note 2 is that performing the Surveillance would remove a required offsite circuit from service, perturb the electrical distribution system, and challenge safety systems. This restriction from normally performing the Surveillance in MODE 1, 2, 3, or 4 is further amplified to allow portions of the Surveillance to be performed for the purpose of reestablishing OPERABILITY (e.g., post work testing following corrective maintenance, corrective modification, deficient or incomplete surveillance testing, and other unanticipated OPERABILITY concerns) provided an assessment determines plant safety is maintained or enhanced. This assessment shall, as a minimum, consider the potential outcomes and transients associated with a failed partial Surveillance, a successful partial Surveillance, and a perturbation of the offsite or onsite system when they are tied together or operated independently for the partial Surveillance; as well as the operator procedures available to cope with these outcomes. These shall be measured against the avoided risk of a plant shutdown and startup to determine that plant safety is maintained or enhanced when portions of the Surveillance are performed in MODE 1 or 2. Risk insights or deterministic methods may be used for the assessment. Credit may be taken for unplanned events that satisfy this SR.

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SR 3.8.1.12

This Surveillance demonstrates that the EDG automatically starts and achieves the required voltage and frequency within the specified time (15 seconds) from an actual or simulated Safety Injection System actuation signal and operates for ≥ 5 minutes. The 5 minute period provides sufficient time to demonstrate stability. SR 3.8.1.12.d and SR 3.8.1.12.e ensure that permanently connected loads and emergency loads are~~remain~~ energized from the offsite electrical power system on a SIS actuation without loss of offsite power.

313, 16-22

BASES

SURVEILLANCE REQUIREMENTS (continued)

313, 16-22

The requirement to verify the connection of permanent and autoconnected loads is intended to satisfactorily show the relationship of these loads to the EDG loading logic. In certain circumstances, many of these loads cannot actually be connected or loaded without undue hardship or potential for undesired operation. For instance, RHR systems performing a decay heat removal function are not desired to be realigned to the ECCS mode of operation. In lieu of actual demonstration of connection and loading of loads, testing that adequately shows the capability of the EDG system to perform these functions is acceptable. This testing may include any series of sequential, overlapping, or total steps so that the entire connection and loading sequence is verified.

The Frequency of 24 months is intended to be consistent with the expected fuel cycle lengths. Operating experience has shown that these components usually pass the SR when performed at the 24 month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

313, 16-22

This SR is modified by two Notes~~a Note~~. The reason for ~~the~~ Note 1 is to minimize wear and tear on the EDGs during testing. For the purpose of this testing, the EDGs must be started from standby conditions, that is, with the engine coolant and oil continuously circulated and temperature maintained consistent with manufacturer recommendations.

The reason for Note 2 is that during operation with the reactor critical, performance of this Surveillance could cause perturbations to the electrical distribution systems that could challenge continued steady state operation and, as a result, plant safety systems. This restriction from normally performing the Surveillance in MODE 1 or 2 is further amplified to allow portions of the Surveillance to be performed for the purpose of reestablishing OPERABILITY (e.g., post work testing following corrective maintenance, corrective modification, deficient or incomplete surveillance testing, and other unanticipated OPERABILITY concerns) provided an assessment determines plant safety is maintained or enhanced. This assessment shall, as a minimum, consider the potential outcomes and transients associated with a failed partial Surveillance, a successful partial Surveillance, and a perturbation of the offsite or onsite system when they are tied together or operated independently for the partial Surveillance; as well as the operator procedures available to cope with these outcomes. These shall be measured against the avoided risk of a plant shutdown and startup to determine that plant safety is maintained or enhanced when portions of the Surveillance are performed in MODE 1 or 2. Risk insights or deterministic methods may be used for the assessment. Credit may be taken for unplanned events that satisfy this SR.

DRAFT

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.1.13

313, 16-23(a)

This Surveillance demonstrates that EDG noncritical protective functions are bypassed on an actual or simulated Loss of Offsite Power signal on the emergency bus~~, or~~ concurrent with an actual or simulated SIS actuation signal. Noncritical automatic trips are all automatic trips except:

a. Engine overspeed;

b. Generator differential current;

c. Low lube oil pressure;

d. High jacket water temperature; and

e. Low Essential Service Water pressure.

The noncritical trips are bypassed during postulated accidents and provide an alarm on an abnormal engine condition. This alarm provides the operator with sufficient time to react appropriately. The EDG availability to mitigate the postulated accident is more critical than protecting the engine against minor problems that are not immediately detrimental to emergency operation of the EDG.

The 24 month Frequency is consistent with the recommendations of Regulatory Guide 1.9 (Ref. 3), Table 1, and is intended to be consistent with expected fuel cycle lengths. Operating experience has shown that these components usually pass the SR when performed at the 24 month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

DRAFT

BASES

SURVEILLANCE REQUIREMENTS (continued)

313, 16-23(a)

The SR is modified by a Note. The reason for the Note is that performing the Surveillance would remove a required EDG from service. This restriction from normally performing the Surveillance in MODE 1 or 2 is further amplified to allow the Surveillance to be performed for the purpose of reestablishing OPERABILITY (e.g., post work testing following corrective maintenance, corrective modification, deficient or incomplete surveillance testing, and other unanticipated OPERABILITY concerns) provided an assessment determines plant safety is maintained or enhanced. This assessment shall, as a minimum, consider the potential outcomes and transients associated with a failed Surveillance, a successful Surveillance, and a perturbation of the offsite or onsite system when they are tied together or operated independently for the Surveillance; as well as the operator procedures available to cope with these outcomes. These shall be measured against the avoided risk of a plant shutdown and startup to determine that plant safety is maintained or enhanced when the Surveillance is performed in MODE 1 or 2. Risk insights or deterministic methods may be used for this assessment. Credit may be taken for unplanned events that satisfy this SR.

----------REVIEWER'S NOTE----------
The above MODE restrictions may be deleted if it can be demonstrated to the staff, on a plant specific basis, that performing the SR with the reactor in any of the restricted MODES can satisfy the following criteria, as applicable:

a. Performance of the SR will not render any safety system or component inoperable,

b. Performance of the SR will not cause perturbations to any of the electrical distribution systems that could result in a challenge to steady state operation or to plant safety systems, and

c. Performance of the SR, or failure of the SR, will not cause, or result in, an AOO with attendant challenge to plant safety systems.

SR 3.8.1.14

Regulatory Guide 1.9 (Ref. 3) requires demonstration once per fuel cycle that the EDGs can start and run continuously at full load capability for an interval of not less than 24 hours, ≥ 2 hours of which is at a load equivalent to 105% - 110% of the continuous duty rating and the remainder of the time at a load equivalent to the continuous duty rating of the EDG. The EDG starts for this Surveillance can be performed either from standby or hot conditions. The provisions for prelubricating and warmup, discussed in SR 3.8.1.2, and for gradual loading, discussed in SR 3.8.1.3, are applicable to this SR.

DRAFT

BASES

LCO (continued)

Each offsite circuit is capable of supplying power to all four divisions. However, normal plant lineup is such that each offsite circuit powers two divisions. Offsite circuit #1 is powered from the switchyard through Emergency Auxiliary Transformer 30BDT01 and feeds Division 1 bus 31BDA and Division 3 bus 33BDA via normal feeder breakers. The circuit can also be aligned to feed Division 2 bus 32BDA and Division 4 bus 34BDA via normally open feeder breakers. Offsite circuit #2 is powered from the switchyard through Emergency Auxiliary Transformer 30BDT02 and feeds Division 2 bus 32BDA and Division 4 bus 34BDA via normal feeder breakers. The circuit can also be aligned to feed Division 1 bus 31BDA and Division 3 bus 33BDA via normally open feeder breakers.

Each EDG must be capable of starting, accelerating to rated speed and voltage, and connecting to its respective ESF bus on detection of bus undervoltage. This sequence must be accomplished within 15 seconds. The EDG must be capable of accepting required loads within the assumed loading sequence intervals, and continue to operate until offsite power can be restored to the ESF buses. These capabilities are required to be met from a variety of initial conditions such as EDG in standby with the engine hot and EDG in standby at ambient conditions.

Proper sequencing of loads, including tripping of nonessential loads, is a required function for EDG OPERABILITY.

313, 16-49(a)

It is acceptable for divisions to be cross tied during shutdown conditions, allowing a single offsite power circuit to supply all required divisions.

APPLICABILITY

The AC sources required to be OPERABLE in MODES 5 and 6 and during movement of irradiated fuel assemblies provide assurance that:

a. Systems to provide adequate coolant inventory makeup are available for the irradiated fuel assemblies in the core;

b. Systems needed to mitigate a fuel handling accident are available;

c. Systems necessary to mitigate the effects of events that can lead to core damage during shutdown are available; and

d. Instrumentation and control capability is available for monitoring and maintaining the unit in a cold shutdown condition or refueling condition.

The AC power requirements for MODES 1, 2, 3, and 4 are covered in LCO 3.8.1.

DRAFT

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.3 Diesel Fuel Oil, Lube Oil, and Starting Air

BASES

BACKGROUND

Each emergency diesel generator (EDG) is provided with a storage tank having a fuel oil capacity sufficient to operate that diesel for a period of 7 days while the EDG is supplying maximum post loss of coolant accident load demand discussed in FSAR Section 9.5.4.2 (Ref. 1). The maximum load demand is calculated using the assumption that a minimum of any two EDGs are available. This onsite fuel oil capacity is sufficient to operate the EDGs for longer than the time to replenish the onsite supply from outside sources.

Fuel oil is transferred from storage tank to day tank by either of two transfer pumps associated with each storage tank. Redundancy of pumps and piping precludes the failure of one pump, or the rupture of any pipe, valve or tank to result in the loss of more than one EDG.

For proper operation of the standby EDGs, it is necessary to ensure the proper quality of the fuel oil. Regulatory Guide 1.137 (Ref. 2) addresses the recommended fuel oil practices as supplemented by ANSI N195 (Ref. 3). The fuel oil properties governed by these SRs are the water and sediment content, the kinematic viscosity, specific gravity (or API gravity), and impurity level.

313, 16-29(b)

The EDG lubrication system is designed to provide sufficient lubrication to permit proper operation of its associated EDG under all loading conditions. The system is required to circulate the lube oil to the diesel engine working surfaces and to remove excess heat generated by friction during operation. Each engine's lube oil system contains an inventory capable of supporting a minimum of 7 days of operation. The onsite storage in addition to the engine oil sump is sufficient to ensure 7 days of continuous operation. This supply is sufficient to allow the operator to replenish lube oil from outside sources.

Each EDG has an air start system with adequate capacity for five successive start attempts on the EDG without recharging the air start receiver(s).

DRAFT

BASES

ACTIONS (continued)

F.1

With a Required Action and associated Completion Time not met, or one or more EDG's fuel oil, lube oil, or starting air subsystem not within limits for reasons other than addressed by Conditions A through E, the associated EDG may be incapable of performing its intended function and must be immediately declared inoperable.

SURVEILLANCE REQUIREMENTS

SR 3.8.3.1

This SR provides verification that there is an adequate inventory of fuel oil in the storage tanks to support each EDG's operation for 7 days at full load. The 7 day period is sufficient time to place the unit in a safe shutdown condition and to bring in replenishment fuel from an onsite or offsite location.

The 31 day Frequency is adequate to ensure that a sufficient supply of fuel oil is available, since low level alarms are provided and unit operators would be aware of any large uses of fuel oil during this period.

SR 3.8.3.2

313, 16-29(b)

This Surveillance ensures that sufficient lube oil inventory is available in the auxiliary ~~makeup tank~~ lube oil system to support at least 7 days of full load operation for each EDG. The 750 gallon requirement is based on the EDG manufacturer consumption values for the run time of the EDG. Implicit in this SR is the requirement to verify the capability to transfer the lube oil from its storage location to the EDG, when the EDG lube oil sump does not hold adequate inventory for 7 days of full load operation without the level reaching the manufacturer recommended minimum level.

A 31 day Frequency is adequate to ensure that a sufficient lube oil supply is onsite, since EDG starts and run time are closely monitored by the unit staff.

SR 3.8.3.3

The tests listed below are a means of determining whether new fuel oil is of the appropriate grade and has not been contaminated with substances that would have an immediate, detrimental impact on diesel engine

DRAFT

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.6 Battery Parameters

BASES

BACKGROUND

This LCO delineates the limits on battery float current as well as electrolyte temperature, level, and float voltage for the DC batteries. A discussion of these batteries and their OPERABILITY requirements is provided in the Bases for LCO 3.8.4, "DC Sources – Operating" and LCO 3.8.5, "DC Sources - Shutdown." In addition to the limitations of this Specification, the licensee controlled program also implements a program specified in Specification 5.5.16 for monitoring various battery parameters that is based on the recommendations of IEEE Standard 450-2002, "IEEE Recommended Practice For Maintenance, Testing, And Replacement Of Vented Lead-Acid Batteries For Stationary Applications" (Ref. 1).

The battery cells are of flooded lead acid construction with a nominal specific gravity of 1.215. This specific gravity corresponds to an open circuit battery voltage of approximately 250 V for 120 cell battery (i.e., cell voltage of 2.065 volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged with its open circuit voltage ≥ 2.065 Vpc, the battery cell will maintain its capacity for 30 days without further charging per manufacturer's instructions. Optimal long term performance however, is obtained by maintaining a float voltage 2.20 to 2.25 Vpc. This provides adequate over-potential which limits the formation of lead sulfate and self discharge. The nominal float voltage of 2.22 Vpc corresponds to a total float voltage output of 266.4 V for a 120 cell battery as discussed in FSAR Chapter 8 (Ref. 2).

APPLICABLE SAFETY ANALYSES

The initial conditions of postulated accidents and anticipated operational occurrences in FSAR Chapter 6 (Ref. 3) and FSAR Chapter 15 (Ref. 4), assume the Protection System (PS) and ~~systems that perform~~ Engineered Safety Features systems~~functions~~ are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the EDGs, emergency auxiliaries, Instrumentation and Control, and control and switching during all MODES of operation.

313, 16-36

The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This includes maintaining at least two divisions of DC sources OPERABLE during accident conditions, in the event of:

a. An assumed loss of all offsite AC power or all onsite AC power; and

b. A worst-case single failure.

Battery parameters satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

DRAFT

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.7 Inverters - Operating

BASES

BACKGROUND

The inverters are the preferred source of power for the AC vital buses because of the stability and reliability they achieve. The function of the inverter is to provide AC electrical power to the vital buses. The Uninterruptible Power Supply (UPS) loads can be powered from an AC source or from the station battery. The station battery provides an uninterruptible power source for the Instrumentation and Control (I&C) system power, which includes the Protection System (PS) and Emergency Diesel Generator (EDG) starting logic. Specific details on inverters and their operating characteristics are found in FSAR Chapter 8 (Ref. 1).

APPLICABLE SAFETY ANALYSES

The initial conditions for postulated accidents and anticipated operational occurrences in FSAR Chapter 6 (Ref. 2) and FSAR Chapter 15 (Ref. 3), assume the PS and ~~systems that perform~~ Engineered Safety Features systems~~functions~~ are OPERABLE. The inverters are designed to provide the required capacity, capability, redundancy, and reliability to ensure the availability of normal and emergency power for 480 VAC loads requiring uninterruptible power and the AC/DC converters that provide power to the I&C system, which includes the PS, during all MODES of operation. This ensures that the fuel, Reactor Coolant System, and containment design limits are not exceeded. These limits are discussed in more detail in the Bases for Section 3.2, Power Distribution Limits; Section 3.4, Reactor Coolant System (RCS); and Section 3.6, Containment Systems.

313, 16-39

The OPERABILITY of the inverters is consistent with the initial assumptions of the accident analyses and is based on meeting the design basis of the unit. This includes maintaining required AC vital buses OPERABLE during accident conditions in the event of:

a. An assumed loss of all offsite AC electrical power or all onsite AC electrical power; and

b. A worst case single failure.

Inverters are a part of the distribution system and, as such, satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

DRAFT

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.8 Inverters - Shutdown

BASES

BACKGROUND

A description of the inverters is provided in the Bases for LCO 3.8.7, "Inverters - Operating."

APPLICABLE SAFETY ANALYSES

313, 16-42

The initial conditions of postulated accidents and anticipated operational occurrences in FSAR Chapter 6 (Ref. 1) and FSAR Chapter 15 (Ref. 2), assume the Protection System (PS) and ~~systems that perform~~ Engineered Safety Features systems~~functions~~ are OPERABLE. The DC to AC inverters are designed to provide the required capacity, capability, redundancy, and reliability to ensure the availability of required power to the Instrumentation and Control (I&C) system, which includes the PS and Emergency Diesel Generator starting logic so that the fuel, Reactor Coolant System, and containment design limits are not exceeded.

The OPERABILITY of the inverters is consistent with the initial assumptions of the accident analyses and the requirements for the supported systems' OPERABILITY.

The OPERABILITY of the inverter to each AC vital bus during MODES 5 and 6 ensures that:

a. The unit can be maintained in the shutdown or refueling condition for extended periods;

b. Sufficient instrumentation and control capability is available for monitoring and maintaining the unit status; and

c. Adequate power is available to mitigate events postulated during shutdown, such as a fuel handling accident.

In general, when the unit is shut down, the Technical Specifications requirements ensure that the unit has the capability to mitigate the consequences of postulated accidents. However, assuming a single failure and concurrent loss of all offsite or all onsite power is not required. The rationale for this is based on the fact that many postulated accidents that are analyzed in MODES 1, 2, 3, and 4 have no specific analyses in MODES 5 and 6 because the energy contained within the reactor pressure boundary, reactor coolant temperature and pressure, and the corresponding stresses result in the probabilities of occurrence being significantly reduced or eliminated, and in minimal consequences. These deviations from analysis assumptions and design requirements during shutdown conditions are allowed by the LCO for required systems.

DRAFT

BASES

APPLICABLE SAFETY ANALYSES (continued)

The shutdown Technical Specification requirements are designed to ensure that the unit has the capability to mitigate the consequences of certain postulated accidents. Worst case postulated accidents which are analyzed for operating MODES are generally viewed not to be a significant concern during shutdown MODES due to the lower energies involved. The Technical Specifications therefore require a lesser complement of electrical equipment to be available during shutdown than is required during operating MODES. More recent work completed on the potential risks associated with shutdown, however, has found significant risk associated with certain shutdown evolutions. As a result, in addition to the requirements established in the Technical Specifications, the industry has adopted NUMARC 91-06, "Guidelines for Industry Actions to Assess Shutdown Management," as an Industry initiative to manage shutdown tasks and associated electrical support to maintain risk at an acceptable low level. This may require the availability of additional equipment beyond that required by the shutdown Technical Specifications.

The inverters were previously identified as part of the distribution system and, as such, satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

313, 16-40(a)

LCO

The inverters ensure~~s~~ the availability of electrical power for the instrumentation for systems required to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence or a postulated accident. The battery powered inverters provide uninterruptible supply of AC electrical power to the AC vital buses even if the 6.9 kV safety buses are de-energized. OPERABILITY of the inverters require~~s~~ that the AC vital bus be powered by the inverter. This ensures the availability of sufficient inverter power sources to operate the unit in a safe manner and to mitigate the consequences of postulated events during shutdown (e.g., fuel handling accidents).

APPLICABILITY

The inverters required to be OPERABLE in MODES 5 and 6 and during movement of irradiated fuel assemblies provide assurance that:

a. Systems to provide adequate coolant inventory makeup are available for the irradiated fuel in the core;

b. Systems needed to mitigate a fuel handling accident are available;

c. Systems necessary to mitigate the effects of events that can lead to core damage during shutdown are available; and

DRAFT

BASES

APPLICABLE SAFETY ANALYSES

The initial conditions of postulated accidents and anticipated operational occurrences in FSAR Chapter 6 (Ref. 1) and FSAR Chapter 15 (Ref. 2), assume the Protection System (PS) and ~~systems that perform~~ Engineered Safety Features systems~~functions~~ are OPERABLE. The AC, DC, and AC vital bus electrical power distribution systems are designed to provide sufficient capacity, capability, redundancy, and reliability to ensure the availability of necessary power to ESF systems so that the fuel, Reactor Coolant System, and containment design limits are not exceeded. These limits are discussed in more detail in the Bases for Section 3.2, Power Distribution Limits; Section 3.4, Reactor Coolant System (RCS); and Section 3.6, Containment Systems.

313, 16-43

The OPERABILITY of the AC, DC, and AC vital bus electrical power distribution systems is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This includes maintaining power distribution systems OPERABLE during accident conditions in the event of:

a. An assumed loss of all offsite power or all onsite AC electrical power; and

b. A worst case single failure.

The distribution systems satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

The required power distribution subsystems listed in Table 3.8.9-1 ensure the availability of AC, DC, and AC vital bus electrical power for the systems required to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated accident. The designated AC, DC, and AC vital electrical power distribution subsystems are required to be OPERABLE.

Maintaining the Divisions 1, 2, 3, and 4 AC, DC, and AC vital bus electrical power distribution subsystems OPERABLE ensures that the redundancy incorporated into the design of ESF is not defeated. Therefore, a single failure within any system or within the electrical power distribution subsystems will not prevent safe shutdown of the reactor.

OPERABLE AC electrical power distribution subsystems require the associated buses, load centers, motor control centers, and distribution panels to be energized to their proper voltages. OPERABLE DC electrical power distribution subsystems require the associated buses and distribution panels to be energized to their proper voltage from the associated battery or charger. OPERABLE vital bus electrical power distribution subsystems require the associated buses to be energized to their proper voltage from the associated inverter via inverted DC voltage, inverter using an AC source, or Class 1E voltage regulated bus.

DRAFT

BASES

LCO (continued)

In addition, tie breakers between redundant safety related AC, DC, and AC vital bus power distribution subsystems, if they exist, must be open unless they are being utilized to align the alternate feed.

Each division can be aligned to power a subset of loads ("alternate fed loads") in the other division in its divisional pair by means of an "alternate feed." An alternate feed provides a standby source of power to required safety systems, safety support systems, or components that do not have the required redundant trains to support maintenance. An OPERABLE EDG supporting the alternate feed loads and the remaining OPERABLE EDG(s) can power the minimum required ESF functions and achieve completion of required safety function following an AOO or postulated accident~~, regardless of which two EDGs are inoperable~~. The alternate feed is interlocked to prevent sources from two divisions supplying a bus at the same time. In addition, interlocks prevent inadvertently paralleling two EDGs together. Open tie breakers prevent any electrical malfunction in any power distribution subsystem from propagating to the redundant subsystem, that could cause the failure of a redundant subsystem and a loss of essential safety function(s). With a tie breaker closed to implement alternate feed, a fault within the alternate fed divisional pair may affect two redundant subsystems within the divisional pair.~~ During alternate feed, this is acceptable since the other divisional pair power distribution subsystems are available to support redundant subsystems.~~ The inter-divisional alternate feeds have a protection and coordination scheme to provide protection so that a fault on one division does not degrade the other division below an acceptable level. The alternate feed circuit protection scheme uses circuit breakers so that a malfunction of the components performing the alternate feed function or a malfunction of the components being alternately fed does not result in unacceptable influences in the division that supplies the power. This applies to the onsite, safety related redundant electrical power distribution subsystems. It does not, however, preclude redundant Class 1E 6.9 kV buses from being powered from the same offsite circuit.

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APPLICABILITY

The electrical power distribution subsystems are required to be OPERABLE in MODES 1, 2, 3, and 4 to ensure that:

a. Acceptable fuel design limits and reactor coolant pressure boundary limits are not exceeded as a result of AOOs or abnormal transients; and

b. Adequate core cooling is provided, and containment OPERABILITY and other vital functions are maintained in the event of a postulated accident.

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.10 Distribution Systems - Shutdown

BASES

BACKGROUND

A description of the AC, DC, and vital AC electrical power distribution systems is provided in the Bases for LCO 3.8.9, "Distribution Systems - Operating."

APPLICABLE SAFETY ANALYSES

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The initial conditions of postulated accidents and anticipated operational occurrences in FSAR Chapter 6 (Ref. 1) and FSAR Chapter 15 (Ref. 2), assume the Protection System (PS) and ~~systems that perform~~ Engineered Safety Features systems~~functions~~ are OPERABLE. The AC, DC, and AC vital electrical power distribution systems are designed to provide sufficient capacity, capability, redundancy, and reliability to ensure the availability of necessary power to ESF systems so that the fuel, Reactor Coolant System, and containment design limits are not exceeded.

The OPERABILITY of the AC, DC, and AC vital electrical power distribution system is consistent with the initial assumptions of the accident analyses and the requirements for the supported systems' OPERABILITY.

The OPERABILITY of the minimum AC, DC, and AC vital electrical power distribution subsystems during MODES 5 and 6, and during movement of irradiated fuel assemblies ensures that:

a. The unit can be maintained in the shutdown or refueling condition for extended periods;

b. Sufficient instrumentation and control capability is available for monitoring and maintaining the unit status; and

c. Adequate power is provided to mitigate events postulated during shutdown, such as a fuel handling accident.

The AC, DC, and AC vital electrical power distribution systems satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

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