ArevaEPRDCPEm Resource

From: WELLS Russell D (AREVA NP INC) [Russell.Wells@areva.com]
Sent: Tuesday, June 30, 2009 7:52 PM
To: Tesfaye, Getachew; Miernicki, Michael
Cc: Pederson Ronda M (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 103, FSAR Ch 16, Supplement 2
Attachments: RAI 103 Supplement 2 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 34 of the 82 questions of RAI No. 103 on November 26, 2008. On March 19, 2009, AREVA NP provided responses to 11 of the 48 remaining questions. The attached file, "RAI 103 Supplement 2 Response US EPR DC.pdf" provides technically correct and complete responses to the remaining 37 questions, as committed.

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 103 Questions 16-138, 16-158, 16-179, and 16-186.

The following table indicates the respective pages in the response document, "RAI 103 Supplement 2 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 103 — 16-138	2	8
RAI 103 — 16-144	9	10
RAI 103 — 16-145	11	13
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RAI 103 — 16-150	19	21
RAI 103 — 16-151	22	22
RAI 103 — 16-153	23	24
RAI 103 — 16-154	25	25
RAI 103 — 16-155	26	26
RAI 103 — 16-156	27	27
RAI 103 — 16-158	28	28
RAI 103 — 16-159	29	29
RAI 103 — 16-160	30	30
RAI 103 — 16-162	31	32
RAI 103 — 16-163	33	33
RAI 103 — 16-164	34	34
RAI 103 — 16-165	35	35
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RAI 103 — 16-178	43	44
RAI 103 — 16-179	45	45
RAI 103 — 16-180	46	47
RAI 103 — 16-181	48	49
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RAI 103 — 16-186	53	53
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RAI 103 — 16-190	57	60
RAI 103 — 16-191	61	63

This concludes the formal AREVA NP response to RAI 103, and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

(Russ Wells on behalf of)

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From: Pederson Ronda M (AREVA NP INC)
Sent: Thursday, March 19, 2009 12:07 PM
To: 'Getachew Tesfaye'
Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); PORTER Thomas (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 103, Supplement 1

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 34 of the 82 questions of RAI No. 103 on November 26, 2008. The attached file, "RAI 103 Supplement 1 Response US EPR DC.pdf" provides technically correct and complete responses to 11 of the remaining 48 questions, as committed.

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 103 Questions 16-193, 16-194, and 16-195.

The following table indicates the respective pages in the response document, "RAI 103 Supplement 1 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

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The schedule for technically correct and complete responses to the remaining 37 questions is unchanged and provided below:

Question #	**Response Date**
RAI 103 — 16-138	June 30, 2009
RAI 103 — 16-144	June 30, 2009
RAI 103 — 16-145	June 30, 2009
RAI 103 — 16-146	June 30, 2009
RAI 103 — 16-147	June 30, 2009
RAI 103 — 16-148	June 30, 2009
RAI 103 — 16-149	June 30, 2009
RAI 103 — 16-150	June 30, 2009
RAI 103 — 16-151	June 30, 2009
RAI 103 — 16-153	June 30, 2009
RAI 103 — 16-154	June 30, 2009
RAI 103 — 16-155	June 30, 2009
RAI 103 — 16-156	June 30, 2009
RAI 103 — 16-158	June 30, 2009
RAI 103 — 16-159	June 30, 2009
RAI 103 — 16-160	June 30, 2009
RAI 103 — 16-162	June 30, 2009
RAI 103 — 16-163	June 30, 2009
RAI 103 — 16-164	June 30, 2009
RAI 103 — 16-165	June 30, 2009
RAI 103 — 16-168	June 30, 2009
RAI 103 — 16-169	June 30, 2009
RAI 103 — 16-172	June 30, 2009
RAI 103 — 16-173	June 30, 2009
RAI 103 — 16-175	June 30, 2009
RAI 103 — 16-176	June 30, 2009
RAI 103 — 16-177	June 30, 2009
RAI 103 — 16-178	June 30, 2009
RAI 103 — 16-179	June 30, 2009
RAI 103 — 16-180	June 30, 2009
RAI 103 — 16-181	June 30, 2009
RAI 103 — 16-182	June 30, 2009
RAI 103 — 16-183	June 30, 2009
RAI 103 — 16-186	June 30, 2009
RAI 103 — 16-189	June 30, 2009
RAI 103 — 16-190	June 30, 2009

Sincerely,

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From: Pederson Ronda M (AREVA NP INC)
Sent: Wednesday, November 26, 2008 1:40 PM
To: 'Getachew Tesfaye'
Cc: PORTER Thomas (EXT); BENNETT Kathy A (OFR) (AREVA NP INC); DUNCAN Leslie E (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 103 (1270), FSAR Ch. 16

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 103 Response US EPR DC.pdf" provides technically correct and complete responses to 34 of the 82 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 103 Questions16-129, 16-130,16-131,16-132,16-133,16-134, 16-135, 16-136, 16-139, 16-140, 16-141, 16-142, 16-143, 16-152, 16-157, 16-161, 16-166, 16-167, 16-170, 16-171, 16-174, 16-187, 16-192, 16-200, 16-202, and 16-207.

The following table indicates the respective page(s) in the response document, "RAI 103 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 103 — 16-128	2	2
RAI 103 — 16-129	3	3
RAI 103 — 16-130	4	4
RAI 103 — 16-131	5	5
RAI 103 — 16-132	6	6
RAI 103 — 16-133	7	7
RAI 103 — 16-134	8	8
RAI 103 — 16-135	9	9
RAI 103 — 16-136	10	10
RAI 103 — 16-137	11	11
RAI 103 — 16-138	12	12
RAI 103 — 16-139	13	13
RAI 103 — 16-140	14	14
RAI 103 — 16-141	15	15

RAI 103 — 16-142	16	16
RAI 103 — 16-143	17	17
RAI 103 — 16-144	18	18
RAI 103 — 16-145	19	19
RAI 103 — 16-146	20	20
RAI 103 — 16-147	21	21
RAI 103 — 16-148	22	22
RAI 103 — 16-149	23	23
RAI 103 — 16-150	24	25
RAI 103 — 16-151	26	26
RAI 103 — 16-152	27	27
RAI 103 — 16-153	28	29
RAI 103 — 16-154	30	30
RAI 103 — 16-155	31	31
RAI 103 — 16-156	32	32
RAI 103 — 16-157	33	33
RAI 103 — 16-158	34	34
RAI 103 — 16-159	35	35
RAI 103 — 16-160	36	36
RAI 103 — 16-161	37	37
RAI 103 — 16-162	38	39
RAI 103 — 16-163	40	40
RAI 103 — 16-164	41	41
RAI 103 — 16-165	42	42
RAI 103 — 16-166	43	43
RAI 103 — 16-167	44	44
RAI 103 — 16-168	45	45
RAI 103 — 16-169	46	46
RAI 103 — 16-170	47	47
RAI 103 — 16-171	48	48
RAI 103 — 16-172	49	49
RAI 103 — 16-173	50	50
RAI 103 — 16-174	51	51
RAI 103 — 16-175	52	52
RAI 103 — 16-176	53	53
RAI 103 — 16-177	54	54
RAI 103 — 16-178	55	55
RAI 103 — 16-179	56	56
RAI 103 — 16-180	57	57
RAI 103 — 16-181	58	58
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RAI 103 — 16-183	60	60
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RAI 103 — 16-185	63	63
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RAI 103 — 16-200	83	83
RAI 103 — 16-201	84	84
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RAI 103 — 16-205	88	88
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RAI 103 — 16-208	92	92
RAI 103 — 16-209	93	93

A complete answer is not provided for 48 of the 82 questions. The schedule for a technically correct and complete response to this question is provided below.

Question #	Response Date
RAI 103 — 16-137	June 30, 2009
RAI 103 — 16-138	June 30, 2009
RAI 103 — 16-144	June 30, 2009
RAI 103 — 16-145	June 30, 2009
RAI 103 — 16-146	June 30, 2009
RAI 103 — 16-147	June 30, 2009
RAI 103 — 16-148	June 30, 2009
RAI 103 — 16-149	June 30, 2009
RAI 103 — 16-150	June 30, 2009
RAI 103 — 16-151	June 30, 2009
RAI 103 — 16-153	June 30, 2009
RAI 103 — 16-154	June 30, 2009
RAI 103 — 16-155	June 30, 2009
RAI 103 — 16-156	June 30, 2009
RAI 103 — 16-158	June 30, 2009
RAI 103 — 16-159	June 30, 2009
RAI 103 — 16-160	June 30, 2009
RAI 103 — 16-162	June 30, 2009
RAI 103 — 16-163	June 30, 2009
RAI 103 — 16-164	June 30, 2009
RAI 103 — 16-165	June 30, 2009
RAI 103 — 16-168	June 30, 2009

RAI 103 — 16-169	June 30, 2009
RAI 103 — 16-172	June 30, 2009
RAI 103 — 16-173	June 30, 2009
RAI 103 — 16-175	June 30, 2009
RAI 103 — 16-176	June 30, 2009
RAI 103 — 16-177	June 30, 2009
RAI 103 — 16-178	June 30, 2009
RAI 103 — 16-179	June 30, 2009
RAI 103 — 16-180	June 30, 2009
RAI 103 — 16-181	June 30, 2009
RAI 103 — 16-182	June 30, 2009
RAI 103 — 16-183	June 30, 2009
RAI 103 — 16-185	March 19, 2009
RAI 103 — 16-186	June 30, 2009
RAI 103 — 16-189	June 30, 2009
RAI 103 — 16-190	June 30, 2009
RAI 103 — 16-191	June 30, 2009
RAI 103 — 16-193	March 19, 2009
RAI 103 — 16-194	March 19, 2009
RAI 103 — 16-195	March 19, 2009
RAI 103 — 16-196	March 31, 2009
RAI 103 — 16-198	June 30, 2009
RAI 103 — 16-203	March 31, 2009
RAI 103 — 16-204	March 31, 2009
RAI 103 — 16-205	March 31, 2009
RAI 103 — 16-206	March 31, 2009

Sincerely,

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From: Getachew Tesfaye [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Tuesday, October 28, 2008 2:00 PM
To: ZZ-DL-A-USEPR-DL
Cc: Joseph DeMarshall; Michael Marshall; Peter Hearn; Joseph Colaccino; John Rycyna
Subject: U.S. EPR Design Certification Application RAI No. 103 (1270), FSARCh. 16

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on October 20, 2008, and on October 28, 2008, you informed us that the RAI is clear and no further clarification is needed. As a result, no change is made to the draft RAI. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

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

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 616

Mail Envelope Properties (1F1CC1BBDC66B842A46CAC03D6B1CD4101A59D1D)

Subject: Response to U.S. EPR Design Certification Application RAI No. 103, FSAR Ch 16, Supplement 2
Sent Date: 6/30/2009 7:51:54 PM
Received Date: 6/30/2009 7:52:02 PM
From: WELLS Russell D (AREVA NP INC)

Created By: Russell.Wells@areva.com

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Tracking Status: None

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Files	**Size**	**Date & Time**
MESSAGE	12963	6/30/2009 7:52:02 PM
RAI 103 Supplement 2 Response US EPR DC.pdf		1050695

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

Response to

Request for Additional Information No. 103, Supplement 2

10/28/2008

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

QUESTIONS for Technical Specification Branch (CTSB)

Question 16-138:

LCO 3.3.1, Protection System

Provide a technical justification for the omission of Permissive Signals from LCO 3.3.1 “Protection System.”

NUREG-1431, “Standard Technical Specifications Westinghouse Plants,” includes “Permissives” and “Interlocks” in the STS, Section 3.3.1, “Reactor Trip System (RTS) Instrumentation,” and Section 3.3.2, “Engineered Safety Features Actuation System (ESFAS) Instrumentation.” The EPR Bases, B 3.3.1, Applicable Safety Analyses, LCO, and Applicability, Section C, “Protection System Permissives,” page B 3.3.1-48, implies that the permissive functions are required to be operable in the same modes that associated Reactor Trip and ESFAS function operability is required on the basis of the statement “the permissive Functions do not need to be OPERABLE when the associated reactor trip or ESF functions are outside the applicable MODES.” In addition, Permissive signals are used to enable, disable, or modify the operation of Reactor Trip and Engineered Safety Features Actuation functions based on plant conditions, which is relative to the information required to be included in TS.

The staff recognizes that the EPR Bases, B 3.3.1, Background Section, Sensors, last paragraph, states that permissive setpoints “are generally considered as nominal values without regard to measurement accuracy and are therefore not considered to be SL-LSSS” (setpoints that directly protect against violating reactor core or RCS pressure boundary safety limits). Although the staff does not want to debate the “degree of directness” to which Permissives affect the reactor core or RCS pressure boundary, we still believe this information is relative and necessary.

On the bases of this information, provide additional technical justification for omitting “Permissive” signals associated with specific Reactor Trip and ESFAS functions or revise Table 3.3.1-1 and Table 3.3.1-2, accordingly.

This technical justification is needed to determine whether or not Permissive signals should be included in the EPR GTS, Section 3.3.1, “Protection System.”

Response to Question 16-138:

The Protection System (PS) Technical Specifications will be revised to include applicable Permissive Signals which meet the criteria in 10 CFR 50.36 "Technical Specifications."

U.S. EPR FSAR Tier 2, Section 7.2 and Section 7.3 provide functional representations of the reactor trip (RT), engineered safety features (ESF) functions, and the Permissives in the form of figures. The use of Permissive signals as part of the initiation of each RT and ESF function is depicted in these figures.

U.S. EPR FSAR Tier 2, Chapter 15 identifies which RT or ESF functions are credited in the safety analysis. Table 16-138-1 provides a summary of which credited RT and ESF functions are either enabled or disabled by each validated Permissive Signal. Permissives that enable a credited function will be included in the Technical Specifications. In addition, as discussed in U.S. EPR FSAR Tier 2 Sections 7.2.1.3.11 and 15.6.5.4, Permissive P16 is implicitly credited because it enables the switchover from cold leg injection to hot leg injection following a loss of coolant accident (LOCA). Permissive P16 will also be included in the Technical Specifications.

Permissives that disable a RT or ESF function are not part of a primary success path of a safety sequence analysis. While their failure may lead to a spurious RT or ESF actuation, their functioning is neither credited to mitigate an accident or anticipated operational occurrence, nor to keep the plant in an analyzed condition. A Failure Mode and Effects Analysis of the Permissive functions has demonstrated that a single failure coupled with a division out for maintenance will not result in any ESF actuation that would exceed the boundaries of the safety analysis. Therefore, Permissives that disable a function when the Permissive is validated are not within the scope of 10 CFR 50.36, Criterion 3, and will not be included in the Technical Specifications.

For each Permissive that is required to be included in the Technical Specifications, Table 16-138-2 shows the operability requirements assumed in the safety analysis for each credited function that each Permissive supports. Enveloping operability requirements are then identified for each Permissive.

Necessary changes will be made to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification 3.3.1 "Protection System (PS)" and U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification Bases 3.3.1 "Protection System (PS)" to address Permissive signals, including their associated sensors and signal processors. Additional changes will also be made to the following U.S. EPR FSAR sections to incorporate design changes associated with this RAI:

- Tier 1, Section 2.4.1, "Protection System."
- Tier 2, Section 7.2, "Reactor Trip System."
- Tier 2, Section 7.3, "Engineered Safety Features Systems."
- Tier 2, Section 15.0, "Transient and Accident Analyses."
- Tier 2, Chapter 16, Technical Specification, Section 3.3.1 "Protection System (PS)."
- Tier 2, Chapter 16, Technical Specification Bases 3.3.1 "Protection System (PS)."

Due to the number of changes, U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification Section 3.3.1 "Protection System (PS)" and Technical Specification Section 3.3.1 Bases, will be replaced in their entirety.

Some of the changes directly affect previous responses:

- RAI 103, Question 16-133 requested clarification of the Required Actions for inoperable actuator logic units (ALUs). The incorporation of Permissives and the inclusion of new ESF functions resulted in new and revised Required Actions. The Required Actions for inoperable ALUs has been re-evaluated and will be revised.
- RAI 103, Question 16-136, requested clarification of the coverage of the High Core Power Level RT function. The wording of the coverage has been revised to be editorially consistent with usage that describes other functions.

- RAI 103, Question 16-140 requested clarification of a Bases statement that referred to RT functions when it should have referenced ESF functions. The wrong paragraph was corrected in the original response. The Bases will be revised to correct this error.
- RAI 103, Question 16-201 requested Technical Specification Bases 3.3.1 "Protection System (PS)" be clarified with regard to how LCO 3.4.9 "Pressurizer" provided adequate compensatory actions when the chemical and volume control system (CVCS) isolation valves are declared inoperable. The Specifications will be revised to require the unit to be brought to MODE 5 and to immediately suspend operations involving positive reactivity additions that could result in the loss of required shutdown margin or boron concentration. Entry into LCO 3.4.9 is no longer required.
- RAI 110, Question 16-218 requested clarification with regards to the Rod Cluster Control Assembly (RCCA) Position Indicator sensors not being listed in Technical Specification Table 3.3.1-1. Because these sensors are now required to support the operability of Permissive P8, the RCCA Position Indicator sensors and the associated RCCA Units will be included in Table 3.3.1-1.

FSAR Impact:

U.S. EPR FSAR Tier 1, Section 2.4.1, "Protection System" and Tier 2, Sections 7.2 and 7.3, Tables 15.0-7 and 15.0-8, and Chapter 16, Technical Specification Section 3.3.1 "Protection System (PS)" and Technical Specification Section 3.3.1 Bases are provided as described in the response and indicated on the enclosed markup.

Table 16-138-1—Summary of Permissive Signals
(2 Sheets)

VALIDATED PERMISSIVE	ENABLED FUNCTIONS	DISABLED FUNCTIONS
P2	RT on Low Departure from Nucleate Boiling Ratio (DNBR) RT on Low DNBR and (Imbalance or Rod Drop (1/4)) RT on Low DNBR and Rod Drop (2/4) RT on Low DNBR - High Quality RT on Low DNBR - High Quality and (Imbalance or Rod Drop (1/4)) RT on High Linear Power Density RT on Low RCS Loop Flow Rate in Two Loops RT on Low Reactor Coolant Pump (RCP) Speed RT on Low Pressurizer Pressure	None
P3	RT on Low-Low RCS Loop Flow Rate in One Loop	None
P5	RT on High Core Power Level RT on Low Saturation Margin	None
P6	None	RT on High Neutron Flux (Intermediate Range) RT on Low Doubling Time (Intermediate Range)
P7	Engineered Safety Feature (ESF) - CVCS Charging Line Isolation on Anti-Dilution Mitigation (ADM) at Shutdown Condition (RCP not operating)	ESF - CVCS Charging Line Isolation on ADM at Standard Shutdown Conditions
P8	ESF - CVCS Charging Line Isolation on ADM at Standard Shutdown Conditions	ESF - CVCS Charging Line Isolation on ADM at Power

Table 16-138-1—Summary of Permissive Signals
(2 Sheets)

VALIDATED PERMISSIVE	ENABLED FUNCTIONS	DISABLED FUNCTIONS
P12	ESF - Safety Injection System (SIS) Actuation on Low Delta Psat	RT on High Pressurizer Level RT on Low Hot Leg Pressure RT on Low Steam Generator (SG) Pressure ESF - Safety Injection System (SIS) Actuation on Low Pressurizer Pressure ESF – Main Steam Relief Train (MSRT) Isolation on Low SG Pressure (Affected SG) ESF – Main Steam Isolation Valve (MSIV) Isolation on Low SG Pressure (All SGs) ESF - Startup and Shutdown Feedwater Isolation on Low SG Pressure (Affected SGs)
P13	None	RT on Low SG Level RT on High SG Level ESF - Emergency Feedwater System (EFWS) Actuation on Low-Low SG Level (Affected SGs) ESF - EFWS Actuation on Loss of Offsite Power (LOOP) and SIS Actuation (All SGs) ESF - Main Feedwater Full Load Isolation on High SG Level (Affected SGs) ESF - Startup and Shutdown Feedwater Isolation on High SG Level for Period of Time (Affected SGs)
P14	ESF - MSRT Actuation on High SG Pressure	ESF - Partial Cooldown Actuation
P15	ESF - SIS Actuation on Low RCS Loop Level	ESF - SIS Actuation on Low Delta Psat
P16	Switchover to Hot Leg Injection following a LOCA	
P17	ESF - PSRV Actuation - First Valve ESF - PSRV Actuation - Second Valve	ESF - CVCS Charging Line Isolation on High-High Pressurizer Level

Table 16-138-2—Permissive Signals Technical Specification Operability Requirements (2 Sheets)

PERMISSIVE	PERMISSIVE VALIDATED - ENABLED FUNCTIONS	MODE REQUIREMENTS
P2	RT on Low Departure from Nucleate Boiling Ratio (DNBR)	MODE 1 > 10% RTP
	RT on Low DNBR and (Imbalance or Rod Drop (1/4))	MODE 1 > 10% RTP
	RT on Low DNBR and Rod Drop (2/4)	MODE 1 > 10% RTP
	RT on Low DNBR - High Quality	MODE 1 > 10% RTP
	RT on Low DNBR - High Quality and (Imbalance or Rod Drop (1/4))	MODE 1 > 10% RTP
	RT on High Linear Power Density	MODE 1 > 10% RTP
	RT on Low RCS Loop Flow Rate in Two Loops	MODE 1 > 10% RTP
	RT on Low Reactor Coolant Pump (RCP) Speed	MODE 1 > 10% RTP
	RT on Low Pressurizer Pressure	MODE 1 > 10% RTP
	Enveloping Permissive Mode Requirements	MODE 1 > 10% RTP
P3	RT on Low-Low RCS Loop Flow Rate in One Loop	MODE 1 > 70% RTP
P5	RT on High Core Power Level	MODES 1 and 2 > 10^{-5} RTP
	RT on Low Saturation Margin	MODES 1 and 2 > 10^{-5} RTP
	Enveloping Permissive Mode Requirements	MODES 1 and 2 > 10^{-5} RTP
P7	ESF - CVCS Charging Line Isolation on Anti-Dilution Mitigation (ADM) at Shutdown Condition (RCP not operating)	MODES 3, 4, 5, and 6 without a RCP in operation
P8	ESF - CVCS Charging Line Isolation on ADM at Standard Shutdown Conditions	MODES 3, 4, and 5 with a RCP in operation
P12	ESF - SIS Actuation on Low Delta Psat	MODE 3 < 2005 psia and MODE 4 P15 inhibited
P14	ESF - MSRT Actuation on High SG Pressure	MODES 1, 2, 3, and MODE 4 when SGs relied upon for heat removal.
P15	ESF - SIS Actuation on Low RCS Loop Level	MODES 4, 5, and 6
P16	Switchover to Hot Leg Injection following a LOCA	MODES 1, 2, 3, and 4

Table 16-138-2—Permissive Signals Technical Specification Operability Requirements (2 Sheets)

PERMISSIVE	PERMISSIVE VALIDATED - ENABLED FUNCTIONS	MODE REQUIREMENTS
P17	ESF - PSRV Actuation - First Valve	Refer to LCO 3.4.11.
	ESF - PSRV Actuation - Second Valve	Refer to LCO 3.4.11.

Question 16-144:

LCO 3.3.1, Protection System

Provide the additional information and any necessary changes regarding the EPR GTS, Table 3.3.1-1, (A.10) mode applicability for Hot Leg Temperature Wide Range (WR) with respect to Reactor Trip functions A.17 (Low SG Level) and A.18 (High SG Level).

The EPR GTS, Table 3.3.1-1, specifies Mode 3(e) for Hot Leg Temperature WR. Hot Leg Temperature WR is used in Permissive P13. The P13 permissive signal (Figure 7.2-32) enables/disables Reactor Trip Functions A.17 (Figure 7.2-21) and A.18 (Figure 7.2-22) as designated in Table 3.3.1-2. Table 3.3.1-2 specifies Modes 1 and 2 for Reactor Trip Functions A.17 and A.18. Determine Hot Leg Temperature WR mode applicability required to support Reactor Trip Functions A.17 and A.18. Identify and correct any potential discrepancies that may exist.

This additional information is needed to ensure the accuracy and completeness of the EPR GTS and Bases, as well as the operability of permissive instrumentation necessary to support Reactor Trip functions in the applicable modes.

Response to Question 16-144:

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

The Hot Leg Temperature (Wide Range (WR)) sensors provide input to multiple functions, including:

- The Safety Injection System (SIS) Actuation on Low Delta Psat function: This function is assumed in the safety analysis to be operable in MODE 3 with Permissive P12 validated (pressurizer pressure less than 2005 psia) and in MODE 4 with Permissive P15 inhibited (hot leg temperature above 350°F, hot leg pressure above 464 psia, and a reactor coolant pump (RCP) running).
- The Main Steam Relief Train (MSRT) Actuation on High Steam Generator (SG) Pressure (Affected SG) function: This function is assumed in the safety analysis to be operable in MODES 1, 2, and 3 and in MODE 4 when the SGs are relied upon for heat removal.
- Permissive P14: As discussed in the Response to Question 16-138, Permissive P14 is required to be operable in MODES 1, 2, 3, and MODE 4 when SGs relied upon for heat removal.
- Permissive P15: As discussed in the Response to Question 16-138, Permissive P15 is required to be operable in MODES 4, 5, and 6.
- Permissive P16: As discussed in the Response to Question 16-138, Permissive P16 is required to be operable in MODES 1, 2, 3, and 4.

Therefore, the Hot Leg Temperature (WR) sensors are required to be operable in MODES 1, 2, 3, 4, 5, and 6.

The corresponding changes to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification section 3.3.1 "Protection System (PS)" and Technical Specification section 3.3.1 Bases are provided in Response to Question 16-138.

FSAR Impact:

See the Response for Question 16-138.

Question 16-145:

LCO 3.3.1, Protection System

Provide the additional information and any necessary changes regarding the EPR GTS, Table 3.3.1-1, Mode applicability for P6 permissive instrumentation, with respect to Reactor Trip Function A.8 (High Neutron Flux - Intermediate Range) and validate the LTSP value.

P6 permissive instrumentation and applicable modes specified in the EPR GTS, Table 3.3.1-1, consist of the following:

Cold Leg Temperature NR	(≥ 10 percent RTP)
Hot Leg Temperature NR	(1, 2(c))
Hot Leg Pressure WR	(1, 2, 3)

P6 permissive (Figure 7.2-28) enables/disables Reactor Trip Function A.8 (Figure 7.2-13) as designated in Table 3.3.1-2. Table 3.3.1-2 specifies Modes 1(g), 2 and 3(e) for Reactor Trip Function A.8. Determine P6 permissive instrumentation mode applicability required to support Reactor Trip Function A.8 and validate function A.8 LTSP value on the basis of both the aforementioned and following list of inconsistencies:

a. Cold Leg Temperature NR mode applicability is ≥ 10 percent RTP in Mode 1. The EPR GTS, Table 3.3.1-2, Reactor Trip Function A.8 mode applicability is ≤ 10 percent RTP in Mode 1 (footnote (g), Table 3.3.1-2.)
b. Hot Leg Temperature NR mode applicability is 1, 2(c). The EPR GTS, Table 3.3.1-2, Reactor Trip Function A.8 Mode applicability is 2. Footnote (c) specifies ≥ 10 to the minus 5 percent power on Intermediate Range Detectors.
c. Reactor Trip Function A.8 LTSP is ≤ 15 percent RTP. The P6 permissive enables Reactor Trip Function A.8 below the low-power setpoint of 10 percent RTP.
d. Reactor Trip Function A.8 LTSP is ≤ 15 percent RTP. The EPR GTS, Table 3.3.1-2, Reactor Trip Function A.8 mode applicability is ≤ 10 percent RTP in Mode 1 (footnote (g) of Table 3.3.1-2.)

This additional information is required to ensure operability of permissive instrumentation necessary to support the associated Reactor Trip Function in the applicable modes and to validate Function A.8 LTSP value.

Response to Question 16-145:

Permissive P6: As discussed in the Response to Question 16-138, Permissive P6 is not within the scope of the Technical Specifications, and the sensors associated with Permissive P6 do not have additional Mode requirements beyond those necessary to support their associated credited functions.

Mode requirements for sensors have been chosen to envelope the required modes of the functions and Permissives they support. With regards to the specific sensors identified in the question:

- The Cold Leg Temperature (Narrow Range (NR)) sensors provide input to:
  - The five Low Departure from Nucleate Boiling Ratio (DNBR) reactor trips: These trips are assumed in the safety analysis to be operable in MODE 1 when the reactor power level is above 10 percent Rated Thermal Power (RTP) (Permissive P2 validated).
  - Permissive P6: As discussed above, this imposes no additional mode constraints.

  Therefore, the Cold Leg Temperature (NR) sensors are required to be operable in MODE 1 when Permissive P2 is validated.

- The Hot Leg Temperature (NR) sensors provide input to multiple functions, including:
  - The High Core Power Level reactor trip: This trip is assumed in the safety analysis to be operable in MODE 1 and in MODE 2 when the reactor power level is above 10^{-5} percent Rated Thermal Power (RTP) (Permissive P5 validated).
  - The Low Saturation Margin reactor trip: This trip is also assumed in the safety analysis to be operable in MODE 1 and in MODE 2 when the reactor power level is above 10^{-5} percent RTP (Permissive P5 validated).
  - Permissive P6: As discussed above, this imposes no additional mode constraints.

  Therefore, the Hot Leg Temperature (NR) sensors are required to be operable in MODE 1 and in MODE 2 when Permissive P5 is validated.

- The Hot Leg Pressure (Wide Range (WR)) sensors provide input to multiple functions, including:
  - The High Core Power Level reactor trip: This trip is assumed in the safety analysis to be operable in MODE 1 and in MODE 2 when the reactor power level is above 10^{-5} percent RTP (Permissive P5 validated).
  - The Low Saturation Margin reactor trip: This trip is also assumed in the safety analysis to be operable in MODE 1 and in MODE 2 when the reactor power level is above 10^{-5} percent RTP (Permissive P5 validated).
  - The Low Hot Leg Pressure reactor trip: This trip is assumed in the safety analysis to be operable in MODES 1 and 2 and in MODE 3 when pressurizer pressure (Permissive P12 inhibited) is greater than 2005 psia and with the reactor control, surveillance, and limitation (RCSL) system capable of withdrawing a rod cluster control assembly (RCCA) or one or more RCCAs not fully inserted.
  - The Safety Injection System Actuation on Low Delta Psat function: This function is assumed in the safety analysis to be operable in MODE 3 with Permissive P12 validated (pressurizer pressure less than 2005 psia) and in MODE 4 with Permissive P15 inhibited (hot leg temperature above 350°F, hot leg pressure above 464 psia, and a reactor coolant pump running).
  - The Pressurizer Safety Relief Valve Actuation function: This function is required to be operable by LCO 3.4.11:
    - ♦ In MODE 4, when any RCS cold leg temperature is less than or equal to the low temperature overpressure protection (LTOP) arming temperature specified in the pressure temperature limitations report (PTLR).

- ♦ In MODE 5.
- ♦ In MODE 6, when the reactor vessel head is on, unless the reactor coolant system is depressurized and a vent of greater than or equal to 10.1 square inches is established.

- Permissive P6: As discussed above, this imposes no additional mode constraints.
- Permissives P14: As discussed in the Response to Question 16-138, Permissive P14 is required to be operable in MODES 1, 2, 3, and MODE 4 when the steam generators are relied upon for heat removal.
- Permissive P15: As discussed in the Response to Question 16-138, Permissive P15 is required to be operable in MODES 4, 5 and 6.
- Permissive P16: As discussed in the Response to Question 16-138, Permissive P16 is required to be operable in MODES 1, 2, 3, and 4.

Therefore, the Hot Leg Pressure (WR) sensors are required to be operable in MODES 1, 2, 3, 4, 5 and 6.

The corresponding changes to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification section 3.3.1 "Protection System (PS)" and Technical Specification section 3.3.1 Bases are provided in Response to Question 16-138.

FSAR Impact:

See the Response for Question 16-138.

Question 16-146:

LCO 3.3.1, Protection System

Provide the additional information and any necessary changes regarding EPR GTS, Table 3.3.1-1, mode applicability for P6 permissive instrumentation, with respect to Reactor Trip Function A.9 (Low Doubling Time - Intermediate Range (IR).)

P6 permissive instrumentation and applicable Modes specified in the EPR GTS, Table 3.3.1-1, consist of the following:

Cold Leg Temperature NR	($\geq$ 10 percent RTP)
Hot Leg Temperature NR	(1, 2(c))
Hot Leg Pressure WR	(1, 2, 3)

P6 permissive (Figure 7.2-28) enables/disables Reactor Trip Function A.9 (Figure 7.2-14) as designated in Table 3.3.1-2. Table 3.3.1-2 specifies Modes 1(g), 2 and 3(e) for Reactor Trip Function A.9. Determine P6 permissive instrumentation mode applicability required to support Reactor Trip Function A.9 on the basis of both the aforementioned and following list of inconsistencies:

> Cold Leg Temperature NR mode applicability is $\geq$ 10 percent RTP in Mode 1. The EPR GTS, Table 3.3.1-2, Reactor Trip Function A.9 mode applicability is $\leq$ 10 percent RTP in Mode 1 (footnote (g), Table 3.3.1-2.)
>
> Hot Leg Temperature NR mode applicability is 1, 2(c). The EPR GTS, Table 3.3.1-2, Reactor Trip Function A.9 Mode applicability is 2. Footnote (c) specifies $\geq$ 10 to the minus 5 percent power on Intermediate Range Detectors.

This additional information is required to ensure operability of permissive instrumentation necessary to support the associated Reactor Trip Function in the applicable modes.

Response to Question 16-146:

See the Response to Question 16-145.

Question 16-147:

LCO 3.3.1, Protection System

Provide the additional information and any necessary changes regarding the EPR GTS, Table 3.3.1-1, mode applicability for A.14 (Pressurizer Pressure Narrow Range (NR)) with respect to Reactor Trip Function A.13 (Low Hot Leg Pressure.)

The EPR GTS, Table 3.3.1-1 specifies Modes 1, 2, and 3(h) for Pressurizer Pressure NR (A.14). Pressurizer Pressure NR is used in Permissive P12. The P12 permissive signal (Figure 7.2-31) enables/disables Reactor Trip Function A.13 (Figure 7.2-17) as designated in Table 3.3.1-2. Table 3.3.1-2 specifies Modes 1, 2, 3(e) and 3(h) for Reactor Trip Function A.13. Determine Pressurizer Pressure NR mode applicability required to support Reactor Trip Function A.13. Determination to include an evaluation of mode applicability both above and below 2500 psia in Mode 3. Identify and correct any potential discrepancies that may exist.

This additional information is required to ensure operability of permissive instrumentation necessary to support the associated Reactor Trip Function in the applicable modes.

Response to Question 16-147:

As discussed in the Response to Question 16-138, Permissive P12 is required to be operable in MODE 3 with the pressurizer pressure less than 2005 psia and in MODE 4 with Permissive P15 inhibited (hot leg temperature above 350°F, hot leg pressure above 464 psia, and a reactor coolant pump (RCP) running).

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

The Pressurizer Pressure (NR) sensors provide input to multiple functions, including:

- The five Low Departure from Nucleate Boiling Ratio (DNBR) reactor trips: These trips are assumed in the safety analysis to be operable in MODE 1 when the reactor power level is above 10 percent Rated Thermal Power (RTP) (Permissive P2 validated). In response to an issue raised in Question 16-150, the instrument range of 1615 - 2515 psia is adequate to support these trips.
- The Low Pressurizer Pressure reactor trip: This trip is also assumed in the safety analysis to be operable in MODE 1 when the reactor power level is above 10 percent RTP (Permissive P2 validated). In response to an issue raised in Question 16-150, the instrument range of 1615 - 2515 psia is adequate to support this trip since the setpoint is 2005 psia.
- The High Pressurizer Pressure reactor trip: This trip is assumed in the safety analysis to be operable in MODES 1 and 2. In response to an issue raised in Question 16-150, the instrument range of 1615 - 2515 psia is adequate to support this trip since the setpoint is 2415 psia.
- The Safety Injection System (SIS) Actuation on Low Pressurizer Pressure function: This function is assumed in the safety analysis to be operable in MODES 1 and 2 and in MODE 3 with Permissive P12 inhibited (pressurizer pressure greater than 2005 psia). In response to

an issue raised in Question 16-150, the instrument range of 1615 - 2515 psia is adequate to support this function since the setpoint is 1668 psia.

- Permissive P12. As discussed in the Response to Question 16-138, Permissive P12 is assumed to be operable in MODE 3 with pressurizer pressure less than 2005 psia and in MODE 4 with Permissive P15 inhibited (hot leg temperature above 350°F, hot leg pressure above 464 psia, and an RCP running). In response to an issue raised in Question 16-150, the instrument range of 1615 - 2515 psia is adequate to support this function since the setpoint is 2005 psia. Design features exist that allow the input signals to the permissive to remain at the lowest range of the instrument after the instrument drops off scale. This is acceptable for this application since the actual pressurizer pressure is not necessary for the proper functioning of the permissive. Rather, the validation of Permissive P12 is only dependent on the pressurizer pressure being above or below its setpoint.

Therefore, the Pressurizer Pressure (NR) sensors are required to be operable in MODES 1, 2 and 3 and in MODE 4 with Permissive P15 inhibited and the range of the sensor is adequate to support its associated functions.

The corresponding changes to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification section 3.3.1 "Protection System (PS)" and Technical Specification section 3.3.1 Bases are provided in Response to Question 16-138.

FSAR Impact:

See the Response for Question 16-138.

Question 16-148:

LCO 3.3.1, Protection System

Provide the additional information and any necessary changes regarding the EPR GTS, Table 3.3.1-1, mode applicability for A.14 (Pressurizer Pressure Narrow Range (NR)) with respect to Reactor Trip Function A.15 (Low SG Pressure.)

The EPR GTS, Table 3.3.1-1 specifies Modes 1, 2, and 3(h) or Pressurizer Pressure NR (A.14). Pressurizer Pressure NR is used in Permissive P12. The P12 permissive signal (Figure 7.2-31) enables/disables Reactor Trip Function A.15 (Figure 7.2-19) as designated in Table 3.3.1-2. Table 3.3.1-2 specifies Modes 1, 2, 3(e) and 3(h) for Reactor Trip Function A.15. Determine Pressurizer Pressure NR mode applicability required to support Reactor Trip Function A.15. Determination to include an evaluation of mode applicability both above and below 2500 psia in Mode 3. Identify and correct any potential discrepancies that may exist.

This additional information is required to ensure operability of permissive instrumentation necessary to support the associated Reactor Trip Function in the applicable modes.

Response to Question 16-148:

See the Response to Question 16-147.

Question 16-149:

LCO 3.3.1, Protection System

Provide a technical justification for not including the Safety Injection Signal (SIS) Actuation Signal on RCS Loop Low Level in the EPR GTS, Table 3.3.1-2 and associated Bases.

The EPR GTS, Section 3.3.1, Table 3.3.1-2 and the EPR Bases, Section B.3.3.1, do not include a SIS Actuation on RCS Loop Low Level. Supporting Hot Leg Loop Level sensors are missing from the EPR GTS, Table 3.3.1-2, and the EPR Bases as well. In accordance with the EPR FSAR, Section 7.2.1.2 (Pg 7.3-2), a SIS Actuation is initiated by RCS water level measurements below a fixed setpoint in any two of the four Protection System divisions. Identify and correct any omissions in the EPR GTS and the EPR Bases. Include the necessary discussions to ensure a clear understanding of the bases.

This additional information is needed to ensure the completeness and accuracy of the EPR GTS, Table 3.3.1-2, and associated Bases.

Response to Question 16-149:

The Safety Injection Signal (SIS) Actuation on Reactor Coolant System (RCS) Loop Low Level function and its associated sensor (RCS Loop Level) will be included in U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification 3.3.1 "Protection System (PS)" and U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification Bases 3.3.1 "Protection System (PS)".

The corresponding changes to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification section 3.3.1 "Protection System (PS)" and Technical Specification section 3.3.1 Bases are provided in Response to Question 16-138.

FSAR Impact:

See the Response for Question 16-138.

Question 16-150:

LCO 3.3.1, Protection System

Provide the additional information and any changes needed to explain and correct inconsistencies associated with Emergency Safety Features Actuation Signal (ESFAS) Function B.3.b (SIS Actuation on Low Delta Psat) mode applicability in the EPR GTS, Table 3.3.1-1, Table 3.3.1-2, and EPR Bases.

The EPR GTS, Table 3.3.1-1, specifies mode applicability for sensors (including P12 and P15 permissive instrumentation) associated with ESFAS Function B.3.b. Corresponding Bases Section B.3.b, does not contain all the information regarding mode applicability for either the sensors or the function.

The EPR Bases, Section B.3.b (pg. B 3.3.1-34), states that these “sensors and processors are required to be OPERABLE in MODE 3 when Trip/Actuation Function B.3.a / SIS Actuation on Low Pressurizer Pressure is disabled.” The Bases, Section B.3.b (pgs B 3.3.1-33 & 34), also states that “this function ensures SIS actuation in the Hot and Cold Shutdown conditions with LHSI/RHR in operation and at least one of the RCPs are operating” (Hot and Cold Shutdown conditions are Modes 4 and 5). The EPR GTS, Table 3.3.1-2, does not specify Modes 4 and 5 for function B.3.b, only Mode 3(k). In addition, ESF Function 9.b, Containment Isolation (Stage 1) on SIS Actuation, specifies Modes 1, 2, 3 and 4 which may be an indication that Mode 4 should be included.

In addition, the following potential inconsistencies in mode applicability have been identified in the EPR GTS, Table 3.3.1-1, regarding Delta Psat sensor instrumentation:

i. The EPR GTS, Table 3.3.1-1, Pressurizer Pressure NR (A.14) currently specifies Modes 1, 2 and 3(h). Pressurizer Pressure NR (A.14) would be required in Modes 3, 4 and 5 to support Permissive P12. This would indicate that Pressurizer Pressure NR would need to be operable during Modes 1, 2, 3, 4 and 5 to support ESFAS Functions B.3.a and B.3.b. The Pressurizer Pressure NR instrument range is 1615 – 2515 psia and cannot support both ESFAS Functions. Identify the intended Pressurizer Pressure NR application(s) for Modes 1, 2, 3, 4 and 5 in support of ESFAS Functions B.3.a and B.3.b.

   Determine which application(s) are consistent with Pressurizer Pressure NR capability and which application(s) (if any) are not consistent with its capability. Provide the necessary corrections for those beyond the Pressurizer Pressure NR capability in both the EPR GTS and FSAR. Provide any necessary corrections and sufficient descriptions in the EPR Bases for Pressurizer Pressure NR Mode applicablity in support of ESFAS Functions B.3.a and B.3.b.

ii. The EPR GTS, Table 3.3.1-1, Hot Leg Temperature WR (A.10) currently specifies Mode 3(e). Hot Leg Temperature WR (A.10) would be required in Modes 3(e), 4 and 5 to support the Delta Psat Function and Permissive P15. In addition, this instrumentation would also be required in Mode 5 to support the P15 Permissive input signal into the SIS Actuation on Low Hot Leg Loop Level Logic. Provide any necessary corrections in the EPR GTS and sufficient descriptions in the EPR Bases for Hot Leg Temperature WR (A.10) mode applicability in support of ESFAS Function B.3.b and Permissive P15.

iii. The EPR GTS, Table 3.3.1-1, Hot Leg Pressure WR (A.8) currently specifies Modes 1, 2, 3 and (d). Hot Leg Pressure WR (A.8) would be required in Modes 3(e), 4 and 5 to support the Delta Psat Function and Permissive P15. In addition, this instrumentation would also be required in Mode 5 to support the P15 Permissive input signal into the SIS Actuation on Low Hot Leg Loop Level Logic. Provide any necessary corrections in the EPR GTS and sufficient descriptions in the EPR Bases for Hot Leg Pressure WR (A.8) mode applicability in support of ESFAS Function B.3.b and Permissive P15.

iv. The EPR GTS, Table 3.3.1-1, RCP Current (A.17) currently specifies Modes 1, 2 and 3. RCP Current (A.17) would be required in Modes 3(e), 4 and 5 to support Permissive P15 . In addition, this instrumentation would also be required in Mode 5 to support the P15 Permissive input signal into the SIS Actuation on Low Hot Leg Loop Level Logic. Provide any necessary corrections in the EPR GTS and sufficient descriptions in the EPR Bases for RCP Current (A.17) mode applicability in support of Permissive P15.

This additional information is needed to ensure the completeness and the accuracy of the EPR GTS, Table 3.3.1-1, Table 3.3.1-2, and associated Bases, as well as the operability of all sensors (including permissive instrumentation) necessary to support Function B.3.b in the applicable modes.

Response to Question 16-150:

As shown in U.S. EPR FSAR Tier 2 Figure 7.3-2—SIS Actuation, Safety Injection System (SIS) Actuation is accomplished by three functions:

- SIS Actuation on Low Pressurizer Pressure function, which is assumed in the safety analysis to be operable in MODES 1 and 2 and in MODE 3 with Permissive P12 inhibited (pressurizer pressure greater than 2005 psia).
- SIS Actuation on Low Delta Psat function, which is assumed in the safety analysis to be operable in MODE 3 with Permissive P12 validated (pressurizer pressure less than 2005 psia) and in MODE 4 with Permissive P15 inhibited (hot leg temperature above 350°F, hot leg pressure above 464 psia, and a reactor coolant pump (RCP) running).
- SIS Actuation on Low RCS Loop Level function, which is assumed in the safety analysis to be operable in MODE 4 with Permissive P15 validated (hot leg temperature below 350°F, hot leg pressure below 464 psia, and no RCPs running) and in MODES 5 and 6.

These three functions will be included in the Technical Specifications and will provide the full range of operability requirements assumed in the safety analysis.

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

For a discussion of Mode requirements for Permissives P12 and P15, see the Response to Question 16-138.

For a discussion of Mode and instrument range requirements for the Pressurizer Pressure (Narrow Range) sensors, see the Response to Question 16-147.

For a discussion of Mode requirements for the Hot Leg Temperature (Wide Range (WR)) sensors, see the Response to Question 16-144.

For a discussion of Mode requirements for the Hot Leg Pressure (WR) sensors, see the Response to Question 16-145.

The RCP Current sensors provide input to multiple functions:

- The RCP Trip on Low Delta P across RCP with SIS Actuation function: This function is assumed in the safety analysis to be operable in MODES 1, 2, 3, and 4.
- Permissive P7. As discussed in the Response to Question 16-138, Permissive P7 is required to be operable in MODES 3, 4, 5, and 6 with no RCPs in operation.
- Permissive P15. As discussed in the Response to Question 16-138, Permissive P15 is required to be operable in MODES 4, 5, and 6.

Therefore, the RCP Current sensors are required to be operable in MODES 1, 2, 3, 4, 5, and 6.

The corresponding changes to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification section 3.3.1 "Protection System (PS)" and Technical Specification section 3.3.1 Bases are provided in Response to Question 16-138.

FSAR Impact:

See the Response for Question 16-138.

Question 16-151:

LCO 3.3.1, Protection System

Provide the additional information and any changes needed to explain and correct inconsistencies associated with ESFAS Function B.3.b (SIS Actuation on Low Delta Psat) in the EPR Bases.

The EPR Bases, Applicable Safety Analyses, LCO, and Applicability Section, (pg B 3.3.1-34, 6th paragraph), states that the “P15 permissive automatically enables the SIS Actuation on Low Delta Psat function when at least two Reactor Coolant Pumps (RCP) are running, the hot leg pressure is greater than or equal to 464 psia, and when the hot leg temperature is greater than or equal to 365 degrees F.” On the basis of a review of logic drawings 7.2-34 and 7.3-2, only one (not two) RCP pumps need to be running. In addition, the logic drawings indicate that the “and” should be replaced by an “or” in the statement “hot leg pressure is greater than or equal to 464 psia, *and* when the hot leg temperature . . .” Determine the technically correct information, provide any necessary details, and correct any errors in the EPR Bases and EPR FSAR.

This additional information is required to verify and correct potential discrepancies between the EPR Bases and EPR FSAR.

Response to Question 16-151:

The NRC's interpretation of the functions depicted in U.S. EPR FSAR Tier 2, Figure 7.2-34 and Figure 7.3-2 is correct. As shown on U.S. EPR FSAR Tier 2, Figure 7.2-34 , the three inputs from the Hot Leg Temperature (Wide Range (WR)) below minimum setpoint, Hot Leg Pressure (WR) below minimum setpoint, and RCP Current sensors below minimum setpoint (no RCPs running) feed an "AND" functional block. All three conditions must be met before the permissive is validated. Any one condition not being met results in the permissive being inhibited.

As shown on Figure 7.3-2, when validated, Permissive P15 enables the Safety Injection System (SIS) Actuation on Low Reactor Coolant System (RCS) Loop Level function and disables the SIS Actuation on Low Delta Psat function. Therefore, the P15 permissive automatically disables the SIS Actuation on Low Delta Psat function when no RCPs are running with hot leg pressure is less than 464 psia, and hot leg temperature is less than 350°F.

The corresponding changes to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification section 3.3.1 "Protection System (PS)" Bases are provided in Response to Question 16-138.

FSAR Impact:

See the Response for Question 16-138.

Question 16-153:

LCO 3.3.1, Protection System

Provide additional information needed to identify the mode applicability for sensors in the EPR GTS, Table 3.3.1-1 (including P12 and P15 permissive instrumentation), associated with ESFAS Function B.9.b. Provide any necessary changes to EPR Table 3.3.1-1 and Bases Section B.9.b to include the required sensor and mode applicability information.

The EPR GTS, Table 3.3.1-2, specifies Modes 1, 2, 3 and 4 for ESFAS Function B.9.b, Containment Isolation (Stage 1) on SIS Actuation. The EPR Bases, Section B.9.b (pg. B 3.3.1-42), does not specify the required sensors, including sensor modes of applicability necessary to support the SIS Actuation function.

SIS Actuation Functions consist of B.3.a (SIS Actuation on Low Pressurizer Pressure) and B.3.b (SIS Actuation on Low Delta Psat). SIS function, supporting instrumentation, and associated Modes of applicability are as follows:

- The EPR GTS, Table 3.3.1-2, Function B.3.a, SIS Actuation on Low Pressurizer Pressure, currently specifies Modes 1, 2, and 3(h).

  The EPR GTS, Table 3.3.1-1, Pressurizer Pressure NR (A.14) currently specifies Modes 1, 2 and 3(h). Pressurizer Pressure NR (A.14) would be required in Modes 1, 2 and 3 for Permissive P12 to support Function B.3.a and also to support Function B.3.a directly (sensor inputs). Pressurizer Pressure NR instrumentation operability should extend both above and below 2005 psia in Mode 3 in order to ensure Function B.9.b is not compromised with respect to function B.3.a.

- The EPR GTS, Table 3.3.1-2, (B.3.b) SIS Actuation on Low Delta Psat currently specifies Mode 3(k). Low Delta Psat would be required in Modes 3(k) and 4 to support Function B.9.b.

  Note: Mode applicability associated with SIS Actuation on Low Delta Psat (B.3.b) is being evaluated under a separate RAI on the basis of B.3.b Bases statements on pages B 3.3.1-33 and B 3.3.1-34 which state "this function ensures SIS actuation in the Hot and Cold Shutdown conditions with LHSI/RHR in operation and at least one of the RCPs are operating." (Hot and Cold Shutdown conditions are Modes 4 and 5).

The EPR GTS, Table 3.3.1-1, Pressurizer Pressure NR (A.14) currently specifies Modes 1, 2 and 3(h). Pressurizer Pressure NR (A.14) would be required in Modes 3 and 4 for Permissive P12 to support Function B.3.b. Pressurizer Pressure NR instrumentation operability should extend both above and below 2005 psia in order to ensure Function B.9.b is not compromised with respect to function B.3.b. Pressurizer Pressure NR instrument range is 1615 – 2515 psia.

The EPR GTS, Table 3.3.1-1, Hot Leg Temperature WR (A.10) currently specifies Mode 3(e). Hot Leg Temperature WR (A.10) would be required in Modes 3(e), and 4 for Permissive P15 to support Function B.3.b and also to support Function B.3.a directly (sensor inputs).

The EPR GTS, Table 3.3.1-1, Hot Leg Pressure WR (A.8) currently specifies Modes 1, 2, 3 and (d). Hot Leg Pressure WR (A.8) would be required in Modes 3(e), and 4 for Permissive P15 to support Function B.3.b and also to support Function B.3.a directly (sensor inputs).

The EPR GTS, Table 3.3.1-1, RCP Current (A.17) currently specifies Modes 1, 2, and 3. RCP Current (A.17) would be required in Modes 3(e) and 4 for Permissive P15 to support function B.3.b.

This additional information is needed to ensure the completeness and accuracy of the EPR GTS, Table 3.3.1-1, Table 3.3.1-2, and associated Bases, as well as the operability of all sensors (including permissive instrumentation) necessary to support Function B.9.b in the applicable modes.

Response to Question 16-153:

The Containment Isolation (Stage 1) on Safety Injection System (SIS) Actuation is required to be operable in MODES 1, 2, 3, and 4.

The three SIS Actuation functions and their associated operability requirements are discussed in the Response to Question 16-150. Sensor operability is described separately in the protection system (PS) Bases for each of the three SIS functions. For the purposes of the Containment Isolation function description in the Technical Specifications Bases, SIS is treated as a signal and the individual contributing sensors are not identified in the Bases for this function. This is analogous to the Turbine Trip on Reactor Trip function. There would be no value added by duplicate listings of the sensors associated with RT functions in the Bases for the Turbine Trip on Reactor Trip function. However, the Bases will be clarified to refer to the SIS Actuation functions that are required to be operable to support the Containment Isolation (Stage 1) on SIS Actuation function.

For a discussion of Mode requirements for Permissives P12 and P15, see the Response to Question 16-138.

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

For a discussion of Mode requirements for the Pressurizer Pressure (Narrow Range (NR)) sensors, see the Response to Question 16-147.

For a discussion of Mode requirements for the Hot Leg Pressure (Wide Range (WR)) sensors, see the Response to Question 16-145.

For a discussion of Mode requirements for the Hot Leg Temperature (WR) sensors, see the Response to Question 16-144.

For a discussion of Mode requirements for the Reactor Coolant Pump (RCP) Current sensors, see the Response to Question 16-150.

The corresponding changes to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification section 3.3.1 "Protection System (PS)" Bases are provided in Response to Question 16-138.

FSAR Impact:

See the Response for Question 16-138.

Question 16-154:

LCO 3.3.1, Protection System

Provide the additional information and any changes needed to identify the range of the Containment Service Compartment Pressure sensors in the EPR Bases Document, Section B.9.a, consistent with the EPR FSAR.

The EPR Bases, Applicable Safety Analyses, LCO, and Applicability Section (pg B 3.3.1-41), lists the sensors and processors required for the Stage 1 Isolation on High Containment Pressure Function. The Containment Service Compartment Pressure sensors should specify the "instrument range" consistent with the EPR FSAR, Table 7.3-1 (ESF Actuation Variables) to distinguish between sensor types.

This additional information is needed to ensure the completeness and accuracy of the EPR Bases document consistent with the EPR FSAR.

Response to Question 16-154:

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

The Containment Equipment Compartment Pressure and Containment Service Compartment Pressure (Narrow Range (NR)) sensors provide input to the High Containment Pressure reactor trip. The High Containment Pressure reactor trip is assumed in the safety analysis to be operable in MODES 1 and 2 and MODE 3 with the RCSL System capable of withdrawing a rod cluster control assembly (RCCA) or one or more RCCAs not fully inserted. Therefore, the Containment Equipment Compartment Pressure and Containment Service Compartment Pressure (NR) sensors are required 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.

The Containment Service Compartment Pressure (Wide Range (WR)) 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. These functions are required to be operable in MODES 1, 2, 3, and 4. Therefore, the Containment Service Compartment Pressure (WR) sensors are required to be operable in MODES 1, 2, 3, and 4.

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification 3.3.1 "Protection System (PS)" and U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification Bases 3.3.1 "Protection System (PS)" will be revised to explicitly differentiate between the three types of containment pressure sensors.

The corresponding changes to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification 3.3.1 "Protection System (PS)" are provided in Response to Question 16-138.

FSAR Impact:

See the Response to Question 16-138.

Question 16-155:

LCO 3.3.1, Protection System

Provide the additional information and any changes needed to validate instrumentation applicability and to identify the range of the Containment Service Compartment Pressure sensors in the EPR Bases Document, Section B.9.c consistent with the EPR FSAR.

The EPR Bases, Applicable Safety Analyses, LCO, and Applicability Section (pg B 3.3.1-42), lists the sensors and processors required for the Stage 2 Isolation on High-High Containment Pressure Function. The Containment Service Compartment Pressure sensors should specify the “instrument range” consistent with the EPR FSAR, Table 7.3-1 (ESF Actuation Variables) and to distinguish between sensor types.

In addition, verify the reference to “Containment Equipment Compartment Pressure Monitors” in the EPR Bases, Section B.9.c. There is no supporting information that these instruments are used in the High-High Containment Pressure Isolation Function (Figure 7.3-20). Provide a technical justification for referring to these instruments and revise the Bases as necessary to ensure consistency with the EPR FSAR.

This additional information is needed to ensure the completeness and accuracy of the EPR Bases document consistent with the EPR FSAR.

Response to Question 16-155:

See the Response to Question 16-154.

FSAR Impact:

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

Question 16-156:

LCO 3.3.1, Protection System

Provide the additional information and any changes needed to identify Containment Pressure sensor designations associated with Containment Pressure (A.7) in the EPR GTS, Table 3.3.1-1, consistent with the EPR Bases.

The EPR GTS, Table 3.3.1-1, currently specifies four Containment Pressure sensors associated with Containment Pressure (A.7). The EPR Bases identifies a total of 12 Containment Pressure sensors (8 Service Compartment and 4 Equipment Compartment) that support Reactor Trip and ESFAS Containment Isolation functions (Figure 7.2-23 and Figure 7.3-20). The 12 Containment Pressure sensors include the follows:

a. Containment Service Compartment Pressure Narrow Range (4)
b. Containment Service Compartment Pressure Wide Range (4)
c. Containment Equipment Compartment Pressure (4)

This additional information is needed to ensure the completeness and accuracy of the EPR GTS, Table 3.3.1-1, consistent with the EPR Bases information.

Response to Question 16-156:

See the Response to Question 16-154.

FSAR Impact:

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

Question 16-158:

LCO 3.3.1, Protection System

Provide the additional information and any changes needed to explain and correct inconsistencies associated with Permissive P13 as it applies to ESF Function B.6.b (EFWS Actuation on Loss of Offsite Power and SIS Actuation) in the EPR Bases.

The EPR FSAR, Section 7.3.1.2.2 and logic drawing 7.3-3, indicate that the EFWS is actuated on either “Low-Low SG Level” or “Loss of Offsite Power and SIS Actuation.” The EPR FSAR, Section 7.3.1.2.2 states that “in both cases, EFWS actuation is bypassed when hot leg temperature is below the P13 permissive setpoint.” The EPR Bases, Section B.6.b (pg B 3.3.1-37, last sentence) states that “there are no automatic permissives associated with this function.” These statements are inconsistent. The correct permissive logic needs to be identified and documented consistently throughout the EPR Bases and FSAR. Conflicting statements need to be corrected with sufficient information to provide a clear understanding of the facts, as appropriate.

This additional information is needed to ensure the accuracy, completeness and consistency between the EPR Bases and FSAR.

Response to Question 16-158:

U.S. EPR FSAR Tier 2, Chapter 7, Figure 7.3-3— EFWS Actuation and U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification Bases 3.3.1 "Protection System (PS)" will be revised to show that Emergency Feedwater (EFW) Actuation on Loss of Offsite Power (LOOP) and Safety Injection System (SIS) Actuation will be enabled when the hot leg temperature is greater than or equal to 200°F (P13 inhibited).

The corresponding changes to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification section 3.3.1 "Protection System (PS)" 3.3.1 are provided in Response to Question 16-138.

FSAR Impact:

U.S. EPR FSAR Tier 2, Figure 7.3-3 will be revised as described in the response and indicated on the enclosed markup.

Question 16-159:

LCO 3.3.1, Protection System

Provide the additional information and any necessary changes regarding EPR GTS, Table 3.3.1-1, (A.10) mode applicability for Hot Leg Temperature Wide Range with respect to ESFAS Function B.6.a (EFWS Actuation on Low-Low SG Level).

The EPR GTS, Table 3.3.1-1, specifies Mode 3(e) for Hot Leg Temperature WR. Hot Leg Temperature WR is used in Permissive P13. The P13 permissive signal (Figure 7.2-32) enables/disables ESFAS Function B.6.a (Figure 7.3-3) as designated in Table 3.3.1-2. Table 3.3.1-2 specifies Modes 1, 2 and 3 for ESFAS Function B.6.a. Determine Hot Leg Temperature WR mode applicability required to support ESFAS Function B.6.a and correct any potential discrepancies. Include any discussions necessary to ensure a clear understanding of mode applicability.

This additional information is needed to ensure the accuracy and completeness of the EPR GTS and Bases, as well as the operability of permissive instrumentation necessary to support the associated ESFAS function in the applicable modes.

Response to Question 16-159:

For a discussion of Mode requirements for Permissive P13, see the Response to Question 16-138.

For a discussion of Mode requirements for the Hot Leg Temperature (Wide Range (WR)) sensors, see the Response to Question 16-144.

FSAR Impact:

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

Question 16-160:

LCO 3.3.1, Protection System

Provide the additional information and any necessary changes regarding EPR GTS, Table 3.3.1-1, (A.10) mode applicability for Hot Leg Temperature Wide Range with respect to ESFAS Function B.6.c (EFWS Isolation on High SG Level).

The EPR GTS, Table 3.3.1-1, specifies Mode 3(e) for Hot Leg Temperature WR. The Hot Leg Temperature WR is used in Permissive P13. The P13 permissive signal (Figure 7.2-32) enables/disables the ESFAS Function B.6.c (Figure 7.3-5) as designated in Table 3.3.1-2. Table 3.3.1-2 specifies Modes 1, 2 and 3 for ESFAS Function B.6.c. Determine Hot Leg Temperature WR mode applicability required to support ESFAS Function B.6.c and correct any potential discrepancies. Include any discussions necessary to ensure a clear understanding of Mode applicability.

This additional information is needed to ensure the accuracy and completeness of the EPR GTS and Bases, as well as the operability of permissive instrumentation necessary to support the associated ESFAS function in the applicable modes.

Response to Question 16-160:

For a discussion of Mode requirements for Permissive P13, see the Response to Question 16-138.

For a discussion of Mode requirements for the Hot Leg Temperature (Wide Range (WR)) sensors, see the Response to Question 16-144.

Emergency Feedwater (EFW) Isolation on High Steam Generator (SG) Level function is no longer credited in U.S. EPR FSAR Tier 2, Table 15.0-8. Manual operator action is assumed to mitigate a SG tube rupture (SGTR) event with no automatic functions. A corrective action is being performed to resolve inconsistencies between the safety analysis, Protection System design, and the Technical Specifications.

FSAR Impact:

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

Question 16-162:

LCO 3.3.1, Protection System

Provide additional information needed to identify the mode applicability for sensors in the EPR GTS, Table 3.3.1-1 (including Permissives P12 and P15 instrumentation) associated with ESFAS Function B.5. Provide any necessary changes to EPR Table 3.3.1-1 and Bases Section B.5 to include the required sensor and mode applicability information.

The EPR GTS, Table 3.3.1-2, specifies Modes 1, 2 and 3 for ESFAS Function B.5, Partial Cooldown Actuation on SIS Actuation. The EPR Bases, Section B.5 (pg B.3.3.1-36), does not specify the required sensors, including sensor modes of applicability necessary to support the SIS Actuation function.

SIS Actuation Functions consist of B.3.a (SIS Actuation on Low Pressurizer Pressure) and B.3.b (SIS Actuation on Low Delta Psat). SIS function, supporting instrumentation, and associated modes of applicability are as follows:

- The EPR GTS, Table 3.3.1-2, Function B.3.a, SIS Actuation on Low Pressurizer Pressure, currently specifies Modes 1, 2 and 3(h).

  The EPR GTS, Table 3.3.1-1, Pressurizer Pressure NR (A.14), currently specifies Modes 1, 2 and 3(h). Pressurizer Pressure NR (A.14) would be required in Modes 1, 2 and 3 for Permissive P12 to support Function B.3.a and to support Function B.3.a directly (sensor inputs). Pressurizer Pressure NR instrumentation operability should extend both above and below 2005 psia in Mode 3 in order to ensure Function B.5 is not compromised with respect to Function B.3.a.

- The EPR GTS, Table 3.3.1-2, Function B.3.b, SIS Actuation on Low Delta Psat, currently specifies Mode 3 (k).

  The EPR GTS, Table 3.3.1-1, Pressurizer Pressure NR (A.14), currently specifies Modes 1, 2 and 3(h). Pressurizer Pressure NR (A.14) would be required in Mode 3 for Permissive P12 to support function B.3.b. Pressurizer Pressure NR instrumentation operability should extend both above and below 2005 psia in Mode 3 in order to ensure Function B.5 is not compromised with respect to Function B.3.b.

  The EPR GTS, Table 3.3.1-1, Hot Leg Temperature WR (A.10) instrumentation currently specifies Mode 3(e). Hot Leg Temperature WR (A.10) would be required in Mode 3(e) for Permissive P15 to support Function B.3.b and also to support Function B.3.b directly (sensor inputs).

  The EPR GTS, Table 3.3.1-1, Hot Leg Pressure WR (A.8), currently specifies Modes 1, 2, 3 and (d). Hot Leg Pressure WR would be required in Mode 3(e) for Permissive P15 to support Function B.3.b and to support Function B.3.b directly (sensor inputs).

  The EPR GTS, Table 3.3.1-1, RCP Current (A.17) currently specifies Modes 1, 2, and 3. RCP Current (A.17) would be required in Mode 3(e) for Permissive P15 to support function B.3.b.

This additional information is needed to ensure the accuracy and completeness of the EPR GTS and Bases, as well as the operability of all sensors (including permissive instrumentation) necessary to support Function B.5 in the applicable modes.

Response to Question 16-162:

The three Safety Injection System (SIS) Actuation functions and their associated operability requirements are discussed in the Response to Question 16-150. Sensor operability is described separately in the Protection System (PS) Bases for each of the three SIS Actuation functions. For the purposes of the Partial Cooldown Actuation on SIS Actuation function description in the Technical Specifications Bases, SIS actuation is treated as a signal and the individual contributing sensors are not identified in the Bases for this function. This is analogous to the Turbine Trip on Reactor Trip function. There would be no value added by duplicate listings of the sensors associated with RT functions in the Bases for the Turbine Trip on Reactor Trip function. However, the Bases will be clarified to refer to the SIS Actuation functions that are required to be operable to support the Partial Cooldown Actuation on SIS Actuation function.

For a discussion of Mode requirements for Permissive P12, see the Response to Question 16-138.

For a discussion of Mode requirements for Permissive P15, see the Response to Question 16-138.

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

For a discussion of Mode requirements for the Pressurizer Pressure (Narrow Range (NR)) sensors, see the Response to Question 16-147.

For a discussion of Mode requirements for the Hot Leg Pressure (Wide Range (WR)) sensors, see the Response to Question 16-145.

For a discussion of Mode requirements for the Hot Leg Temperature (WR) sensors, see the Response to Question 16-144.

For a discussion of Mode requirements for the Reactor Coolant Pump (RCP) Current sensors, see the Response to Question 16-150.

The corresponding changes to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification section 3.3.1 "Protection System (PS)" Bases are provided in Response to Question 16-138.

FSAR Impact:

See the Response to Question 16-138.

Question 16-163:

LCO 3.3.1, Protection System

Provide the additional information and any corrections necessary to clarify the intent of the EPR GTS, Table 3.3.1-2, footnote regarding ESFAS Functions B.8.a and B.8.b.

The EPR GTS, Table 3.3.1-2, Footnote (l), “Except when all MSIVs are closed”, specifies Mode 3 for ESF Function B.8.b (MSIV Closure on Low SG Pressure). Footnote (l) does not specify Mode 3 for ESF Function B.8.a (MSIV Closure on SG Pressure Drop). Footnote (l) wording is included in Bases B.8.b (pg B 3.3.1-41) but not in Bases B.8.a. Provide clarification with respect to the footnote and Bases. Explain why Footnote (l) does not apply to both ESF functions. Provide the changes needed to ensure that the referenced information is clearly stated in the EPR GTS and Bases.

This additional information is needed to ensure the accuracy and completeness of the EPR GTS and Bases.

Response to Question 16-163:

The modifier clause which states "Except when all MSIVs are closed" applies to both the Main Steam Isolation Valve (MSIV) Isolation on Steam Generator (SG) Pressure Drop (All SGs) and MSIV Isolation on Low SG Pressure functions. The necessary changes will be included in U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification 3.3.1 "Protection System (PS)" and U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification Bases 3.3.1 "Protection System (PS)".

The corresponding changes to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification section 3.3.1 "Protection System (PS)" and Technical Specification section 3.3.1 Bases are provided in Response to Question 16-138.

FSAR Impact:

See the Response to Question 16-138.

Question 16-164:

LCO 3.3.1, Protection System

Provide the additional information and any necessary changes regarding the EPR GTS, Table 3.3.1-1, (A.10) mode applicability for Hot Leg Temperature Wide Range with respect to ESFAS Function B.7.a (MSRT Actuation on High SG Pressure).

The EPR GTS, Table 3.3.1-1 specifies Mode 3(e) for Hot Leg Temperature WR. The Hot Leg Temperature WR is used in Permissive P14. Permissive signal P14 (Figure 7.2-33) determines which value of “Max1p” is selected to provide SG overpressure protection for ESFAS Function B.7.a (Figures 7.3-9 & 7.3-10). Table 3.3.1-2 specifies Modes 1, 2 and 3 for ESFAS Function B.7.a. Determine Hot Leg Temperature WR mode applicability required to support ESFAS Function B.7.a and correct any potential discrepancies. Include any discussions necessary to ensure a clear understanding of mode applicability.

This additional information is needed to ensure the accuracy and completeness of the EPR GTS and Bases, as well as the operability of permissive instrumentation necessary to support the associated ESFAS function in the applicable modes.

Response to Question 16-164:

For a discussion of Mode requirements for Permissive P14, see the Response to Question 16-138.

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

For a discussion of Mode requirements for the Hot Leg Temperature (Wide Range) sensors, see the Response to Question 16-144.

FSAR Impact:

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

Question 16-165:

LCO 3.3.1, Protection System

Provide the additional information and any necessary changes regarding the EPR GTS, Table 3.3.1-1, (A.14) mode applicability for Pressurizer Pressure Narrow Range (NR) with respect to ESFAS function B.7.b (MSRT Isolation on Low SG Pressure).

The EPR GTS, Table 3.3.1-1 specifies Modes 1, 2 and 3(h) for Pressurizer Pressure NR . Pressurizer Pressure NR is used in Permissive P12. Permissive signal P12 (Figure 7.2-31) enables/disables ESFAS Function B.7.b (Figure 7.3-13) as designated in Table 3.3.1-2. Table 3.3.1-2 specifies Modes 1, 2 and 3(h) for ESFAS Function B.7.b.

Determine Pressurizer Pressure NR mode applicability required to support ESFAS Function B.7.b. The determination is to include an evaluation of mode applicability both above and below 2500 psia in Mode 3 in order to ensure Function B.7.b is not compromised. Identify and correct any potential discrepancies that may exist. Include any discussions necessary to ensure a clear understanding of mode applicability.

This additional information is needed to ensure the accuracy and completeness of the EPR GTS and Bases, as well as the operability of permissive instrumentation necessary to support the associated ESFAS function in the applicable modes.

Response to Question 16-165:

For a discussion of Mode requirements for Permissive P12, see the Response to Question 16-138.

For a discussion of Mode requirements for the Pressurizer Pressure (Narrow Range) sensors, see the Response to Question 16-147.

FSAR Impact:

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

Question 16-168:

LCO 3.3.1, Protection System

Provide the additional information and any necessary changes regarding the EPR GTS, Table 3.3.1-1, (A.14) mode applicability for Pressurizer Pressure Narrow Range (NR) with respect to ESFAS Function B.8.b.(MSIV Closure on Low SG Pressure).

The EPR GTS, Table 3.3.1-1 specifies Modes 1, 2 and 3(h) for Pressurizer Pressure NR . Pressurizer Pressure NR is used in Permissive P12. The P12 permissive signal (Figure 7.2-31) enables/disables ESFAS Function B.8.b (Figure 7.3-14 and Figure 7.2-19) as designated in Table 3.3.1-2. Table 3.3.1-2 specifies Modes 1, 2 and 3(l) for ESFAS Function B.8.b.

Determine Pressurizer Pressure NR mode applicability required to support ESFAS Function B.8.b. Determination to include an evaluation of mode applicability both above and below 2500 psia in Mode 3 in order to ensure Function B.8.b is not compromised. Identify and correct any potential discrepancies that may exist. Include any discussions necessary to ensure a clear understanding of mode applicability.

This additional information is needed to ensure the accuracy and completeness of the EPR GTS and Bases, as well as the operability of permissive instrumentation necessary to support the associated ESFAS function in the applicable modes.

Response to Question 16-168:

For a discussion of Mode requirements for Permissive P12, see the Response to Question 16-138.

For a discussion of Mode requirements for the Pressurizer Pressure (Narrow Range) sensors, see the Response to Question 16-147.

FSAR Impact:

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

Question 16-169:

LCO 3.3.1, Protection System

Provide additional information and any corrections necessary to clarify the applicability of the EPR GTS, Table 3.3.1-1, Footnote (g), to Mode 2 for Reactor Trip Circuit Breaker Position Indication (A.21).

The EPR GTS, Table 3.3.1-1, Footnote (g) states that “with the Reactor Control, Surveillance and Limitation (RCSL) System capable of withdrawing a Rod Cluster Control Assembly (RCCA) or one or more RCCAs not fully inserted.” Mode 2 is classified as “Startup” with a Reactivity Condition of Keff $\geq$ 0.99 and a RTP $\leq$ 5 percent. Under normal conditions, one or more RCCAs would have to be “not fully inserted” in order to achieve a Keff $\geq$ 0.99. Provide clarification and any changes needed to resolve the applicability of this footnote with respect to Mode 2 for Reactor Trip Circuit Breaker Position Indication in the EPR GTS and Bases.

This additional information is needed to ensure the accuracy and completeness of the EPR GTS and Bases.

Response to Question 16-169:

Mode requirements for sensors have been chosen to envelope the required modes of the functions and Permissives they support. The Reactor Trip Circuit Breaker (RTCB) Position Indication sensors provide input to multiple functions:

- The Turbine Trip on Reactor Trip function: This function is assumed in the safety analysis to be operable in MODE 1.
- The Main Feedwater (MFW) Full Load Isolation on Reactor Trip function: This function is assumed in the safety analysis to be operable in MODE 1 and in MODES 2 and 3, except when all MFW full load lines are isolated.
- The Startup and Shutdown Feedwater (SSS) Isolation on High Steam Generator (SG) Level for Period of Time (Affected SGs) function: This function is assumed in the safety analysis to be operable in MODE 1 and in MODES 2 and 3, except when all MFW full load and low load lines are isolated.

Therefore, the 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.

The corresponding changes to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification section 3.3.1 "Protection System (PS)" and Technical Specification section 3.3.1 Bases are provided in Response to Question 16-138.

FSAR Impact:

See the Response to Question 16-138.

Question 16-172:

LCO 3.3.1, Protection System

Provide additional information and any necessary changes regarding EPR GTS, Table 3.3.1-1, (A.10) Mode applicability for Hot Leg Temperature Wide Range with respect to ESFAS function B.2.b (MFW Full Load Closure on High SG Level).

The EPR GTS, Table 3.3.1-1 specifies Modes 3(e) for Hot Leg Temperature WR. Hot Leg Temperature WR is used in Permissive P13. The P13 permissive signal (Figure 7.2-32) enables/disables ESFAS Function B.2.b (Figure 7.3-16) as designated in Table 3.3.1-2. Table 3.3.1-2 specifies Mode 1, 2(i) and 3(i) for ESFAS Function B.2.b. Determine Hot Leg Temperature WR mode applicability required to support ESFAS Function B.2.b and correct any potential discrepancies. Include any discussions necessary to ensure a clear understanding of Mode applicability.

This additional information is needed to ensure the accuracy and completeness of the EPR GTS and Bases, as well as the operability of permissive instrumentation necessary to support the associated ESFAS function in the applicable modes.

Response to Question 16-172:

For a discussion of Mode requirements for Permissive P13, see the Response to Question 16-138.

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

For a discussion of Mode requirements for the Hot Leg Temperature (Wide Range) sensors, see the Response to Question 16-144.

FSAR Impact:

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

Question 16-173:

LCO 3.3.1, Protection System

Provide additional information and any corrections needed to accurately describe ESFAS Function B.2.c in the EPR GTS, Table 3.3.1-2, and EPR Bases, Section B.2.c with respect to the “All SGs” designation.

The EPR GTS, Table 3.3.1-2, ESF Function B.2.c (Startup and Shutdown Feedwater Isolation on SG Pressure Drop) currently specifies “All SGs.” In addition, the EPR Bases, Section B.2.c, Applicable Safety Analyses, LCO, and Applicability Section (pg B 3.3.1-30, title line and first paragraph), specifies “All SGs” as well. The EPR FSAR, Section 7.3.1.2.8 (pg 7.3-11, bottom paragraph) and applicable logic diagram (Figure 7.3-17) indicate that ESF Function B.2.c should specify “Affected SGs.” Determine the correct SG applicability and correct any potential discrepancies. Include any discussions necessary to ensure a clear understanding associated with SG functional references in the Bases and FSAR documents.

This additional information is needed to ensure the accuracy and completeness of the EPR GTS, Bases and FSAR.

Response to Question 16-173:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification 3.3.1 "Protection System (PS)" and U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification Bases 3.3.1 "Protection System (PS)" will be revised to consistently refer to the affected Steam Generator (SG) when discussing the Startup and Shutdown Feedwater (SSS) Isolation on SG Pressure Drop (Affected SG) function.

The corresponding changes to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification section 3.3.1 "Protection System (PS)" and Technical Specification section 3.3.1 Bases are provided in Response to Question 16-138.

FSAR Impact:

See the Response to Question 16-138.

Question 16-175:

LCO 3.3.1, Protection System

Provide additional information and any necessary changes regarding EPR GTS, Table 3.3.1-1, (A.14) mode applicability for Pressurizer Pressure Narrow Range (NR) with respect to ESFAS Function B.2.d (Startup and Shutdown Feedwater Isolation on Low SG Pressure).

The EPR GTS, Table 3.3.1-1, specifies Modes 1, 2 and 3(h) for Pressurizer Pressure NR . Pressurizer Pressure NR is used in Permissive P12. Permissive signal P12 (Figure 7.2-31) enables/disables ESFAS Function B.2.d (Figure 7.3-17) as designated in Table 3.3.1-2. Table 3.3.1-2 specifies Modes 1, 2(j) and 3(h)(j) for ESFAS Function B.2.d.

Determine Pressurizer Pressure NR mode applicability required to support ESFAS Function B.2.d. The determination is to include an evaluation of mode applicability both above and below 2500 psia in Mode 3 in order to ensure Function B.2.d is not compromised. Identify and correct any potential discrepancies. Include any discussions necessary to ensure a clear understanding of mode applicability.

This additional information is needed to ensure the accuracy and completeness of the EPR GTS and Bases, as well as the operability of permissive instrumentation necessary to support the associated ESFAS function in applicable modes.

Response to Question 16-175:

For a discussion of Mode requirements for Permissive P12, see the Response to Question 16-138.

For a discussion of Mode requirements for the Pressurizer Pressure (Narrow Range) sensors, see the Response to Question 16-147.

FSAR Impact:

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

Question 16-176:

LCO 3.3.1, Protection System

Provide additional information and any corrections needed to accurately describe ESFAS Function B.2.d in the EPR GTS, Table 3.3.1-2, and EPR Bases, Section B.2.d with respect to the “All SGs” designation.

The EPR GTS, Table 3.3.1-2, ESF Function B.2.d (Startup and Shutdown Feedwater Isolation on Low SG Pressure), currently specifies “All SGs.” In addition, the EPR Bases, Section B.2.d, Applicable Safety Analyses, LCO, and Applicability Section (pg B 3.3.1-31, title line and first paragraph), specifies “All SGs” as well. The EPR FSAR, Section 7.3.1.2.8 (pg 7.3-11, bottom paragraph) and applicable logic diagram (Figure 7.3-17) indicate that ESF Function B.2.d should specify “Affected SGs.” Determine the correct SG applicability and correct any potential discrepancies. Include any discussions necessary to ensure a clear understanding associated with SG functional references in the Bases and FSAR documents.

This additional information is needed to ensure the accuracy and completeness of the EPR GTS, Bases and FSAR.

Response to Question 16-176:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification 3.3.1 "Protection System (PS)" and U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification Bases 3.3.1 "Protection System (PS)" will be revised to consistently refer to the affected steam generator (SG) when discussing the Startup and Shutdown Feedwater (SSS) Isolation on Low SG Pressure (Affected SG) function.

The corresponding changes to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification section 3.3.1 "Protection System (PS)" and Technical Specification section 3.3.1 Bases are provided in Response to Question 16-138.

FSAR Impact:

See the Response to Question 16-138.

Question 16-177:

LCO 3.3.1, Protection System

Provide the additional information and any necessary changes regarding the EPR GTS, Table 3.3.1-1, (A.10) mode applicability for Hot Leg Temperature Wide Range with respect to ESFAS function B.2.e (Startup and Shutdown Isolation on High SG Level for Period of Time).

The EPR GTS, Table 3.3.1-1, specifies Mode 3(e) for Hot Leg Temperature WR. Hot Leg Temperature WR is used in Permissive P13. The P13 permissive signal (Figure 7.2-32) enables/disables ESFAS Function B.2.e (Figure 7.3-16) as designated in the EPR GTS, Table 3.3.1-2. Table 3.3.1-2 specifies Modes 1, 2(j) and 3(j) for ESFAS Function B.2.e. Determine Hot Leg Temperature WR mode applicability required to support ESFAS Function B.2.e, and correct any potential discrepancies. Include any discussions necessary to ensure a clear understanding of the mode applicability.

This additional information is needed to ensure the accuracy and completeness of the EPR GTS and Bases, as well as the operability of permissive instrumentation necessary to support the associated ESFAS function in the applicable modes.

Response to Question 16-177:

For a discussion of Mode requirements for Permissive P13, see the Response to Question 16-138.

For a discussion of Mode requirements for the Hot Leg Temperature (Wide Range) sensors, see the Response to Question 16-144.

FSAR Impact:

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

Question 16-178:

LCO 3.3.1, Protection System

Provide a technical justification for the omission of the Steam Generator Isolation function from the EPR GTS, Table 3.3.1-2, and the corresponding Bases.

In accordance with the EPR FSAR, during a SG tube rupture, partial cooldown is initiated to depressurize the RCS to the point where Medium Head Safety Injection (MHSI) becomes effective. The SG containing the tube rupture is isolated after the partial cooldown is initiated if a high SG level or high main steam activity is detected. This is done to prevent the release of contaminated fluid from the affected SG, and to prevent other water sources from adding to the uncontrolled SG level increase. SG isolation consists of the following ESF actuations/actions:

a. “MSRT opening setpoint increase”

b. “MSIV, MSIV bypass and SG blowdown closure”

c. “MFW and SSS Isolation”

d. “EFWS isolation”

The EPR GTS, Table 3.3.1-2, Section B (Engineered Safety Features Actuation System Signals), and the corresponding EPR Bases do not include the Steam Generator Isolation function or the main steam activity sensors that input directly into the SG isolation logic.

On the bases of this information, provide additional technical justification for omission of the Steam Generator Isolation function and associated main steam activity sensors or revise the EPR GTS, Table 3.3.1-2, the corresponding Bases, and the EPR FSAR accordingly to ensure consistency among these documents and sufficient detailed information to adequately explain this function.

This additional information is needed to ensure the accuracy, completeness, and consistency amongst the EPR GTS, Bases and FSAR.

Response to Question 16-178:

The scope of the U.S. EPR Technical Specifications satisfies the four criterion of 10 CFR 50.36 "Technical specifications." The Protection System (PS) Technical Specifications satisfy 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 discussed in the NRC Policy Statement on Technical Specification Improvements for Nuclear Power Plants:

> "The primary success path for a particular mode of operation does not include backup and diverse equipment (e.g., rod withdrawal block which is a backup to the average power range monitor high flux trip in the startup mode, safety valves which are backup to low temperature overpressure relief valves during cold shutdown)."

The analysis of a steam generator tube rupture (SGTR) is provided U.S. EPR FSAR Tier 2, Section 15.6.3. It states:

> "Radiation monitors located in the steam lines and blowdown lines detect increased activity soon after the break occurrence and identify the affected SG. Although high activity in a steam line (or high SG level) in combination with the initiation of partial cooldown isolates the affected SG, this function is not credited in the SGTR analysis."

There are two scenarios considered in the SGTR analysis:

1. Charging pumps are not operating - In combination with loss of offsite power, the safety injection system (SIS) signal also automatically starts the emergency feedwater system (EFWS), which subsequently automatically isolates the steam generator (SG) blowdown lines. If not already initiated automatically by the combination of high activity or high SG level in combination with a partial cooldown, the operator isolates the affected SG. To isolate the SG, the operator closes its main steam isolation valve, resets its main steam relief train setpoint high, and closes its main feedwater system (MFWS) and EFWS isolation valves. This action terminates the radiological release from the affected SG.
2. Charging pumps are operating - With the charging pumps available to offset the break flow, the PS does not detect the loss of coolant. In this case, the operator trips the reactor once the event is detected and institutes the SGTR mitigation procedure:

Both scenarios credit manual operator action to mitigate the SGTR.

The engineered safety features (ESFs) used in the accident analysis is delineated in U.S. EPR FSAR Tier 2, Table 15.0-8. The table notes that the accident analysis does not credit automatic actions based on main steam line activity and that the SGTR mitigation features are credited in the accident analysis as manual operator actions. Therefore, neither the Main Steam Line Radiation monitors nor the SG Isolation function satisfy Criterion 3 for inclusion in the PS Technical Specifications.

FSAR Impact:

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

Question 16-179:

LCO 3.3.1, Protection System

Provide additional information needed to adequately explain if the SG isolation function is bypassed below the P13 setpoint consistent with logic Figure 7.3-25.

The EPR FSAR, Section 7.3.1.2.14 (pg 7.3-20), states there is no operating bypass explicitly associated with the SG isolation function. This statement is inconsistent with logic Figure 7.3-25 which identifies Permissive P13 as a functional input into the isolation logic. The SG isolation is bypassed below the P13 setpoint according to the logic. Determine if the bypass function exists and correct any potential discrepancies. Include any discussions necessary to ensure a clear understanding of this function.

The EPR GTS and Bases make no mention of this bypass function. If the SG isolation function is capable of being bypassed, this information will need to be added to both the EPR GTS and Bases.

This additional information is needed to ensure the accuracy, completeness, and consistency amongst the EPR GTS, Bases and FSAR.

Response to Question 16-179:

As discussed in the Response to Question 16-178, the steam generator tube rupture (SGTR) mitigation features are credited in the accident analysis as manual operator actions. Therefore, the Steam Generator (SG) Isolation function does not satisfy Criterion 3 for inclusion in the Protection System (PS) Technical Specifications.

U.S. EPR FSAR Tier 2, Section 7.3.1.2.14 will be revised to reflect the use of Permissive P13 in the SG Isolation function.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 7.3.1.2.14 will be revised as described in the response and indicated on the enclosed markup.

Question 16-180:

LCO 3.3.1, Protection System

Provide the additional information and any necessary changes regarding the EPR GTS, Table 3.3.1-1, (A.6) mode applicability for Cold Leg Temperature Wide Range with respect to ESFAS Function B.11.a (CVCS Charging Line Isolation on High-High Pressurizer Level).

The EPR GTS, Table 3.3.1-1, specifies Modes 1 and 2(c) for Cold Leg Temperature WR. Cold Leg Temperature WR is used in Permissive . The P17 permissive signal (Figure 7.2-36) enables/disables ESFAS Function B.11.a (Figure 7.3-21) as designated in Table 3.3.1-2. Table 3.3.1-2 specifies Modes 1, 2 and 3 for ESFAS Function B.11.a. Determine Cold Leg Temperature WR mode applicability required to support ESFAS Function B.11.a and correct any potential discrepancies. Include any discussions necessary to ensure a clear understanding of the mode applicability.

This additional information is needed to ensure the accuracy and completeness of the EPR GTS and Bases, as well as the operability of permissive instrumentation necessary to support the associated ESFAS function in the applicable modes.

Response to Question 16-180:

For a discussion of Mode requirements for Permissive P17, see the Response to Question 16-138.

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

The Cold Leg Temperature (Wide Range) sensors provide input to the:

- High Core Power Level reactor trip: This trip is assumed in the safety analysis to be operable in MODE 1 and in MODE 2 when the reactor power level is above 10^{-5} percent Rated Thermal Power (RTP) (Permissive P5 validated).
- Low Saturation Margin reactor trip: This trip is also assumed in the safety analysis to be operable in MODE 1 and in MODE 2 when the reactor power level is above 10^{-5} percent RTP (Permissive P5 validated).
- CVCS Charging Line Isolation on ADM at Standard Shutdown Conditions function (reactor coolant pump (RCP) operating) function: This function is assumed in the safety analysis to be operable in MODES 3, 4, and 5 with a RCP in operation.
- Permissive P17: As discussed in response to Question 16-138, this function supports low temperature overpressure protection (LTOP) and is required to be operable when required by LCO 3.4.11.

Therefore, the Cold Leg Temperature (Wide Range) sensors are required to be operable in MODE 1, MODE 2 with Permissive P5 validated, MODES 3, 4, 5 with a RCP in operation, and when the Pressurizer Safety Relief Valve (PSRV) Actuation functions are required to be operable as specified in LCO 3.4.11.

The corresponding changes to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification section 3.3.1 "Protection System (PS)" and Technical Specification section 3.3.1 Bases are provided in Response to Question 16-138.

FSAR Impact:

See the Response to Question 16-138.

Question 16-181:

LCO 3.3.1, Protection System

Provide a technical justification for omission of the ESFAS function for “CVCS Charging Isolation on Pressurizer Level above the Max1p setpoint” from the EPR GTS, Table 3.3.1-2, and Bases.

The EPR FSAR, Section 7.3.1.2.10, states that the CVCS Charging isolation is performed in two stages with staggered setpoints. The following initiating conditions are used to perform this two-stage CVCS isolation:

a. “Pressurizer Level > Max1p”

b. “Pressurizer Level > Max2p”

If two out of four level measurements exceed the Max1p setpoint, the normal and auxiliary pressurizer spray lines are isolated. If two out of four level measurements exceed the Max2p setpoint, the CVCS charging flow is isolated as well (ESFAS function B.11.a).

The EPR FSAR information regarding the CVCS Charging isolation functions is not consistent with omission of the ESFAS function for “CVCS Charging Isolation on Pressurizer Level above the Max1p setpoint” from the EPR GTS, Table 3.3.1-2 and Bases. Determine if omission of this function is warranted and correct any potential discrepancies. Include any discussions necessary to ensure a clear understanding of this function.

The EPR GTS and Bases make no mention of the “CVCS Charging isolation on Pressurizer Level above the Max1p setpoint” function. If omission of the function is unwarranted, then information will need to be added to the EPR GTS and Bases. Include any discussions necessary to ensure a clear understanding of this function.

This additional information is needed to ensure the accuracy, completeness, and consistency amongst the EPR GTS, Bases and FSAR.

Response to Question 16-181:

The scope of the U.S. EPR Technical Specifications satisfies the four criterion of 10 CFR 50.36 "Technical specifications." The protection system (PS) Technical Specifications satisfy 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 discussed in the NRC Policy Statement on Technical Specification Improvements for Nuclear Power Plants:

> "The primary success path for a particular mode of operation does not include backup and diverse equipment (e.g., rod withdrawal block which is a backup to the average power range monitor high flux trip in the startup mode, safety valves which are backup to low temperature overpressure relief valves during cold shutdown)."

The applicable accident analyses that utilize Chemical and Volume Control System (CVCS) Isolation on High Pressurizer Level function are discussed in U.S. EPR FSAR Tier 2, Section 15.5.1 "Inadvertent Operation of ECCS or EBS." The engineered safety features (ESFs) used in the accident analysis are also delineated in U.S. EPR FSAR Tier 2, Table 15.0-8. The table notes that the accident analysis only credits the CVCS Charging Line Isolation on Pressurizer Level greater than MAX2p.

Therefore, the CVCS Charging Line Isolation on Pressurizer Level above the Max1p setpoint function does not satisfy Criterion 3 for inclusion in the Technical Specifications.

FSAR Impact:

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

Question 16-182:

LCO 3.3.1, Protection System

Provide a technical justification for omission of the ESF Function for “CVCS Isolation on Anti-Dilution Mitigation (ADM) at Power Operation” from the EPR GTS, Table 3.3.1-2 and Bases.

In accordance with the EPR FSAR, an on-line calculation of the boron concentration in the RCS is performed during power operation based on the boron concentration measurements in the CVCS charging line and the measured CVCS charging flow. The calculated boron concentration is compared to a fixed setpoint corresponding to the critical boron concentration of the core at hot zero power with the highest worth rod not inserted.

The EPR FSAR information regarding the CVCS Isolation for Anti-Dilution functions is not consistent with omission of the ESFAS function for “CVCS Isolation on Anti-Dilution Mitigation (ADM) at Power Operation” from the EPR GTS, Table 3.3.1-2 and Bases. Determine if omission of this function is warranted and correct any potential discrepancies. Include any discussions necessary to ensure a clear understanding of this function.

The EPR GTS and Bases make no mention of the “CVCS Isolation on ADM at Power Operation” Function. If omission of the function is unwarranted, then information will need to be added to the EPR GTS and Bases. Include any discussions necessary to ensure a clear understanding of this function.

This additional information is needed to ensure the accuracy, completeness, and consistency amongst the EPR GTS, Bases and FSAR.

The corresponding changes to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification section 3.3.1 "Protection System (PS)" and Technical Specification section 3.3.1 Bases are provided in Response to Question 16-138.

Response to Question 16-182:

See the Response to Question 16-138.

Question 16-183:

LCO 3.3.1, Protection System

Provide the additional information and any corrections necessary to clarify the intent of the EPR GTS, Table 3.3.1-1 and Table 3.3.1-2 footnote applicability for RCP operation with respect to "CVCS Isolation on ADM at Shutdown Condition" ESFAS Functions.

The EPR GTS, Table 3.3.1-1, sensors A.2, A.3, A.4. A.6 and A.19 support ESFAS Functions B.11.b and B.11.c. The footnotes from Table 3.3.1-1 and 3.3.1-2 that are associated with Reactor Coolant Pump operation are not applied consistently and appear to conflict in several cases. Specific examples include the following:

a. The EPR GTS, Table 3.3.1-1, A.6 (Cold Leg Temperature WR), specifies Footnote (b) for Mode 6 (Refueling with one or more reactor vessel head closure bolts less than fully tensioned). Footnote (b) states that "with three or more reactor coolant pumps (RCPs) in operation." It is highly unlikely that there would be three or more RCPs in operation in Mode 6. The EPR GTS, Table 3.3.1-1, A.2 (Boron Concentration) and A.3 (Boron Temperature) both do not include Footnote (b) during Mode 6 operation.

b. The EPR GTS, Table 3.3.1-1, A.6 (Cold Leg Temperature WR), does not specify Footnote (b) during Modes 3, 4, and 5, however, Footnote (b) is specified during Modes 3 and 4 for sensors A.2 and A.3, and during Modes 3, 4, and 5 for sensor A.4. Aside from the fact that Footnote (b) is not applied uniformly with respect to sensors that support ESFAS Functions B.11.b and B.11.c, an operational situation could develop requiring the operability of sensors A.2, A.3, and A.4 during Modes 3(b), 4(b), and 5(b) with two or less RCPs in operation.

c. The EPR GTS, Table 3.3.1-1, A.19 (RCP speed sensor) mode applicability is $\geq$ 10 percent RTP. Sensor A.19 Mode applicability should include Modes 3, 4, and 5 (and possibly Mode 6) to align with the applicable modes and footnotes specified for sensors A.2, A.3, and A.4.

d. The EPR GTS, Table 3.3.1-2, Function B.11.c does not specify Footnote (o) during Mode 3 operations. However, EPR Bases, B.11.c (pg B 3.3.1-46), states "MODE 3, with three or more RCPs in operation."

Provide clarification associated with footnote applicability. Explain why the footnotes are not applied consistently. Provide the changes needed to ensure that the referenced information is made consistent and clearly stated in the EPR GTS and Bases.

This additional information is needed to ensure the accuracy, completeness and consistency of the EPR GTS and Bases.

Response to Question 16-183:

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.

For a discussion of Mode requirements for Cold Leg Temperature (Wide Range) sensors, see the Response to Question 16-180.

The Boron Concentration and Boron Temperature sensors provide input to multiple functions, including:

- The Chemical and Volume Control System (CVCS) Charging Line Isolation on Anti-Dilution Mitigation (ADM) at Shutdown Conditions (reactor coolant pump (RCP) not operating) function: This function is assumed in the safety analysis to be operable in MODES 3, 4, 5, and 6 with no RCPs in operation (Permissive P7 validated).
- The CVCS Charging Line Isolation on ADM at Standard Shutdown Conditions function: This function is assumed in the safety analysis to be operable in MODES 3, 4, and 5 with RCPs in operation (Permissive P7 inhibited).
- The CVCS Charging Line Isolation on ADM at Power function: This function is assumed in the safety analysis to be operable in MODES 1 and 2.

Therefore, the Boron Concentration and Boron Temperature sensors are required to be operable in MODES 1, 2, 3, 4, and 5 and in MODE 6 with no RCPs in operation (Permissive P7 validated).

Note that the determination of whether or not "RCPs are running" is now made using Permissive P7. The revised Permissive P7 uses the RCP Current sensors for input; not the RCP Speed sensors. For a discussion of Mode requirements for RCP Current sensors, see the Response to Question 16-150.

The RCP Speed sensors provide input to multiple functions, including:

- The five Low Departure from Nucleate Boiling Ratio (DNBR) reactor trips: These trips are assumed in the safety analysis to be operable in MODE 1 when the reactor power level is above 10 percent Rated Thermal Power (RTP) (Permissive P2 validated).
- The Low RCP Speed reactor trip: This trip is assumed in the safety analysis to be operable in MODE 1 when the reactor power level is above 10 percent RTP (Permissive P2 validated).

Therefore, the RCP Speed sensors are required to be operable in MODE 1 when Permissive P2 is validated.

The corresponding changes to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification section 3.3.1 "Protection System (PS)" and Technical Specification section 3.3.1 Bases are provided in Response to Question 16-138.

FSAR Impact:

See the Response to Question 16-138.

Question 16-186:

LCO 3.3.1, Protection System

Provide the additional information and any corrections necessary to clarify and correct a potential discrepancy identified in the EPR FSAR, ESFAS Function B.11.b and B.11.c Anti-Dilution Mitigation Logic Diagram.

The EPR FSAR, ESFAS Function B.11.b and B.11.c Anti-Dilution Mitigation Logic Diagram, Figure 7.3-22, appears to have a missing electrical connection tie between the “Temperature Compensation of Boron Measurement” block and the “Calculation of Reactor Coolant Boron Concentration Variable Coolant Mass” block. Verify the overall correctness of Figure 7.3-22. Correct the logic diagram as necessary. If it is determined that an electrical connection tie is not needed between the “Temperature Compensation of Boron Measurement” block and the “Calculation of Reactor Coolant Boron Concentration Variable Coolant Mass” block, provide an explanation as to how the “Reactor Coolant Boron Concentration Variable Coolant Mass” can be calculated without a “Temperature Compensated Boron Measurement” input.

This additional information is needed to ensure the accuracy, and completeness of the EPR FSAR.

Response to Question 16-186:

U.S. EPR FSAR Tier 2, Figure 7.3-22—Anti-Dilution will be revised to show an arrow originating at the Temperature Compensation of Boron Measurement Block function and ending (proving input) to the calculation of Reactor Coolant Boron Concentration (Variable Coolant Mass) block.

FSAR Impact:

U.S. EPR FSAR Tier 2, Figure 7.3-22 will be revised as described in the response and indicated on the enclosed markup.

Question 16-189:

LCO 3.3.1, Protection System

Provide additional information needed to identify the mode applicability for sensors in the EPR GTS, Table 3.3.1-1 (including P12 and P15 permissive instrumentation) associated with ESFAS Function B.4. Provide any necessary changes to the EPR, Table 3.3.1-1, and Bases Section B.4, to include the required sensor and mode applicability information.

The EPR GTS, Table 3.3.1-2, specifies Modes 1, 2 and 3 for ESFAS Function B.4, RCP Trip on Low Delta P across RCP with SIS Actuation. The EPR Bases, Section B.4 (pg B 3.3.1-35) does not specify the required sensors, including sensor modes of applicability necessary to support the SIS Actuation function.

SIS Actuation Functions consist of B.3.a (SIS Actuation on Low Pressurizer Pressure) and B.3.b (SIS Actuation on Low Delta Psat). SIS function, supporting instrumentation, and associated modes of applicability are as follows:

> The EPR GTS, Table 3.3.1-2, Function B.3.a, SIS Actuation on Low Pressurizer Pressure, currently specifies Modes 1, 2, and 3(h).
>
> The EPR GTS, Table 3.3.1-1, Pressurizer Pressure NR (A.14) currently specifies Modes 1, 2 and 3(h). Pressurizer Pressure NR (A.14) would be required in Modes 1, 2 and 3 for Permissive P12 to support Function B.3.a and also to support Function B.3.a directly (sensor inputs). Pressurizer Pressure NR instrumentation operability should extend both above and below 2005 psia in Mode 3 in order to ensure Function B.4 is not compromised with respect to Function B.3.a.
>
> The EPR GTS, Table 3.3.1-2, Function B.3.b, SIS Actuation on Low Delta Psat, currently specifies Mode 3(k).
>
> The EPR GTS, Table 3.3.1-1, Pressurizer Pressure NR (A.14) currently specifies Modes 1, 2 and 3(h). Pressurizer Pressure NR (A.14) would be required in Mode 3 for Permissive P12 to support Function B.3.b. Pressurizer Pressure NR instrumentation operability should extend both above and below 2005 psia in Mode 3 in order to ensure Function B.4 is not compromised with respect to Function B.3.b.
>
> The EPR GTS, Table 3.3.1-1, Hot Leg Temperature WR (A.10) instrumentation currently specifies Mode 3(e). Hot Leg Temperature WR (A.10) would be required in Mode 3(e) for Permissive P15 to support Function B.3.b and also to support Function B.3.b directly (sensor inputs).
>
> The EPR GTS, Table 3.3.1-1, Hot Leg Pressure WR (A.8) currently specifies Modes 1, 2, 3 and (d). Hot Leg Pressure WR would be required in Mode 3(e) for Permissive P15 to support Function B.3.b and also to support Function B.3.b directly (sensor inputs).
>
> The EPR GTS, Table 3.3.1-1, RCP Current (A.17) currently specifies Modes 1, 2, and 3. RCP Current (A.17) would be required in Mode 3(e) for Permissive P15 to support function B.3.b.

This additional information is needed to ensure the accuracy, completeness and consistency within the EPR GTS and Bases, as well as the operability of all sensors (including permissive instrumentation) necessary to support Function B.4 in the applicable modes.

Response to Question 16-189:

This issue is analogous to the issue regarding the Containment Isolation (Stage 1) on Safety Injection System (SIS) Actuation function discussed in response to Question 16-153.

The Reactor Coolant Pump (RCP) Trip on Low Delta P across RCP with SIS Actuation function is assumed in the safety analysis to be operable in MODES 1, 2, 3, and 4.

There are three SIS Actuation functions:

- SIS Actuation on Low Pressurizer Pressure function: This function is assumed in the safety analysis to be operable in MODES 1 and 2, and in MODE 3 above the P12 Permissive. Input is provided by the Pressurizer Pressure (Narrow Range (NR)) sensor.
- SIS Actuation on Low Delta Psat function: This function is assumed in the safety analysis to be operable in MODE 3 below the P12 Permissive and in MODE 4 with the RCPs operating (Permissive P15). Inputs are provided by the Hot Leg Pressure (Wide Range (WR)) and Hot Leg Temperature (WR) sensors.
- SIS Actuation on Low Reactor Coolant System (RCS) Loop Level function: This function is assumed in the safety analysis to be operable in MODE 4 with the RCPs not operating (Permissive P15) and in MODES 5 and 6. Input is provided by the RCS Loop Level sensors.

Sensor operability is described separately in the Protection System (PS) Bases for each of the three SIS functions. For the purposes of the RCP Trip on Low Delta P across RCP with SIS Actuation function description in the Technical Specifications Bases, SIS is treated as a signal and the individual contributing sensors are not identified in the Bases for this function. This is analogous to the Turbine Trip on Reactor Trip function. There would be no value added in duplicate listings of the sensors associated with reactor trips in the Bases for the Turbine Trip on Reactor Trip function. However, the Bases will be clarified to refer to the SIS Actuation functions that are required to be operable to support the RCP Trip on Low Delta P across RCP with SIS Actuation function.

For a discussion of Mode requirements for Permissives P12 and P15, see the Response to Question 16-138.

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

For a discussion of Mode requirements for the Pressurizer Pressure (Narrow Range) sensors, see the Response to Question 16-147.

For a discussion of Mode requirements for the Hot Leg Temperature (WR) sensors, see the Response to Question 16-144.

For a discussion of Mode requirements for the Hot Leg Pressure (WR) sensors, see the Response to Question 16-145.

For a discussion of Mode requirements for the RCP Current sensors, see the Response to Question 16-150.

The corresponding changes to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification section 3.3.1 "Protection System (PS)" and Technical Specification section 3.3.1 Bases are provided in Response to Question 16-138.

FSAR Impact:

See the Response to Question 16-138.

Question 16-190:

LCO 3.3.1, Protection System

Provide additional information and any necessary changes to clarify and correct potential inconsistencies associated with EPR Bases Table B 3.3.1-1. Provide a description of the purpose, scope, and proposed use of the table in the Bases.

The EPR Bases, Table B 3.3.1-1, Protection System (PS) Functional Dependencies, was apparently compiled to identify functions with multiple inputs and functions that do not have four divisions of Actuation Logic Units (ALUs). The table may be used as an aid to assess divisional operability in applying EPR GTS, Table 3.3.1-2 Footnote (a), which states that "[a] division is OPERABLE provided: a) the minimum sensors required for functional capability for all sensors providing input to the Trip/Actuation Function are OPERABLE; and b) the associated APU is OPERABLE." This information is relevant and needs to be included in the text of the Bases.

Provide a technical justification and the necessary corrections for the following apparent inconsistencies:

a. The EPR Bases (pgs. B 3.3.1-79, 80), regarding Reactor Coolant Pump Speed, specifies "1 of 2" sensors per division. The EPR GTS, Table 3.3.1-1 (A.19), specifies a total of 4 RCP Speed sensors (one per pump). EPR FSAR Figure 7.2-12 is consistent with Section 7.2.1.2.7 of the FSAR which states that "[t]he loss of four RCPs is detected based on measurements of RCP speed (one measurement per pump)."

b. The EPR Bases (pg. B 3.3.1-82), regarding Hot Leg Temperature NR instrumentation associated with the "Low Saturation Margin" Reactor Trip Function, does not specify the minimum number of sensors required for functional capability. However, EPR Bases Table B 3.3.1-1, Item 4 (pg B 3.3.1-81), "High Core Power Level" Reactor Trip, specifies "3 of 4" sensors per division, indicating a total of 16 sensors (4 per division). The EPR GTS, Table 3.3.1-1 (A.9), specifies a minimum of 3 per division.

c. The EPR Bases (pgs. B 3.3.1-79, 80, 81, 82), regarding RCS Loop Flow, specifies "3 of 4" sensors. EPR FSAR Figures 7.2-10 and 7.2-11, RCS Loop Flow Logics, show four different loop flow sensors (one for each of the RCS loops) per division, not four flow sensors within the same loop per division. The EPR GTS, Table 3.3.1-1 (A.20), specifies a minimum of "3 sensors per loop."

   These inconsistencies are a potential problem if the "minimum number of sensors required for functional capability" is based on "3 of 4" loop flow sensors within the same division. If two RCS Loop Flow sensors within the same loop (different divisions) became inoperable, the "Minimum Required for Functional Capability" specified in the EPR GTS, Table 3.3.1-1, would be less than the three required (resulting in entry into Condition "J"). While this configuration would satisfy the "3 of 4" minimum DIVISIONAL requirement of Bases Table B 3.3.1-1, it would be non-conservative with respect to the intent of the table. If the intent is to interpret/evaluate "3 of 4" as the minimum sensors required for functional capability for all sensors providing input to the Trip Function (all divisions across the board as opposed to individual divisions), then the integrity of the table is maintained. The "3 of 4" logic as currently presented in the EPR GTS, Table B 3.3.1-1, is not clear with respect to the RCS Loop Flow Function.

d. The EPR Bases (pg. B 3.3.1-84), regarding RCP Current, specifies “2 of 3” sensors. EPR FSAR Figure 7.2-27, RCP Current Logic, shows three different current sensors (each associated with a different RCP) per division, not three current sensors for the same pump per division. The EPR GTS, Table 3.3.1-1 (A.17), specifies a minimum of “2 sensors per RCP.”

   These inconsistencies are a potential problem if the “minimum number of sensors required for functional capability” is based on “2 of 3” RCP current sensors within the same division. If two RCP Current sensors associated with the same pump (different divisions) became inoperable, the “Minimum Required for Functional Capability” specified in the EPR GTS, Table 3.3.1-1, would be less than the two required (resulting in entry into Condition “M”). While this configuration would satisfy the “2 of 3” minimum DIVISIONAL requirement of Bases Table B 3.3.1-1, it would be non-conservative with respect to the intent of the table. If the intent is to interpret/evaluate “2 of 3” as the minimum sensors required for functional capability for all sensors providing input to the trip function (all divisions across the board as opposed to individual divisions), then the integrity of the table is maintained. The “2 of 3” logic as currently presented in the EPR GTS, Table B 3.3.1-1, is not clear with respect to the RCP Current Function.

e. The EPR Bases, Table B 3.3.1-1 (pg B 3.3.1-84), regarding ESFAS Function B.11.a, shows two divisions of ALUs (1 and 4). It appears that there are actually four divisions of ALUs associated with ESFAS Function B.11.a, Divisions 2 and 3 to isolate the Normal Pressurizer Spray Lines, and Divisions 1 and 4 to isolate the Auxiliary Spray Lines and the Charging Line. Verify Division 2 and 3 ALU applicability with respect to ESFAS Function B.11.a and either provide a technical justification for not including these ALUs in Bases Table 3.3.1-1 or revise the table accordingly. In addition, a value of “2” is specified in the EPR Bases, Table B 3.3.1-1, under the column “Complete Divisions For Functional Capability-Sensors / Processors.” Two appears to be the correct number for ESFAS Function B.11.a with respect to ALU functional assignments. However, an informational note should be added to the table to clarify the fact that this column value applies to the individual pairing of ALUs within either divisions “1 and 4” or “2 and 3”.

f. The EPR Bases, Table B 3.3.1-1 (pages B 3.3.1-79, 80), specifies “One Remote Acquisition Unit per division with a required OPERABLE SPND.” This information does not appear to be consistent with EPR FSAR Logic Figures 7.2-2 and 7.2-7. In accordance with the Logics, RAUs in each division acquire one-fourth (18) of the total SPND measurements and distribute those measurements to APU in all four divisions allowing for an accurate calculation over the whole reactor core in each division. If this information is correct, the table should read “One Remote Acquisition Unit per division with the required OPERABLE SPNDs.”

This additional information is needed to ensure the accuracy, completeness and consistency of the EPR Bases.

Response to Question 16-190:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification Bases Table B 3.3.1-1 "Protection System (PS) Functional Dependencies," identifies functions and Permissives that could be impacted by the cumulative failures of different sensors or signal processors in different divisions and to explicitly note those functions that do not have four divisions of Actuator Logic Units (ALU). In general, when a sensor becomes inoperable, the Acquisition and Processing

Unit (APU) that receives the signal from the sensor declares the functions or permissives supported by that sensor to be invalid. This is not true for Self-Powered Neutron Detectors (SPND) and with other parameters where multiple sensors are provided in a division to monitor the same variable (e.g., the Hot Leg Temperature (Narrow Range) sensors which provide input to the High Core Power Level and Low Saturation Margin reactor trips). The ALUs change the voting logic to reflect the loss of that division when an inoperable sensor results in the invalidation of a function(s) or permissive in a division. U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification Bases Table 3.3.1-1 may be used as an aid to assess divisional operability in applying U.S. EPR GTS, U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification Table 3.3.1-2 Footnote (a), which states that “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.” U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification Table 3.3.1-2 Footnote (a) and the Bases will be revised to incorporate this clarification.

As discussed in the Response to Question 16-138, Permissives, including their associated sensors and signal processors, that enable a RT or ESF function when the Permissive is validated are part of a primary success path of a safety sequence analysis. Therefore, some specific Permissives are within the scope of 10 CFR 50.36, Criterion 3, and will be included in the Technical Specifications. U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification Bases Table B 3.3.1-1 "Protection System (PS) Functional Dependencies," will be updated to reflect the new dependencies associated with the addition of the Permissives and their associated sensors and signal processors. With regards to the other specific items identified in the question:

a) U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification Bases Table B 3.3.1-1 will be revised to reflect the use of one RCP Speed sensor per division,

b) Three Hot Leg Temperature (Narrow Range) sensors from each hot leg are required to support the High Core Power Level and Low Saturation Margin reactor trips. With less than three validated temperature measurements, the loop is invalidated and the voting logic is degraded. U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification Bases Table B 3.3.1-1, for the Low Saturation Margin reactor trip, will be revised to specify the minimum number of sensors required for functional capability.

c) U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification Table 3.3.1-1 and U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification Bases Table B 3.3.1-1 will be revised to specify that three RCS Flow sensors per division and per loop are required to maintain functional capability.

d) As shown in both U.S. EPR FSAR Tier 2, Figure 7.2-34 "Permissive P15" and U.S. EPR FSAR Tier 2, Figure 7.3-27 "RCP Trip", each PS division acquires three RCP current measurements (from different pumps) and compares each to a setpoint (50 percent no load current). However, the results of all 12 setpoint comparisons are used in all four divisions in two-out-of -three voting for each pump. (NOTE: If two RCP Current sensors associated with the same pump fail, the voting logic will default to a pump stopped signal.) When signals are generated for all four pumps, a delay time is started. After the delay time has expired, and the pressure and temperature conditions are satisfied, the operator is prompted to manually validate permissive P15. Requiring two out of three current sensors per pump for functional capability in U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification

Table 3.3.1-1 is conservative. However, U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification Bases Table B 3.3.1-1 will be revised to define which RCP Current sensors are initially acquired by each PS division.

e) The scope of the U.S. EPR Technical Specifications satisfies the four criteria of 10 CFR 50.36 "Technical specifications". The Protection System Technical Specifications satisfy 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 discussed in the NRC Policy Statement on Technical Specification Improvements for Nuclear Power Plants:

> "The primary success path for a particular mode of operation does not include backup and diverse equipment (e.g., rod withdrawal block which is a backup to the average power range monitor high flux trip in the startup mode, safety valves which are a backup to low temperature overpressure relief valves during cold shutdown)."

The engineered safety features (ESFs) used in the accident analysis is delineated in U.S. EPR FSAR Tier 2, Table 15.0-8. Chemical and Volume Control System (CVCS) Charging Line Isolation on Pressurizer Level > Max2p is credited in the accident analysis. CVCS Charging Line Isolation on Pressurizer Level > Max1p is not credited.

CVCS Charging Isolation is shown on U.S. EPR FSAR Tier 2, Figure 7.3-21. As shown, CVCS Charging Line Isolation on Pressurizer Level > Max2p is only processed by ALUs in Divisions 1 and 4. U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification Table 3.3.1-1 states the Minimum Required ALUs for Functional Capability is "3 per division, 4 divisions". This is accurate for the CVCS Charging Line Isolation on High-High Pressurizer Level function. If either Division 1 or Division 4 ALUs were inoperable, a single failure in the remaining divisions ALUs would not prevent the redundant ALU in that division from performing the safety function.

f) The note regarding RAUs in U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification Bases Table 3.3.1-1 will be revised to read: "Two Remote Acquisition Units per division." This will preclude a single failure of an RAU in a division from impacting the functional capability of the associated reactor trip functions.

The corresponding changes to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification section 3.3.1 "Protection System (PS)" and Technical Specification section 3.3.1 Bases are provided in Response to Question 16-138.

FSAR Impact:

See the Response to Question 16-138.

Question 16-191:

LCO 3.3.1, Protection System

Provide the technical justifications and necessary corrections for apparent inconsistencies in the EPR GTS, Tables 3.3.1-1 and 3.3.1-2.

CONDITION assignments appear to have been applied inconsistently throughout Tables 3.3.1-1 and 3.3.1-2 of the EPR GTS. The Required Actions associated with the Conditions specified do not always encompass all modes of applicability and appear to conflict in a number cases as indicated in the following examples:

a. The EPR GTS, Table 3.3.1-1 (A.15), Radiation Monitor – Containment High Range, specifies Condition “K” which requires being in MODE 3 and “Opening” the reactor trip breakers within 6 hours. Function A.15 modes of applicability are Modes 1, 2, 3, 4. Required Action for Condition “K” does not include Mode 4 operations. In addition, Mode 4 operation is not required for either the Reactor Trip Circuit Breakers or Reactor Trip Circuit Breaker Position Indication in accordance with the EPR GTS, Tables 3.3.1-1, D.2 and 3.3.1-1, A.21 respectively.

b. The EPR GTS, Table 3.3.1-1 (A.16), Radiation Monitor – Control Room HVAC Intake Activity, specifies Condition “N” while in Modes 1, 2, 3, 4 and Condition “R” while in Modes 5, 6(i). Required Action for Condition “R” requires declaring both Control Room Emergency Filtration trains inoperable (immediately). It would appear that declaration of CREF inoperability (Condition “R”) is applicable in Modes 1, 2, 3 and 4 as well.

c. The EPR GTS, Table 3.3.1-2 (B.13), Control Room HVAC Reconfiguration to Recirculation Mode on High Intake Activity, specifies Condition “N” while in Modes 1, 2, 3, 4 and Condition “R” while in Modes 5, 6(r). Required Action for Condition “R” requires declaring both Control Room Emergency Filtration trains inoperable (immediately). It would appear that declaration of CREF inoperability (Condition “R”) is applicable in Modes 1, 2, 3 and 4 as well.

d. The EPR GTS, Table 3.3.1-1 (C.3), Actuation Logic Units, specifies Condition “N” while in Modes 1, 2, 3, 4 and Condition “T” in Modes 5, 6(i). Required Action for Condition “T” requires declaring the associated Actuation Logic Units inoperable (Immediately) and “Opening” reactor trip breakers within 1 hour. It would appear that declaration of ALU inoperability (Condition “T”) is applicable in Modes 1, 2, 3 and 4 as well. In addition, operability is not required for either the Reactor Trip Circuit Breakers or Reactor Trip Circuit Breaker Position Indication in Modes 4, 5 and 6(i) in accordance with the EPR GTS, Tables 3.3.1-1, D.2 and 3.3.1-1, A.21 respectively.

e. The EPR GTS, Table 3.3.1-2, ESFAS functions B.10.a (EDG Start on Degraded Grid Voltage) and B.10.b (EDG Start on LOOP) both specify a Condition of “N/A.” It would appear that Condition “O” is applicable. Condition “O” requires declaring the associated EDG inoperable (Immediately). Condition “O” is specified in the EPR GTS, Table 3.3.1-1 (A.1), for the 6.9 kV Bus Voltage sensors that support both of these functions.

f. The EPR GTS, Table 3.3.1-1 (B.1), Reactor Trip Manual Actuation Switches, specifies Condition “S” while in Modes 4(g), 5(g). Required Action for Condition “S” requires “Opening” the reactor trip breakers within 1 hour. Operability is not required for either the Reactor Trip Circuit Breakers or Reactor Trip Circuit Breaker Position Indication in

Modes 4(g) and 5(g) in accordance with the EPR GTS, Tables 3.3.1-1, D.2 and 3.3.1-1, A.21 respectively.

g. The EPR GTS, Table 3.3.1-2 (B.11.a), CVCS Charging Line Isolation on High-High Pressurizer Level, specifies Condition “M” while in Modes 1, 2, and 3. Required Action for Condition “P” which is specified for ESFAS Functions B.11.b and B.11.c, requires declaring the associated Chemical and Volume Control System isolation valve(s) inoperable (Immediately).” It would appear that declaration of CVCS isolation valve inoperability (Condition “P”) is applicable to ESFAS Function B.11.a as well, in Modes 1, 2 and 3.

This additional information is needed to ensure accuracy, completeness and consistency within the EPR GTS.

Response to Question 16-191:

In response to the potential inconsistencies noted above:

a) The Radiation Monitors - Containment High Range sensors are now assumed in the safety analysis to be operable in MODES 1, 2, 3, and 4. Therefore, the associated Condition will be revised to "N," which requires the plant to be in MODE 3 in 6 hours and MODE 5 in 36 hours.

   For a discussion of Mode requirements for the Reactor Trip Circuit Breaker (RTCB) Position Indication sensors, refer to the response to Question 16-169.

   The Mode requirements for the RTCB and contactors will be revised to reflect the requirements for the Manual Reactor Trip Actuation Switches (i.e., MODES 1 and 2, and MODES 3, 4, and 5 with the RCSL System capable of withdrawing a RCCA or one or more RCCAs not fully inserted).

   As discussed in the response to Question 16-226, U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification Bases 3.3.1 "Protection System (PS)" will be revised to clarify that the Protection System sensors, signal processors, and specified actuation devices that only support reactor trips are not required to be OPERABLE in MODES 4 and 5 when all RCCAs are fully inserted, and only if RCSL System is placed in a configuration whereby inadvertent rod cluster control assembly (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.

b) The Condition for both Control Room HVAC Reconfiguration to Recirculation Mode on High Intake Activity function and the associated Radiation Monitor - Control Room HVAC Intake Activity monitors have been revised to require the associated Control Room Emergency Filtration train be declared inoperable and the Conditions and Required Actions of LCO 3.7.10, "Control Room Emergency Filtration (CREF)" be entered.

c) Refer to the response to Item b, above.

d) The Required Action to immediately declare functions on associated ALUs inoperable and open the RT breakers within one hour will be added to MODES 1, 2, 3, and 4 for the Actuation Logic Units.

   The Reactor Trip Circuit Breakers and Reactor Trip Contactors will be required to be operable in MODES 1 and 2 and in MODES 3, 4, and 5 with the RCSL System capable of withdrawing a RCCA or one or more RCCAs not fully inserted.

e) The Conditions for both the Emergency Diesel Generator (EDG) Start on Degraded Grid Voltage and EDG Start on Loss of Offsite Power functions will be revised to require the operator to immediately declare the associated EDG inoperable and enter the applicable Conditions and Required Actions of LCOs 3.8.1, "AC Sources - Operating," and 3.8.2, "AC Sources - Shutdown".

f) Refer to the response to Item a, above.

g) The isolation of the Chemical and Volume Control System (CVCS) Charging Line on High-High Pressurizer Level is required in MODES 1, 2, 3, and 4 to avoid filling of the pressurizer and subsequent water overflow through the safety valves. This function protects against a CVCS malfunction that causes an increase in RCS water inventory. This CVCS malfunction was not caused by a faulty isolation valve and declaring the isolation valves inoperable would not be appropriate. CVCS charging line flow would be required as some point during the recovery to provide make-up to the shrinking RCS volume during cooldown.

   The Required Action to declare associated CVCS isolation valve(s) inoperable and enter the applicable Conditions and Required Actions of LCO 3.4.9, "Pressurizer" has been revised to require the plant to be in MODE 3 in 6 hours and MODE 5 in 36 hours.

The corresponding changes to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specification section 3.3.1 "Protection System (PS)" and Technical Specification section 3.3.1 Bases are provided in Response to Question 16-138.

FSAR Impact:

See the Response to Question 16-138.

U.S. EPR Final Safety Analysis Report Markups

Table 2.4.1-2—Protection System Automatic Reactor Trip Signals and Input Variables (2 Sheets)

Reactor Trip Signal	Input Variable
High Linear Power Density (HLPD)	Neutron Flux - Self Powered Neutron Detectors
Low Departure from Nucleate Boiling Ratio (DNBR)	Neutron Flux - Self Powered Neutron Detectors
	Cold Leg Temperature (NR)
	Reactor Coolant Pump (RCP) Speed
16-138	RCS Loop Flow
	Rod Control Cluster Assembly Position
	Pressurizer Pressure
High Neutron Flux Rate of Change	Neutron Flux - Power Range Detectors
High Core Power Level	Cold Leg Temperature (WR)
	Hot Leg Pressure (WR)
	Hot Leg Temperature (NR)
	RCS Loop Flow
Low RCP Speed	RCP Speed
Low Loop Flow Rate (two loops)	RCS Loop Flow
Low–Low Loop Flow Rate (one loop)	RCS Loop Flow
Low Doubling Time	Neutron Flux - Intermediate Range Detectors
High Neutron Flux	Neutron Flux - Intermediate Range Detectors
Low Pressurizer Pressure	Pressurizer Pressure (NR)
High Pressurizer Pressure	Pressurizer Pressure (NR)
High Pressurizer Level	Pressurizer Level (NR)
Low Hot Leg Pressure	Hot Leg Pressure (WR)
Steam Generator (SG) Pressure Drop	SG Pressure
Low Steam Generator Pressure	SG Pressure
High Steam Generator Pressure	SG Pressure
Low Steam Generator Level	SG Level (NR)
High Steam Generator Level	SG Level (NR)
High Containment Pressure	Containment Service Compartment Pressure (NR)
	Containment Equipment Compartment Pressure
Low Saturation Margin	Cold Leg Temperature (WR)
	Hot Leg Pressure (WR)
	Hot Leg Temperature (NR)
16-138	RCS Loop Flow
On Safety Injection System (SIS) Actuation	SIS Actuation Signal

Table 2.4.1-3—Protection System Automatic Engineered Safety Feature Signals and Input Variables (2 Sheets)

Engineered Safety Feature Signal	Input Variable
Safety Injection System Actuation	Pressurizer Pressure (NR)
	Hot Leg Pressure (WR)
	Hot Leg Temperature (WR)
	RCS Loop Level
Emergency Feedwater System Actuation	SG Level (WR)
	LOOP Signal
	SIS Actuation signal
Emergency Feedwater System Isolation	SG Level (WR)
	SG Isolation Signal
Partial Cooldown Actuation	SIS Actuation signal
Main Steam Relief Train (MSRT) Opening	SG Pressure
MSRT Isolation	SG Pressure
Main Steam Isolation	SG Pressure
	SG Isolation Signal
Main Feedwater Isolation	SG Level (NR)
	SG Pressure
	RT Breaker Position
	SG Isolation Signal
Containment Isolation Stage 1	Containment Service Compartment Pressure (NR)
	Containment Service Compartment Pressure (WR)
	Containment Equipment Compartment Pressure
	Containment High Range Activity
	SIS Actuation Signal
Containment Isolation Stage 2	Containment Service Compartment Pressure (WR)
CVCS Charging Isolation	Pressurizer Level (NR)
CVCS Isolation for Anti-Dilution	Boron Concentration
16-138	Boron Temperature
	CVCS Charging Flow
	Cold Leg Temperature (WR)

7.2.1.3.4 P6 Permissive

The P6 permissive is representative of core thermal power above a low-power setpoint value (10 percent power) corresponding to the boundary between the operating ranges of the IRDs and the PRDs.

Hot leg pressure (WR) measurements, hot leg temperature (NR) measurements, and cold leg temperature (NR) 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.

This permissive is P-MANU with respect to validation and a P-AUTO with respect to inhibition.

Figure 7.2-28—P6 Permissive Logic illustrates the logic of the P6 permissive.

7.2.1.3.5 P7 Permissive

The P7 permissive defines when reactor coolant pumps (RCPs) are no longer in operation.

~~The RCP speed measurements (one per RCP) are compared to a setpoint (91 percent nominal speed). When two-out-of-four of the measurements are less than the setpoint, the permissive is validated (i.e., indicates that two or more RCPs are turned off).~~

RCP current measurements are each compared to a setpoint (50 percent no load current). When two-out-of-three of the measurements for an individual pump are less than the setpoint, a signal is generated for that pump. When signals are generated for all four pumps, a delay time is started. After the delay time has expired, the permissive is validated.

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This permissive is P-AUTO with respect to validation and inhibition.

Figure 7.2-29—P7 Permissive Logic illustrates the logic for the P7 permissive.

7.2.1.3.6 P8 Permissive

The P8 permissive defines the shutdown state with all rods in (ARI).

Rod cluster control assembly (RCCA) lower end position sensors are acquired in four different electrical divisions. For each division, when all rods in the shutdown banks reach the lower end position, a signal is generated. When two-out-of-four of divisions indicate all rods in, the permissive is validated.

Table 7.2-1—Reactor Trip Variables

Protective Function	Variables To Be Monitored	Range of Variables
High Linear Power Density	Neutron Flux-Self Powered Neutron Detectors	0–590 W/cm
Low DNBR	Neutron Flux-Self Powered Neutron Detectors	0–590 W/cm
	Cold Leg Temperature (NR)	500°F–626°F
	RCP Speed	500 -1300 rpm
	RCS Loop Flow	0-120% NF
	RCCA position	0–100% Insertion
	Pressurizer Pressure	1615-2515 psia
High Neutron Flux Rate of Change	Neutron Flux-Power Range Detectors	0.5–200% NP
High Core Power Level	Cold Leg Temperature (WR)	32°F - 662°F
	Hot Leg Pressure (WR)	15–3015 psia
16-138	Hot Leg Temperature (NR)	536°F -662°F
	RCS Loop Flow	0-120% NF
Low Reactor Coolant Pump Speed	RCP Speed	500 -1300 rpm
Low Loop Flow Rate (two loops)	RCS Loop Flow	0–120% NF
Low-Low Loop Flow Rate (one loop)	RCS Loop Flow	0–120% NF
Low Doubling Time	Neutron Flux-Intermediate Range Detector	5 x 10E-6–60% NP
High Neutron Flux	Neutron Flux-Intermediate Range Detector	5 x 10E-6–60% NP
Low Pressurizer Pressure	Pressurizer Pressure (NR)	1615–2515 psia
High PZR Pressure	Pressurizer Pressure (NR)	1615–2515 psia
High PZR Level	Pressurizer Level	0-100% MR
Low Hot Leg Pressure	Hot Leg Pressure (WR)	15–3015 psia
Steam Generator Pressure Drop	SG Pressure	15–1615 psia
Low Steam Generator Pressure	SG Pressure	15–1615 psia
High Steam Generator Pressure	SG Pressure	15–1615 psia
Low Steam Generator Level	SG Level (NR)	0-100% MR
High Steam Generator Level	SG Level (NR)	0-100% MR
High Containment Pressure	Containment Service Compartment Pressure (NR)	-3 psig to +7 psig
	Containment Equipment Compartment Pressure	-3 psig to +7 psig
Low Saturation Margin	Cold Leg Temperature (WR)	32°F - 662°F
	Hot Leg Pressure (WR)	15–3015 psia
	Hot Leg Temperature (NR)	536°F–662°F
	RCS Loop Flow	0-120% NF

Notes on Table 7.2–1: NP = Nuclear Power, NF = Nominal Flow, MR = Measuring Range

Figure 7.2-24—RT Signal Generation

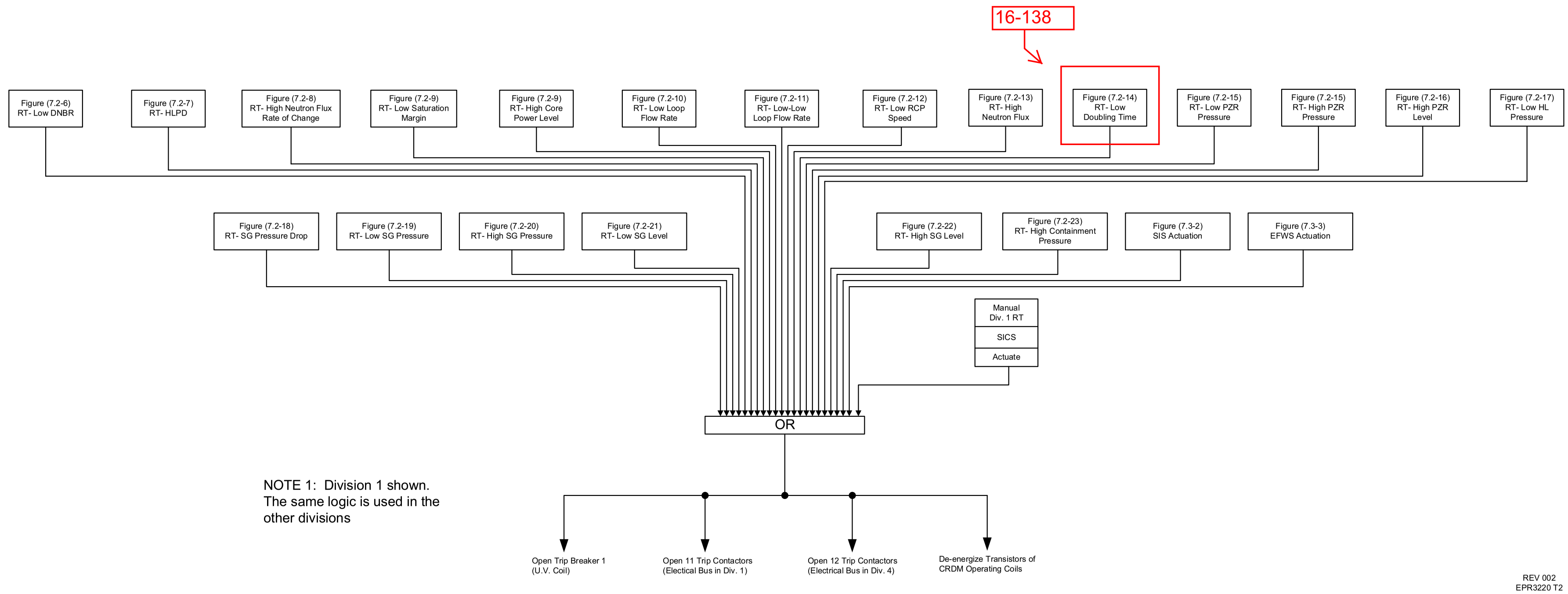

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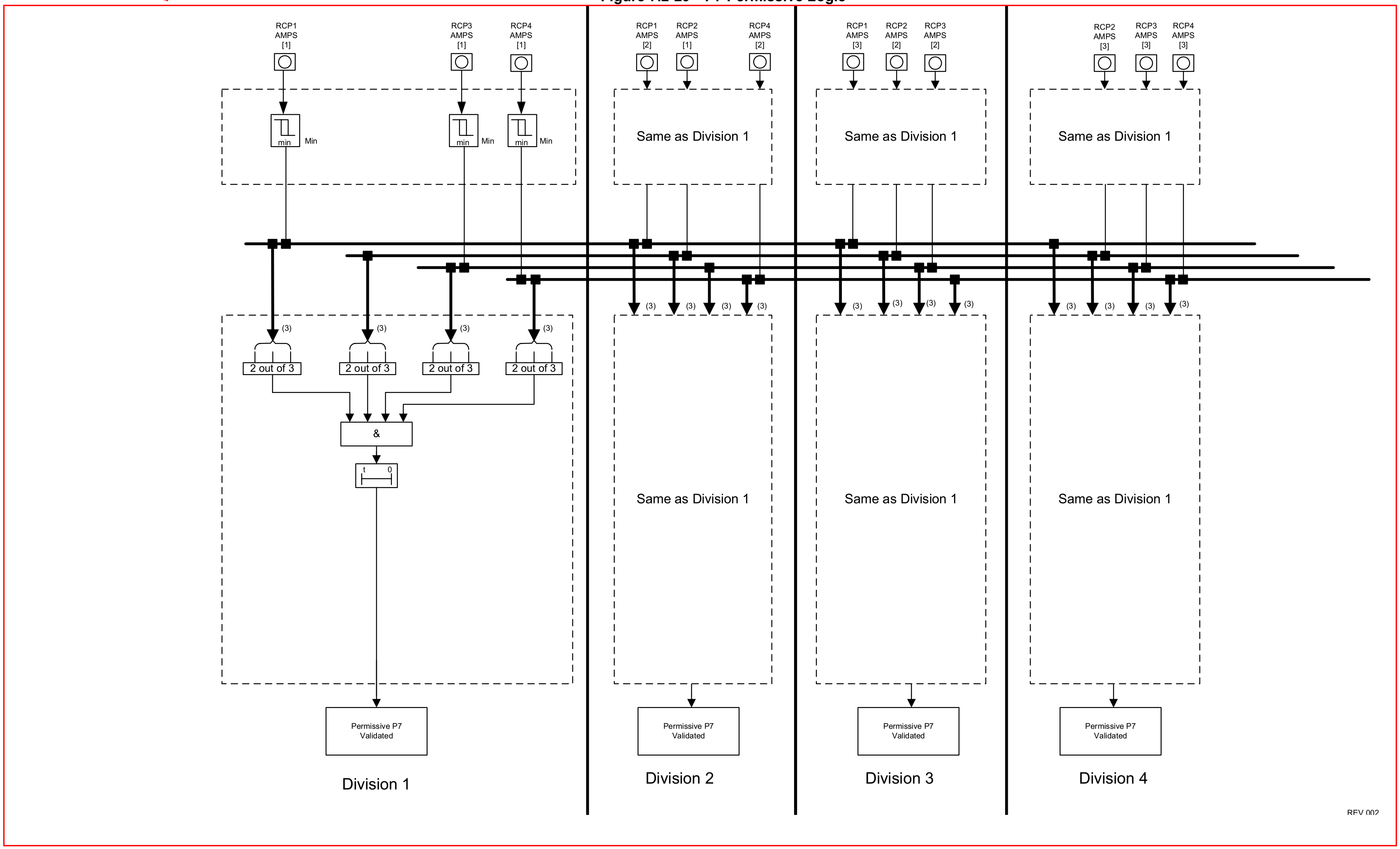
Figure 7.2-29—P7 Permissive Logic



been actuated. In both cases, only the affected SG is isolated and the partial cooldown function is performed via the remaining SGs.

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~~There is no operating bypass explicitly associated with the SG isolation function.~~ The SG Isolation function is bypassed when hot leg temperature is below the P13 permissive setpoint. Generation of the P13 signal is discussed in Section 7.2.1.3. However, when the partial cooldown actuation function is bypassed (Section 7.3.1.2.4), the SG isolation function is bypassed by association to the partial cooldown actuation signal.

The capability for manual initiation of SG isolation on a per SG basis is provided on the SICS in the MCR. Four manual initiation controls are provided per SG, any two of which will isolate the desired SG.

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

The functional logic for automatic SG isolation is shown in Figure 7.3-25—SG Isolation (Div. 1&2) and in Figure 7.3-26—SG Isolation (Div. 3&4).

7.3.1.2.15 Reactor Coolant Pump Trip

In case of a SBLOCA, RCPs are tripped when conditions indicate that two-phase flow is present. This is done because the RCPs may subsequently be lost due to cavitation or operation in a degraded environment. Forced convection of the two-phase flow increases the mass lost via the break. If the RCPs are permitted to operate for an extended period of time in this condition and then are shut down, an inadequate core cooling condition may occur due to insufficient liquid inventory as the two phases separate. For this reason, an automatic RCP pump trip is provided early after two-phase flow is indicated, while the void fraction is still relatively low, to enhance long term accident mitigation and minimize the potential for RCS mass depletion.

Additionally, the RCPs are tripped on a containment isolation stage two signal.

The operation of the RCPs is described in Section 5.4.1.

The U.S. EPR design uses the following initiating conditions to actuate RCP trip:

- ΔP across RCP < Min1p and SIS actuation signal generated.
- Stage two containment isolation signal generated.

The RCP trip based on differential pressure across the RCP results from one of two ΔP measurements below the Min1p setpoint on any two-of-the-four RCPs. A safety

Table 7.3-1—ESF Actuation Variables

Protective Function	Variables To Be Monitored	Range of Variables
Safety Injection System Actuation	Pressurizer Pressure (NR)	1615-2515 psia
	Hot Leg Pressure (WR)	15-3015 psia
	Hot Leg Temperature (WR)	32-662°F
	RCS Loop Level	0-30.71 in.
Reactor Coolant Pump Trip	RCP differential pressure	0-120% nominal
	RCP current measurement	0-120% nominal
Emergency Feedwater Actuation	SG Level (WR)	0-100% MR
Emergency Feedwater Isolation	SG Level (WR)	0-100% MR
SG Isolation	Main Steam Line Activity	$1x10^{-1} – 1x10^{4}$ counts/sec.
	SG Level (NR)	0-100% MR
Main Steam Relief Train Actuation	SG Pressure	15-1615 psia
Main Steam Relief Train Isolation	SG Pressure	15-1615 psia
Main Steam Isolation	SG Pressure	15-1615 psia
Main Feedwater Isolation	SG Level (NR)	0-100% MR
	SG Pressure	15-1615 psia
	RT Breaker Position	Open/Closed
Containment Isolation	Cont. Service Compartment Pressure (NR)	-3 to +7 psig
	Cont. Service Compartment Pressure (WR)	0-75 psig
	Cont. Equipment Compartment Pressure	-3 to +7 psig
	Containment High Range Activity	$1x10^{-1} – 1x10^{7}$ Rad/hr
Emergency Diesel Generator Actuation	6.9 kV Bus Voltage	0-8.625 kV
PSRV Opening	Hot Leg Pressure (WR)	15-3015 psia
CVCS Charging Isolation	Pressurizer Level (NR)	0-100% MR
CVCS Isolation for Anti-Dilution	Boron Concentration	0-5000 ppm
16-138	Boron Temperature	32-212°F
	CVCS Charging Flow	0-320,000 lb/hr
	Cold Leg Temperature (WR)	32-662°F
MCR A/C Isolation and Filtering	MCR Air Intake Duct Activity	$1x10^{-5} – 1x10^{1}$ Rad/hr
Turbine Trip	RT Breaker Position	Open/Closed

Figure 7.3-3—EFWS Actuation

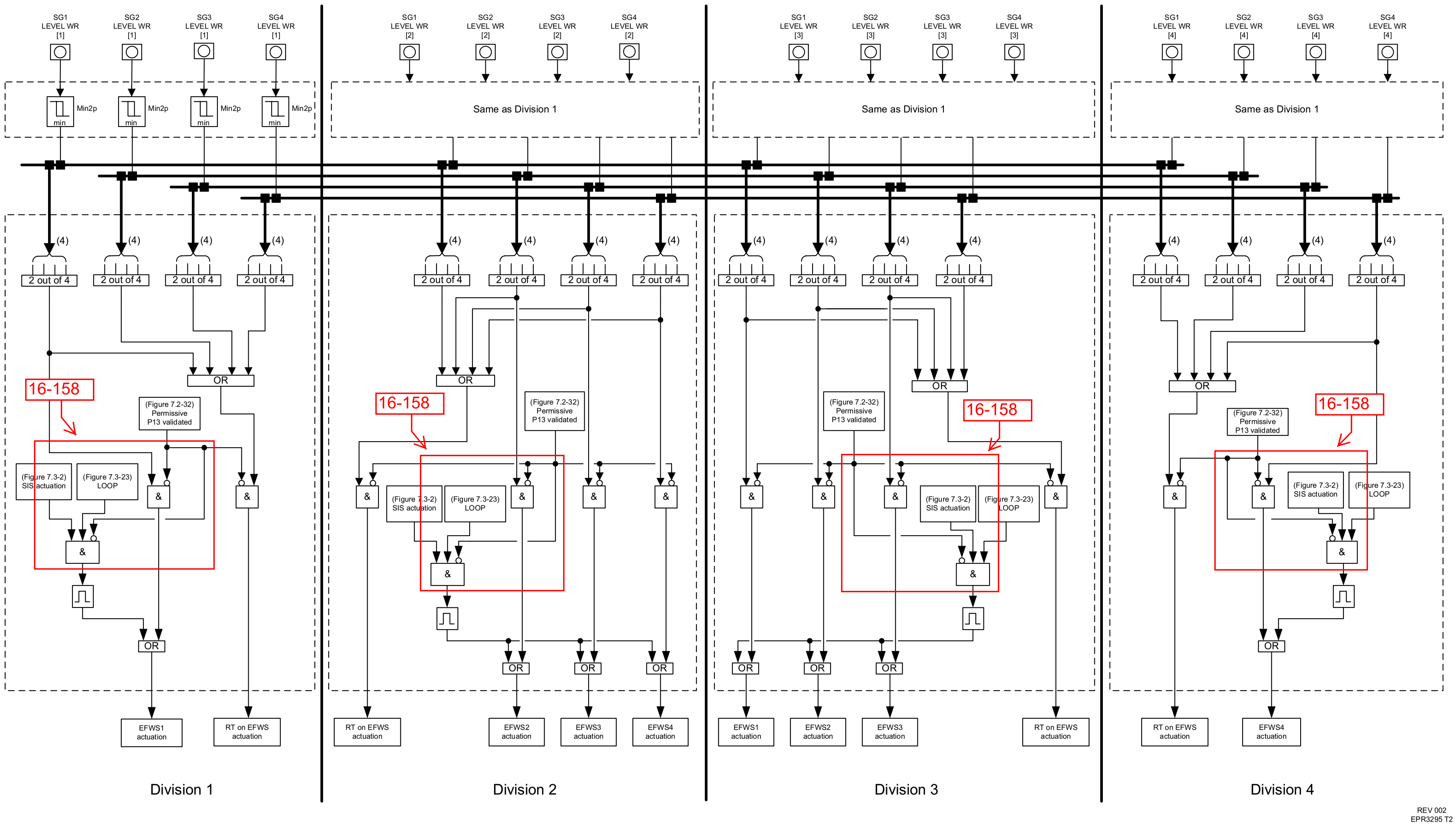

Figure 7.3-22—CVCS Isolation for Anti-Dilution

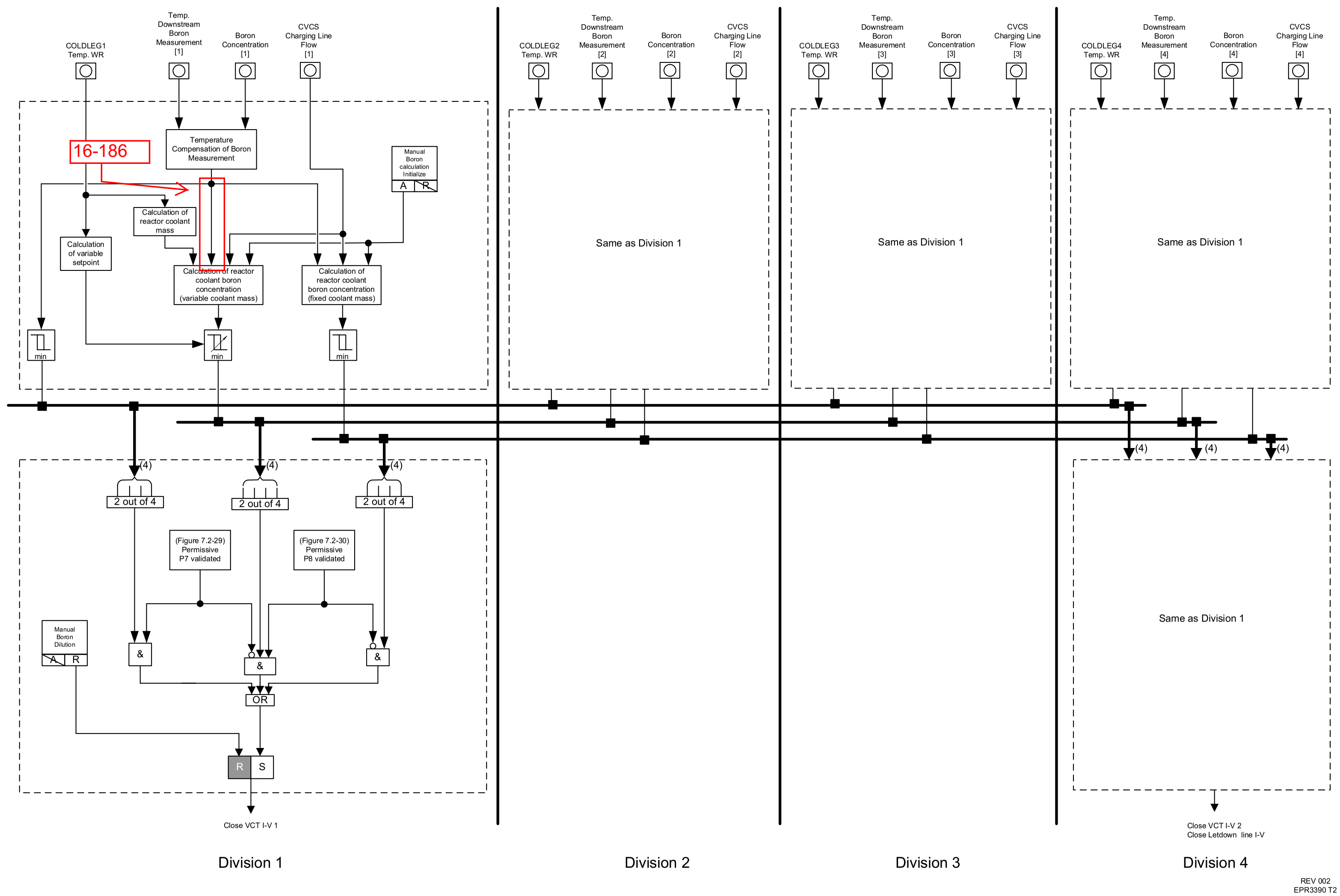

Figure 7.3-23—EDG Actuation

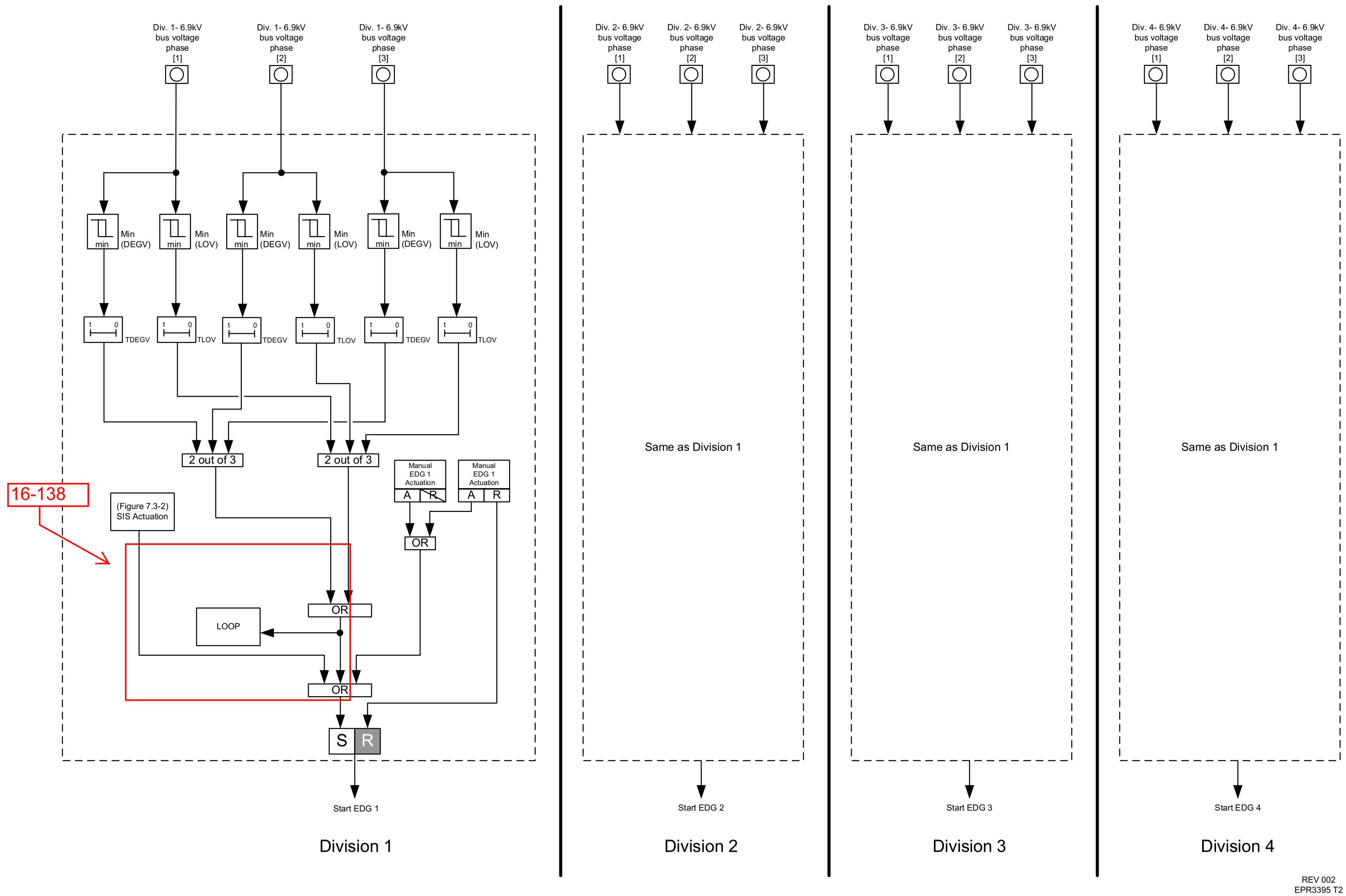

Table 15.0-7—Reactor Trip Setpoints and Delays Used in the Accident Analysis

Signal[4]	Setpoint[1] (Nominal)	Uncertainty (Normal/Degraded)	Time Delay[2] (s)
Pressurizer pressure < MIN2p	2005.0 psia	25 psi/55 psi	1.3
Pressurizer pressure > MAX2p	2414.9 psia	25 psi/55 psi	1.3
Pressurizer level > MAX1p	75%	5.5%/8.0%	1.9
Hot leg pressure < MIN1p	2005.0 psia	45 psi /(75 psi <15 sec, 110 psi > 15 sec)	1.3
SG pressure < MIN1p	724.7 psia	30 psi/75 psi	1.3
SG pressure > MAX1p	1384.7 psia	30 psi/75 psi	1.3
SG ΔP > MAX1p	see note 7	30 psi/75 psi	1.3
SG Level < MIN1p	20% NR[3]	3.5%/15.5%	1.9
SG Level > MAX1p	69% NR	9.5%/11.5%	1.9
Containment pressure > MAX1p[5]	see note 5	see note 5	[5]
High linear power density	460 W/cm	see note 8	1.0
Low DNBR	1.95	see note 8	1.4 plus sensor delays
Low DNBR$_{Imb/Rod\ Drop}$ 16-138	2.10	see note 8	1.4 plus sensor delays
Low DNBR$_{Rod\ Drop}$	3.30	see note 8	1.4 plus sensor delays
Low DNBR$_{High\ Quality}$	25%	see note 8	1.4 plus sensor delays
Low DNBR$_{High\ Quality\ Imb/Rod\ Drop}$	18%	see note 8	1.4 plus sensor delays
Low saturation margin[6]	see note 6	see note 6	see note 6
Excore high neutron flux rate of change	11% NP	2% NP	0.7
High core power level	105% NP	10.2% NP/11.7% NP	0.9 plus sensor delays
Low RCS flow rate (2 loops)	90% NF	4% NF	1.05
Low-low RCS flow rate (one loop)	54% NF	4% NF	1.05
Low RCP speed (2 loops)	93% NS	1% NS	0.75
High neutron flux (IR)	15% NP	10% NP	0.7
Low neutron flux doubling time (IR)	20 s	10 s	0.7

Notes:

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

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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, 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.

6. This safety-related signal was not explicitly credited in the safety analyses. However, it is required to maintain the validity of the high core power level trip.

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.

Table 15.0-8—Engineered Safety Features Actuation System (ESFAS) Functions Used in the Accident Analysis
Sheet 1 of 4

Function	Setpoint	Uncertainty	Time Delay (seconds)[4]
Safety Injection System Actuation			
SIS actuation on pressurizer pressure < Min 3p	1667.9 psia	25 psi/ 55 psi	1.5 plus 15 w/o LOOP for SI delivery or 40 with LOOP (includes EDG loading)
SIS actuation on RCS Hot Leg ΔPsat < Min1p	220 psi	110 psi / 181 psi	0.5 plus sensor delays plus 15 w/o LOOP for SI delivery or 40 with LOOP (includes EDG loading)
SIS actuation on RCS Loop Level < Min 1p	18.9 inches	1.1 inch/ 2.0 inch	1.5
Emergency Feedwater System Actuation[3, 15]			
EFWS actuation on SG Level < Min2p (WR) (affected SG)	40 % WR	2 % / 11 %	1.5 plus 15 w/o LOOP for EFW delivery or 60 with LOOP (includes EDG loading)
EFWS actuation on LOOP + SIS Actuation[1]	See note 1	See note 1	60 with LOOP (includes EDG loading)
SG blowdown isolation (affected SG)[16]	40 % WR	2%/11%	1.5 plus 20 for valve closure
EFW level control	82.2 % WR	8%/9%	Not Applicable
EFWS pump overflow protection	490 gpm max	Not Applicable	See note 15
Emergency Feedwater System Isolation			
EFWS isolation on SG Level > Max1p (WR) (affected SG)	89 % WR[11]	8 % / 9 %	1.5 plus 60 for valve closure
SG Isolation Signal	See SG Isolation function below		
Partial Cooldown Actuation			
SIS actuation signal generated	See note 9	See note 9	See note 9

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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	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 on RT check-back (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)			
Containment pressure > Max 2p (Stage 2)	36.3 psia	Not applicable	0.9

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

Function	Setpoint	Uncertainty	Time Delay (seconds)[4]
CVCS Charging Isolation			
CVCS charging line isolation on pressurizer level > Max2p	80 %	5.5 % / 8.0 %	1.5 plus 40 for valve closure
CVCS Isolation for Ant-Dilution			
Anti-Dilution (power)	See note 5	See note 8	66 + 40[6]
Anti-Dilution (shutdown)	See note 5	See note 8	66 + 40[6]
Anti-Dilution (shutdown no RCPs)	927 ppm	See note 7	66 + 40[6]
Steam Generator Isolation			
MSRT Setpoint Increase on SG Level > Max2p + partial cooldown initiated (affected SG)	85 % NR[11] (1435.5 psia)	9.5 % / 11.5 % (30 psi / 75 psi)	1.5
MSRT setpoint increase on high steam line activity + partial cooldown initiated (affected SG)[2]	See note 2 (1435.5 psia)	See note 2 (30 psi/75 psi)	See note 2.
MSIV closure on SG level > Max2p (NR) + partial cooldown Initiated (affected SG)	85 % NR[11]	9.5 % / 11.5 %	1.5 plus 5 for valve closure
MSIV closure on high steam line activity + partial cooldown initiated (affected SG)[2]	See note 2.	See note 2.	See note 2.
MFW SSS Isolation on SG Level > Max2p (NR) + partial cooldown initiated (affected SG)	85 % NR[11]	9.5 % / 11.5 %	1.5 plus 20 for valve closure
MFW SSS isolation on high steam line activity + partial cooldown initiated (affected SG)[2]	See note 2	See note 2	See note 2
EFWS isolation on SG Level (NR) > Max2p + partial cooldown initiated (affected SG)	85 % NR[11]	9.5 % / 11.5 %	1.5 plus 60 for valve closure
EFWS isolation on High Steam Line Activity + partial cooldown initiated (affected SG)[2]	See note 2.	See note 2.	See note 2.
Reactor Coolant Pump Trip			
RCP Trip on ΔP Over RCP < Min1p + SIS Signal	80 % nominal	3 % / 5 %	3.9[12]
MCR AC System isolation			
MCR air intake activity > Max1p	3 X background		

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

Function	Setpoint	Uncertainty	Time Delay (seconds)[4]
Turbine Trip on RT			
Confirmation of RT	Following RT	Not Applicable	1.0
EDG on LOOP or degraded voltage[17]			
EBS	Manual	Not Applicable	Not Applicable

Notes:

1. EFWS actuation on LOOP and SIS is assumed in the SGTR to minimize the margin to overfill. It is also credited in SBLOCA. This function does not have a specific setpoint, uncertainty, or delay.
2. The accident analysis does not credit automatic actions based on MSL activity but uses MSL activity for input to operator action. This function does not have a specific setpoint, uncertainty, or delay.
3. EFWS actuation also results in SG blowdown isolation.
4. Represents the total time for completion of the function. Includes sensor delay, I&C delay, and other delays as noted until the function is completed.
5. The setpoints for the anti-dilution PS vary as a function of core burnup and are specified in the Core Operating Limits Report.
6. The first time accounts for time delays in trip processing, the second time accounts for the stroke time of the CVCS isolation valves.
7. A bounding uncertainty of 400 ppm is used.
8. Varies with boron concentration.
9. The partial cooldown actuation signal is initiated on the SIS signal and therefore does not have a specific setpoint, uncertainty, or delay.
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.
12. Three seconds of the 3.9-second delay is associated with the bus supply breaker delay. This feature results in an RCP trip.

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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 15.0-8—Engineered Safety Features Functions Used in the Accident Analysis~~

~~Function~~	~~Setpoint~~	~~Uncertainty~~	~~Time Delay (s)~~[4]
~~SIS actuation on pressurizer pressure < MIN 3p~~	~~1667.9 psia~~	~~25 psi/55 psi~~	~~1.5 plus 15 w/o LOOP for SI delivery or 40 with LOOP (includes EDG loading)~~
~~SIS actuation on RCS hot leg ΔPsat < MIN1p~~	~~220 psia~~	~~110 psi/181 psi~~	~~0.5 plus sensor delays plus 15 w/o LOOP for SI delivery or 40 with LOOP (includes EDG loading)~~
~~SIS actuation on RCS loop level < MIN 1p~~	~~18.9 inches~~	~~1.1 inch/2.0 inch~~	~~1.5~~
~~RCP trip on ΔP over RCP < MIN1p + SIS signal~~	~~80% nominal~~	~~3%/5%~~	~~3.9~~ [12]
~~Partial cooldown actuation on SIS signal~~[9]	~~see note 9~~	~~see note 9~~	~~see note 9~~
~~EFWS actuation on SG level < MIN2p (affected SG)~~	~~40% WR~~	~~2%/11%~~	~~1.5 plus 15 w/o LOOP for EFW delivery or 60 with LOOP (includes EDG loading)~~
~~EFWS actuation on LOOP + SIS Actuation~~[1]	~~see note 1~~	~~see note 1~~	~~60 with LOOP (includes EDG loading)~~
~~EFWS isolation on SG level > MAX1p (affected SG)~~	~~89% WR~~[11]	~~8%/9%~~	~~1.5 plus 60 for valve closure~~
~~EFWS isolation on SG Level > MAX2p + partial cooldown initiated (affected SG)~~	~~85% NR~~[11]	~~9.5%/11.5%~~	~~1.5 plus 60 for valve closure~~
~~EFWS Isolation on high steam line activity + partial cooldown initiated (affected SG)~~[2]	~~see note 2~~	~~see note 2~~	~~see note 2~~
~~EFWS pump overflow protection~~	~~490 gpm max~~[15]	~~NA~~	~~see note 3~~
~~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~~
~~MSRT setpoint increase on SG Level > MAX2p + partial cooldown initiated (affected SG)~~	~~85% NR~~[11] ~~(1435.5 psia)~~	~~9.5%/11.5% (30 psi/75 psi)~~	~~1.5~~

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~~Table 15.0-8—Engineered Safety Features Functions Used in the Accident Analysis~~

~~Function~~	~~Setpoint~~	~~Uncertainty~~	~~Time Delay (s)[4]~~
~~Anti-dilution (power)~~	~~see note 5~~	~~see note 8~~	~~66 + 40 [6]~~
~~Anti-dilution (shutdown)~~	~~ssee note 5~~	~~see note 8~~	~~66 + 40 [6]~~
~~Anti-dilution (shutdown no RCPs)~~	~~927 ppm[7]~~	~~see note 8~~	~~66 + 40[6]~~
~~MSRT setpoint increase on high steam line activity + partial cooldown initiated (affected SG)[2]~~	~~(1435.5 psia[2])~~	~~(30 psi/75 psi[2])~~	~~see note 2~~
~~MSIV closure on SG pressure drop > MAX1p (all SGs)~~	~~see note 13~~	~~30 psi/75 psi~~	~~0.9 plus 5 for valve closure~~
~~MSIV closure on SG pressure < MIN1p (All SGs)~~	~~724.7 psia~~	~~30 psi/75 psi~~	~~0.9 plus 5 for valve closure~~
~~MSIV closure on SG Level > MAX2p + partial cooldown initiated (affected SG)~~	~~85% NR[11]~~	~~9.5%/11.5%~~	~~1.5 plus 5 for valve closure~~
~~MSIV closure on high steam line activity + partial cooldown initiated (affected SG)[2]~~	~~see note 2~~	~~see note 2~~	~~see note 2~~
~~MFW full load isolation on SG level > MAX1p (affected SGs)[10]~~	~~69% NR~~	~~9.5%/11.5%~~	~~1.5 plus 25 for isolation valve closure and 40 for control valve~~
~~MFW full load closure on RT check-back (All SGs)~~	~~Not Applicable~~	~~Not Applicable~~	~~Following TT, 25 for isolation valve closure and 40 for control valve~~
~~MFW SSS isolation on SG level > MAX2p + partial cooldown initiated (affected SG)~~	~~85% NR[11]~~	~~9.5%/11.5%~~	~~1.5 plus 20 for valve closure~~
~~MFW SSS isolation on high steam line activity + partial cooldown Initiated (affected SG)[2]~~	~~see note 2~~	~~see note 2~~	~~see note 2~~
~~MFW SSS isolation on SG pressure drop > MAX2p (affected SG)~~	~~see note 14~~	~~30 psi/75 psi~~	~~0.9 plus 20 for valve closure~~
~~MFW SSS isolation on SG pressure < MIN2p (affected SG)~~	~~579.7 psia~~	~~30 psi/75 psi~~	~~0.9 plus 20 for valve closure~~
~~MFW SSS isolation on SG level > MAX0p for period of time (affected SG)~~	~~65% NR for 10 sec w/ RT~~	~~9.5%/11.5%~~	~~1.5 plus 20 for valve closure~~
~~SG blowdown isolation on EFWS actuation (affected SG)~~	~~40% WR~~	~~2%/11%~~	~~1.5 plus 20 for valve closure~~
~~CVCS charging line isolation on pressurizer level > MAX2p~~	~~80%~~	~~5.5%/8.0%~~	~~1.5 plus 40 valve closure~~

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~~Table 15.0-8—Engineered Safety Features Functions Used in the Accident Analysis~~

~~Function~~	~~Setpoint~~	~~Uncertainty~~	~~Time Delay (s)[4]~~
~~EFW level control~~	~~82.2% WR~~	~~8%/9%~~	~~Not Applicable~~
~~EBS~~	~~Manual~~	~~Not Applicable~~	~~Not Applicable~~

~~**Notes:**~~

1. ~~EFWS actuation on LOOP and SIS is assumed in the SGTR to minimize the margin to overfill. It is also credited in SBLOCA. This function does not have a specific setpoint, uncertainty, or delay.~~
2. ~~The accident analysis does not credit automatic actions based on MSL activity but uses MSL activity for input to operator action. This function does not have a specific setpoint, uncertainty or delay for safety analyses.~~
3. ~~Implicitly credited in the MSLB analysis.~~
4. ~~Represents the total time for completion of the function. Includes sensor delay, I&C delay, and other delays as noted until the function is completed.~~
5. ~~The setpoints for the anti-dilution PS vary as a function of core burnup.~~
6. ~~The first time accounts for time delays in trip processing, the second time accounts for the stroke time of the CVCS isolation valves.~~
7. ~~Based on an enriched boron-10 concentration of 37 atom%.~~
8. ~~Varies with boron concentration.~~
9. ~~The partial cooldown actuation signal is initiated on the SIS signal and therefore does not have a specific setpoint, uncertainty or delay.~~
10. ~~MFW is isolated in two steps. The 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.~~
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.~~

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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.~~

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All changes in Technical Specification 3.3.1 were made in response to Question 16-138

~~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.~~
~~---~~

~~---REVIEWER'S NOTE---~~
~~The COL applicant may revise Condition C, Surveillance Requirements 3.3.1.4 and 3.3.1.6, and Table 3.3.1-2 to reflect the use of a Setpoint Control Program.~~
~~---~~

~~CONDITION~~	~~REQUIRED ACTION~~	~~COMPLETION TIME~~
~~A. One or more sensors inoperable.~~	~~A.1 -------------NOTE------------- Only applicable for Table 3.3.1-1, Component A.21. -----------------------------------~~	
	~~Place inoperable sensor in trip.~~	~~1 hour~~
	~~AND~~	
	~~A.2 -------------NOTE------------- Not applicable for Table 3.3.1-1, Component A.21. -----------------------------------~~	
	~~Place inoperable sensor in lockout.~~	~~4 hours~~

~~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 Trip Setpoint (LTSP) for one or more Trip/Actuation Functions not met.~~	~~C.1 --------------NOTE-------------- Only applicable for APUs 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.~~	~~1 hour~~
	~~AND~~	
	~~C.2 --------------NOTE-------------- Not applicable for APUs associated with Table 3.3.1-2, Trip/Actuation Functions B.10.a and B.10.b. -------------------------------------~~	
	~~Place the Trip/Actuation Function in the associated APU in lockout.~~	~~24 hours~~

~~ACTIONS (continued)~~

~~CONDITION~~	~~REQUIRED ACTION~~	~~COMPLETION TIME~~
~~D. One or more signal processors inoperable for reasons other than Condition C.~~	~~D.1 -------------NOTE------------- Only applicable for APUs and ALUs 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 and LCO 3.8.2 for EDG made inoperable by inoperable APU or ALU.~~ ~~AND~~ ~~D.2 Place inoperable signal processor in lockout.~~	~~1 hour~~ ~~4 hours~~
~~E. One or more actuation devices inoperable.~~	~~E.1 Restore actuation device to OPERABLE status.~~	~~48 hours~~
~~F. Required Action and associated Completion Time of Condition A, B, C, D, or E not met.~~ ~~OR~~ ~~Minimum functional capability specified in Table 3.3.1-1 not maintained.~~	~~F.1 Enter the Condition referenced in Table 3.3.1-1.~~	~~Immediately~~

~~ACTIONS (continued)~~

~~CONDITION~~	~~REQUIRED ACTION~~	~~COMPLETION TIME~~
~~G. As required by Required Action F.1 and referenced in Table 3.3.1-1.~~	~~G.1 Reduce THERMAL POWER to < 70% RTP.~~	~~2 hours~~
~~H. As required by Required Action F.1 and referenced in Table 3.3.1-1.~~	~~H.1 Reduce THERMAL POWER to < 10% RTP.~~	~~6 hours~~
~~I. As required by Required Action F.1 and referenced in Table 3.3.1-1.~~	~~I.1 Be in MODE 2.~~	~~6 hours~~
~~J. As required by Required Action F.1 and referenced in Table 3.3.1-1.~~	~~J.1 Be in MODE 3.~~	~~6 hours~~
~~K. As required by Required Action F.1 and referenced in Table 3.3.1-1.~~	~~K.1 Be in MODE 3.~~ ~~AND~~ ~~K.2 Open the reactor trip breakers.~~	~~6 hours~~ ~~6 hours~~
~~L. As required by Required Action F.1 and referenced in Table 3.3.1-1.~~	~~L.1 Be in MODE 3.~~ ~~AND~~ ~~L.2 Reduce pressurizer pressure to < 2005 psia.~~	~~6 hours~~ ~~12 hours~~

~~ACTIONS (continued)~~

~~CONDITION~~	~~REQUIRED ACTION~~	~~COMPLETION TIME~~
~~M. As required by Required Action F.1 and referenced in Table 3.3.1-1.~~	~~M.1 Be in MODE 3.~~ ~~AND~~ ~~M.2 Be in MODE 4.~~	~~6 hours~~ ~~12 hours~~
~~N. As required by Required Action F.1 and referenced in Table 3.3.1-1.~~	~~N.1 Be in MODE 3.~~ ~~AND~~ ~~N.2 Be in MODE 5.~~	~~6 hours~~ ~~36 hours~~
~~O. As required by Required Action F.1 and referenced in Table 3.3.1-1.~~	~~O.1 Declare associated EDG inoperable. Enter applicable Conditions and Required Actions of LCOs 3.8.1, "AC Sources – Operating," and 3.8.2, "AC Sources – Shutdown".~~	~~Immediately~~
~~P. As required by Required Action F.1 and referenced in Table 3.3.1-1.~~	~~P.1 Declare associated Chemical and Volume Control System isolation valve(s) inoperable. Enter applicable Conditions and Required Actions of LCO 3.4.9, "Pressurizer".~~	~~Immediately~~
~~Q. As required by Required Action F.1 and referenced in Table 3.3.1-1.~~	~~Q.1 Declare associated Pressurizer Safety Relief Valve(s) inoperable. Enter applicable Conditions and Required Actions of LCO 3.4.11, "Low Temperature Overpressure Protection (LTOP)".~~	~~Immediately~~

~~ACTIONS (continued)~~

~~CONDITION~~	~~REQUIRED ACTION~~	~~COMPLETION TIME~~
~~R. As required by Required Action F.1 and referenced in Table 3.3.1-1.~~	~~R.1 Declare both Control Room Emergency Filtration trains inoperable. Enter applicable Conditions and Required Actions of LCO 3.7.10, "Control Room Emergency Filtration (CREF)".~~	~~Immediately~~
~~S. As required by Required Action F.1 and referenced in Table 3.3.1-1.~~	~~S.1 Open reactor trip breakers.~~	~~1 hour~~
~~T. As required by Required Action F.1 and referenced in Table 3.3.1-1.~~	~~T.1 Declare functions on associated Actuation Logic Units inoperable.~~ ~~AND~~ ~~T.2 Open reactor trip breakers.~~	~~Immediately~~ ~~1 hour~~

~~SURVEILLANCE REQUIREMENTS~~

~~NOTES~~

1. ~~Refer to Table 3.3.1-1 to determine which SRs apply for each sensor, manual actuation switch, signal processor, or actuation device.~~

2. ~~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 maintains functional capability.~~

~~SURVEILLANCE~~		~~FREQUENCY~~
~~SR 3.3.1.1~~	~~NOTE~~ ~~Not required to be performed until 12 hours after THERMAL POWER ≥ 20% RTP.~~ ~~Compare results of calorimetric heat balance calculation to power range division output. Adjust power range division output if calorimetric heat balance calculations results exceed power range division output by more than +2% RTP.~~	~~24 hours~~
~~SR 3.3.1.2~~	~~NOTE~~ ~~Not required to be performed until 12 hours after THERMAL POWER ≥ 20% RTP.~~ ~~Perform CALIBRATION.~~	~~15 effective full power days~~
~~SR 3.3.1.3~~	~~Perform ACTUATION DEVICE OPERATIONAL TEST.~~	~~31 days~~
~~SR 3.3.1.4~~	~~Perform CALIBRATION.~~	~~92 days~~

~~SURVEILLANCE REQUIREMENTS (continued)~~

~~SURVEILLANCE~~		~~FREQUENCY~~
~~SR 3.3.1.5~~	~~Perform a SENSOR OPERATIONAL TEST.~~	~~24 months~~
~~SR 3.3.1.6~~	~~-------------------NOTE-------------------~~ ~~Neutron detectors are excluded from CALIBRATION.~~ ~~--~~ ~~Perform a CALIBRATION.~~	~~24 months~~
~~SR 3.3.1.7~~	~~Perform EXTENDED SELF TESTS.~~	~~24 months~~
~~SR 3.3.1.8~~	~~Perform ACTUATION DEVICE OPERATIONAL TEST.~~	~~24 months~~
~~SR 3.3.1.9~~	~~Verify setpoints 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~~

~~Table 3.3.1-1 (page 1 of 4)~~
~~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,(a)~~	~~2 per EDG~~	~~O~~	~~SR 3.3.1.5~~ ~~SR 3.3.1.6~~ ~~SR 3.3.1.10~~
~~2. Boron Concentration - Chemical and Volume Control System (CVCS) Charging Line~~	~~4~~	~~3[b],4[b],5,6~~	~~2~~	~~P~~	~~SR 3.3.1.4~~ ~~SR 3.3.1.5~~ ~~SR 3.3.1.10~~
~~3. Boron Temperature - CVCS Charging Line~~	~~4~~	~~3[b],4[b],5,6~~	~~2~~	~~P~~	~~SR 3.3.1.5~~ ~~SR 3.3.1.6~~ ~~SR 3.3.1.10~~
~~4. CVCS Charging Line Flow~~	~~4~~	~~3[b],4[b],5[b]~~	~~2~~	~~P~~	~~SR 3.3.1.5~~ ~~SR 3.3.1.6~~ ~~SR 3.3.1.10~~
~~5. Cold Leg Temperature (Narrow Range)~~	~~4~~	~~≥ 10% RTP~~	~~3~~	~~H~~	~~SR 3.3.1.5~~ ~~SR 3.3.1.6~~ ~~SR 3.3.1.10~~
~~6. Cold Leg Temperature (Wide Range)~~	~~4~~	~~1,2[c]~~	~~3~~	~~J~~	~~SR 3.3.1.5~~ ~~SR 3.3.1.6~~ ~~SR 3.3.1.10~~
	~~4~~	~~3,4,5,6[b]~~	~~2~~	~~P~~	~~SR 3.3.1.5~~ ~~SR 3.3.1.6~~ ~~SR 3.3.1.10~~
~~7. Containment Pressure~~	~~4 per area~~	~~1,2,3~~	~~3 per area~~	~~M~~	~~SR 3.3.1.5~~ ~~SR 3.3.1.6~~ ~~SR 3.3.1.10~~
~~8. Hot Leg Pressure (Wide Range)~~	~~4~~	~~1,2,3~~	~~3~~	~~M~~	~~SR 3.3.1.5~~ ~~SR 3.3.1.6~~ ~~SR 3.3.1.10~~
	~~4~~	~~(d)~~	~~2~~	~~Q~~	~~SR 3.3.1.5~~ ~~SR 3.3.1.6~~ ~~SR 3.3.1.10~~

~~(a) When associated EDG is required to be OPERABLE by LCO 3.8.2, "AC Sources - Shutdown."~~

~~(b) With three or more reactor coolant pumps (RCPs) in operation.~~

~~(c) ≥ 10-5% power on the intermediate range detectors.~~

~~(d) When Pressurizer Safety Relief Valves (PSRVs) are required to be OPERABLE per LCO 3.4.11, "Low Temperature Overpressure Protection (LTOP)."~~

~~Table 3.3.1-1 (page 2 of 4)~~
~~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~~
~~9. Hot Leg Temperature (Narrow Range)~~	~~4 per division, 4 divisions~~	~~1,2(c)~~	~~3 per division, 3 divisions~~	~~J~~	~~SR 3.3.1.5~~ ~~SR 3.3.1.6~~ ~~SR 3.3.1.10~~
~~10. Hot Leg Temperature (Wide Range)~~	~~4~~	~~3(e)~~	~~3~~	~~M~~	~~SR 3.3.1.5~~ ~~SR 3.3.1.6~~ ~~SR 3.3.1.10~~
~~11. Intermediate Range~~	~~4~~	~~1(f),2,3(g)~~	~~3~~	~~K~~	~~SR 3.3.1.5~~ ~~SR 3.3.1.6~~
~~12. Power Range~~	~~2 per division, 4 divisions~~	~~1,2,3(g)~~	~~2 per division, 3 divisions~~	~~K~~	~~SR 3.3.1.1~~ ~~SR 3.3.1.5~~ ~~SR 3.3.1.6~~
~~13. Pressurizer Level (Narrow Range)~~	~~4~~	~~1,2,3~~	~~3~~	~~M~~	~~SR 3.3.1.5~~ ~~SR 3.3.1.6~~ ~~SR 3.3.1.10~~
~~14. Pressurizer Pressure (Narrow Range)~~	~~4~~	~~1,2,3(h)~~	~~3~~	~~L~~	~~SR 3.3.1.5~~ ~~SR 3.3.1.6~~ ~~SR 3.3.1.10~~
~~15. Radiation Monitor - Containment High Range~~	~~4~~	~~1,2,3,4~~	~~3~~	~~N~~	~~SR 3.3.1.5~~ ~~SR 3.3.1.6~~ ~~SR 3.3.1.10~~
~~16. Radiation Monitor - Control Room HVAC Intake Activity~~	~~4~~	~~1,2,3,4~~	~~3~~	~~N~~	~~SR 3.3.1.5~~ ~~SR 3.3.1.6~~ ~~SR 3.3.1.10~~
	~~4~~	~~5,6,(i)~~	~~3~~	~~R~~	~~SR 3.3.1.5~~ ~~SR 3.3.1.6~~ ~~SR 3.3.1.10~~

~~(c) ≥ 10-5 % power on the intermediate range detectors.~~

~~(e) When Table 3.3.1-2, Trip/Actuation Function B.3.a is disabled.~~

~~(f) ≤ 10% RTP.~~

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

~~(h) With pressurizer pressure ≥ 2005 psia.~~

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

~~Table 3.3.1-1 (page 3 of 4)~~
~~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~~
~~17. RCP Current~~	~~3 per RCP~~	~~1,2,3~~	~~2 per RCP~~	~~M~~	~~SR 3.3.1.5~~ ~~SR 3.3.1.6~~ ~~SR 3.3.1.10~~
~~18. RCP Delta P Sensors~~	~~2 per RCP~~	~~1,2,3~~	~~1 per RCP~~	~~M~~	~~SR 3.3.1.5~~ ~~SR 3.3.1.6~~ ~~SR 3.3.1.10~~
~~19. RCP Speed~~	~~4~~	~~≥ 10% RTP~~	~~3~~	~~H~~	~~SR 3.3.1.5~~ ~~SR 3.3.1.6~~ ~~SR 3.3.1.10~~
~~20. Reactor Coolant System (RCS) Loop Flow~~	~~4 per loop~~	~~1,2[c]~~	~~3 per loop~~	~~J~~	~~SR 3.3.1.5~~ ~~SR 3.3.1.6~~ ~~SR 3.3.1.10~~
~~21. Reactor Trip Circuit Breaker Position Indication~~	~~4~~	~~1,2[g],3[g]~~	~~3~~	~~M~~	~~SR 3.3.1.5~~ ~~SR 3.3.1.8~~ ~~SR 3.3.1.10~~
~~22. Self-Powered Neutron Detectors~~	~~72~~	~~≥ 10% RTP~~	~~67~~	~~H~~	~~SR 3.3.1.2~~ ~~SR 3.3.1.5~~
~~23. Steam Generator (SG) Level (Narrow Range)~~	~~4 per SG~~	~~1,2[j],3[j]~~	~~3 per SG~~	~~M~~	~~SR 3.3.1.5~~ ~~SR 3.3.1.6~~ ~~SR 3.3.1.10~~
~~24. SG Level (Wide Range)~~	~~4 per SG~~	~~1,2,3~~	~~3 per SG~~	~~M~~	~~SR 3.3.1.5~~ ~~SR 3.3.1.6~~ ~~SR 3.3.1.10~~
~~25. SG Pressure~~	~~4 per SG~~	~~1,2,3~~	~~3 per SG~~	~~M~~	~~SR 3.3.1.5~~ ~~SR 3.3.1.6~~ ~~SR 3.3.1.10~~
~~B. Manual Actuation Switches~~					
~~1. Reactor Trip~~	~~4~~	~~1,2,3[g]~~	~~3~~	~~K~~	~~SR 3.3.1.8~~
	~~4~~	~~4[g],5[g]~~	~~3~~	~~S~~	~~SR 3.3.1.8~~
~~2. Safety Injection System (SIS) Actuation~~	~~4~~	~~1,2,3,4~~	~~3~~	~~N~~	~~SR 3.3.1.8~~
~~3. SG Isolation~~	~~4 per SG~~	~~1,2,3~~	~~3 per SG~~	~~M~~	~~SR 3.3.1.8~~

~~(c) ≥ 10-5 % power on the intermediate range detectors.~~

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

~~(i) During movement of irradiated fuel assemblies.~~
~~(j) Except when all main feedwater (MFW) isolation valves are closed.~~

Table 3.3.1-1 (page 4 of 4)
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. Remote Acquisition Units (RAUs)	2 per division, 4 divisions	≥ 10% RTP	2 per division, 4 divisions	H	SR 3.3.1.5 SR 3.3.1.7 SR 3.3.1.10
2. 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
3. Actuation Logic Units (ALUs)	4 per division, 4 divisions	1,2,3,4	3 per division, 4 divisions	N,O,P, Q,R,T	SR 3.3.1.5 SR 3.3.1.7 SR 3.3.1.10
	4 per division, 4 divisions	5,6,(i)	3 per division, 4 divisions	O,P,Q,R,T	SR 3.3.1.5 SR 3.3.1.7 SR 3.3.1.10
D. Actuation Devices					
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(g)	3	K	SR 3.3.1.3 SR 3.3.1.10
3. Reactor Trip Contactors	4 per set, 23 sets	1,2,3(g)	3 per set, 23 sets	K	SR 3.3.1.3 SR 3.3.1.10

(g) With the RCSL capable of withdrawing a RCCA or one or more RCCAs not fully inserted.

(i) During movement of irradiated fuel assemblies.

(j) Except when all main feedwater (MFW) isolation valves are closed.

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

~~TRIP/ACTUATION FUNCTION~~	~~APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS~~	~~MINIMUM REQUIRED FOR FUNCTIONAL CAPABILITY~~[(a)]	~~LIMITING TRIP SETPOINT / DESIGN LIMIT~~	~~CONDITION~~
~~A. Reactor Trip~~				
~~1.a. Low Departure from Nucleate Boiling Ratio (DNBR)~~	~~≥ 10% RTP~~	~~3 divisions~~	~~(d)~~[(b)(c)]	~~H~~
~~1.b. Low DNBR and Imbalance or Rod Drop~~	~~≥ 10% RTP~~	~~3 divisions~~	~~(d)~~[(b)(c)]	~~H~~
~~1.c. Variable Low DNBR and Rod Drop~~	~~≥ 10% RTP~~	~~3 divisions~~	~~(d)~~[(b)(c)]	~~H~~
~~1.d. Low DNBR - High Quality~~	~~≥ 10% RTP~~	~~3 divisions~~	~~(d)~~[(b)(c)]	~~H~~
~~1.e. Low DNBR - High Quality and Imbalance or Rod Drop~~	~~≥ 10% RTP~~	~~3 divisions~~	~~(d)~~[(b)(c)]	~~H~~
~~2. High Linear Power Density~~	~~≥ 10% RTP~~	~~3 divisions~~	~~(d)~~[(b)(c)]	~~H~~
~~3. High Neutron Flux Rate of Change (Power Range)~~	~~1,2,3~~[(e)]	~~3 divisions~~	~~11% RTP~~[(b)(c)]	~~K~~
~~4. High Core Power Level~~	~~1,2~~[(f)]	~~3 divisions~~	~~105% RTP~~[(b)(c)]	~~J~~
~~5. Low Saturation Margin~~	~~1,2~~[(f)]	~~3 divisions~~	~~30 Btu/lb~~[(b)(c)]	~~J~~
~~6.a. Low-Low Reactor Coolant System (RCS) Loop Flow Rate in One Loop~~	~~≥ 70% RTP~~	~~3 divisions~~	~~54% Nominal Flow~~[(b)(c)]	~~G~~
~~6.b. Low RCS Loop Flow Rate in Two Loops~~	~~≥ 10% RTP~~	~~3 divisions~~	~~90% Nominal Flow~~[(b)(c)]	~~H~~
~~7. Low Reactor Coolant Pump (RCP) Speed~~	~~≥ 10% RTP~~	~~3 divisions~~	~~93% Nominal Speed~~[(b)(c)]	~~H~~
~~8. High Neutron Flux (Intermediate Range)~~	~~1~~[(g)]~~,2,3~~[(e)]	~~3 divisions~~	~~15% RTP~~[(b)(c)]	~~K~~

~~(a) A division is OPERABLE provided: a) the minimum sensors required for functional capability for all sensors providing input to the Trip/Actuation Function are OPERABLE; and b) the associated APU is 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 Limiting Trip Setpoint (LTSP) at the completion of the surveillance; otherwise, the Trip/Actuation Function 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) As specified in the COLR.~~

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

~~(f) ≥ 10-5% power on the intermediate range detectors.~~

~~(g) ≤ 10% RTP.~~

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

~~TRIP/ACTUATION FUNCTION~~	~~APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS~~	~~MINIMUM REQUIRED FOR FUNCTIONAL CAPABILITY[(a)]~~	~~LIMITING TRIP SETPOINT / DESIGN LIMIT~~	~~CONDITION~~
~~9. Low Doubling Time (Intermediate Range)~~	~~1[(g)],2,3[(e)]~~	~~3 divisions~~	~~20 Sec.[(b)(c)]~~	~~K~~
~~10. Low Pressurizer Pressure~~	~~≥ 10% RTP~~	~~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[(e)(h)]~~	~~3 divisions~~	~~2005 psia[(b)(c)]~~	~~L~~
~~14. Steam Generator (SG) Pressure Drop~~	~~1,2~~	~~3 divisions~~	~~29 psi/min; 102 psi<steady state; Max 1088 psia[(b)(c)]~~	~~J~~
~~15. Low SG Pressure~~	~~1,2,3[(e)(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 divisions~~	~~18.7 psia[(b)(c)]~~	~~J~~

~~(a) A division is OPERABLE provided: a) the minimum sensors required for functional capability for all sensors providing input to the Trip/Actuation Function are OPERABLE; and b) the associated APU is 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 Limiting Trip Setpoint (LTSP) at the completion of the surveillance; otherwise, the Trip/Actuation Function shall be declared inoperable. Setpoints more conservative than the LTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures to confirm Trip/Actuation Function performance. The methodologies used to determine the as-found and the as-left tolerances are specified in a document controlled under 10 CFR 50.59.~~

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

~~(g) ≤ 10% RTP.~~

~~(h) With pressurizer pressure ≥ 2005 psia.~~

~~Table 3.3.1-2 (page 3 of 6)~~
~~Acquisition and Processing Unit Requirements Referenced from Table 3.3.1-1~~

~~TRIP/ACTUATION FUNCTION~~	~~APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS~~	~~MINIMUM REQUIRED FOR FUNCTIONAL CAPABILITY[a]~~	~~LIMITING TRIP SETPOINT / DESIGN LIMIT~~	~~CONDITION~~
~~B. Engineered Safety Features Actuation System (ESFAS) Signals~~				
~~1. Turbine Trip on Reactor Trip (RT)~~	~~1~~	~~3 divisions~~	~~RT for 1 sec.~~	~~I~~
~~2.a. Main Feedwater Full Load Closure on Reactor Trip (All SGs)~~	~~1,2[i]~~	~~3 divisions~~	~~NA~~	~~J~~
~~2.b. Main Feedwater Full Load Closure on High SG Level (Affected SGs)~~	~~1,2[i],3[i]~~	~~3 divisions~~	~~69% Narrow Range[b][c]~~	~~M~~
~~2.c. Startup and Shutdown Feedwater Isolation on SG Pressure Drop (All SGs)~~	~~1,2[j],3[j]~~	~~3 divisions~~	~~29 psi/min; 247 psi<steady state; Max 943 psia[b][c]~~	~~M~~
~~2.d. Startup and Shutdown Feedwater Isolation on Low SG Pressure (Affected SGs)~~	~~1,2[j],3[h][j]~~	~~3 divisions~~	~~580 psia[b][c]~~	~~L~~
~~2.e. Startup and Shutdown Feedwater Isolation on High SG Level for Period of Time (Affected SGs)~~	~~1,2[j],3[j]~~	~~3 divisions~~	~~65% Narrow Range for 10 sec.[b][c]~~	~~M~~
~~3.a. Safety Injection System (SIS) Actuation on Low Pressurizer Pressure~~	~~1,2,3[h]~~	~~3 divisions~~	~~1668 psia[b][c]~~	~~L~~
~~3.b. SIS Actuation on Low Delta P_{sat}~~	~~3[k]~~	~~3 divisions~~	~~220 psia[b][c]~~	~~M~~
~~4. RCP Trip on Low Delta P across RCP with SIS Actuation~~	~~1,2,3~~	~~3 divisions~~	~~80% Nominal Pressure[b][c]~~	~~M~~
~~5. Partial Cooldown Actuation on SIS Actuation~~	~~1,2,3~~	~~3 divisions~~	~~NA~~	~~M~~

~~(a) A division is OPERABLE provided: a) the minimum sensors required for functional capability for all sensors providing input to the Trip/Actuation Function are OPERABLE; and b) the associated APU is 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 Limiting Trip Setpoint (LTSP) at the completion of the surveillance; otherwise, the Trip/Actuation Function 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.~~

~~(h) With pressurizer pressure ≥ 2005 psia.~~

~~(i) Except when all MFW full load isolation valves are closed.~~

~~(j) Except when all MFW low load isolation valves are closed.~~

~~(k) When Trip/Actuation Function B.3.a is disabled.~~

Table 3.3.1-2 (page 4 of 6)
Acquisition and Processing Unit Requirements Referenced from Table 3.3.1-1

TRIP/ACTUATION FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	MINIMUM REQUIRED FOR FUNCTIONAL CAPABILITY[(a)]	LIMITING TRIP SETPOINT / DESIGN LIMIT	CONDITION
6.a. Emergency Feedwater System (EFWS) Actuation on Low-Low SG Level (All 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
6.c. EFWS Isolation on High SG Level (Affected SG)	1,2,3	3 divisions	89% Wide Range [(b)(c)]	M
7.a. Main Steam Relief Train (MSRT) Actuation on High SG Pressure	1,2,3	3 divisions	1385 psia [(b)(c)]	M
7.b. MSRT Isolation on Low SG Pressure	1,2,3[(h)]	3 divisions	580 psia [(b)(c)]	L
8.a. Main Steam Isolation Valve (MSIV) Closure on SG Pressure Drop (All SGs)	1,2,3	3 divisions	29 psi/min; 102 psi<steady state; Max 1088 psia [(b)(c)]	M
8.b. MSIV Closure on Low SG Pressure (All SGs)	1,2,3[(h)(l)]	3 divisions	725 psia [(b)(c)]	L
9.a. Containment Isolation (Stage 1) on High Containment Pressure	1,2,3	3 divisions	18.7 psia [(b)(c)]	M
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	3 divisions	≤ 36.3 psia	M
9.d. Containment Isolation (Stage 1) on High Containment Radiation	1,2,3,4	3 divisions	≤ 100 x background	N

(a) A division is OPERABLE provided: a) the minimum sensors required for functional capability for all sensors providing input to the Trip/Actuation Function are OPERABLE; and b) the associated APU is 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 Limiting Trip Setpoint (LTSP) at the completion of the surveillance; otherwise, the Trip/Actuation Function 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.

(h) With pressurizer pressure ≥ 2005 psia.

(l) Except when all MSIVs are closed.

~~Table 3.3.1-2 (page 5 of 6)~~
~~Acquisition and Processing Unit Requirements Referenced from Table 3.3.1-1~~

~~TRIP/ACTUATION FUNCTION~~	~~APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS~~	~~MINIMUM REQUIRED FOR FUNCTIONAL CAPABILITY[(a)]~~	~~LIMITING TRIP SETPOINT / DESIGN LIMIT~~	~~CONDITION~~
~~10.a. Emergency Diesel Generator (EDG) Start on Degraded Grid Voltage~~	~~1,2,3,4~~	~~4 divisions~~	~~≥ 6210 V and ≤ 6350 V;~~	~~O~~
	~~(m)~~	~~2 divisions~~	~~≥ 7 sec. and ≤ 11 sec. w/SIS; ≥ 270 sec. and ≤ 300 sec. wo/SIS~~	~~O~~
~~10.b. EDG Start on LOOP~~	~~1,2,3,4~~	~~4 divisions~~	~~≥ 4830 V and ≤ 4970 V;~~	~~O~~
	~~(m)~~	~~2 divisions~~	~~≥ 0.4 sec. and ≤ 0.6 sec.~~	~~O~~
~~11.a. Chemical and Volume Control System (CVCS) Charging Line Isolation on High-High Pressurizer Level~~	~~1,2,3~~	~~3 divisions~~	~~80% Measuring Range[(b)(c)]~~	~~M~~
~~11.b. CVCS Charging Line Isolation on Anti-Dilution Mitigation (ADM) at Shutdown Condition (RCP not operating)~~	~~5[(n)],6~~	~~3 divisions~~	~~927 ppm[(b)(c)]~~	~~P~~
~~11.c. CVCS Charging Line Isolation on ADM at Standard Shutdown Conditions~~	~~3,4[(o)],5[(o)]~~	~~3 divisions~~	~~(d)[(b)(c)]~~	~~P~~

~~(a) A division is OPERABLE provided: a) the minimum sensors required for functional capability for all sensors providing input to the Trip/Actuation Function are OPERABLE; and b) the associated APU is 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 Limiting Trip Setpoint (LTSP) at the completion of the surveillance; otherwise, the Trip/Actuation Function 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) As specified in the COLR.~~

~~(m) When associated EDG is required to be OPERABLE by LCO 3.8.2.~~

~~(n) With two or less RCPs in operation.~~

~~(o) With three or more RCPs in operation.~~

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

~~TRIP/ACTUATION FUNCTION~~	~~APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS~~	~~MINIMUM REQUIRED FOR FUNCTIONAL CAPABILITY(a)~~	~~LIMITING TRIP SETPOINT / DESIGN LIMIT~~	~~CONDITION~~
~~12.a. Pressurizer Safety Relief Valve (PSRV) Actuation - First Valve~~	~~(p)~~	~~3 divisions~~	~~(q)~~ [(b)(c)]	~~Q~~
~~12.b. PSRV Actuation - Second Valve~~	~~(p)~~	~~3 divisions~~	~~(q)~~ [(b)(c)]	~~Q~~
~~13. Control Room Heating, Ventilation, and Air Conditioning Reconfiguration to Recirculation Mode on High Intake Activity~~	~~1,2,3,4~~	~~3 divisions~~	~~≤3 x background~~	~~N~~
	~~5,6,(r)~~	~~3 divisions~~	~~≤3 x background~~	~~R~~

~~(a) A division is OPERABLE provided: a) the minimum sensors required for functional capability for all sensors providing input to the Trip/Actuation Function are OPERABLE; and b) the associated APU is 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 Limiting Trip Setpoint (LTSP) at the completion of the surveillance; otherwise, the Trip/Actuation Function 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.~~

~~(p) When the PSRVs are required to be OPERABLE by LCO 3.4.11.~~

~~(q) The LTOP arming temperature is specified in the PTLR.~~

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

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.

--REVIEWER'S NOTE--

The COL applicant may revise Condition C, Surveillance Requirements 3.3.1.4 and 3.3.1.6, and Table 3.3.1-2 to reflect the use of a Setpoint Control Program.

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. ------------------------------------	
	Place inoperable sensor in trip.	1 hour
	AND	
	A.2 -------------NOTE--------------- Not applicable for Table 3.3.1-1, Component A.24. ------------------------------------	
	Place inoperable sensor in lockout.	4 hours

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 Trip Setpoint (LTSP) for one or more Trip/Actuation Functions/Permissives not met.	C.1 -------------NOTE--------------- Only applicable for APUs 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.	1 hour
	AND	
	C.2 -------------NOTE--------------- Not applicable for APUs associated with Table 3.3.1-2, Trip/Actuation Functions B.10.a and B.10.b. -------------------------------------	
	Place the Trip/Actuation Function in the associated APU in lockout.	24 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. One or more signal processors inoperable for reasons other than Condition C.	D.1 --------------NOTE--------------- Only applicable for APUs and ALUs 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 and LCO 3.8.2 for EDG made inoperable by inoperable APU or ALU.	1 hour
	AND	
	D.2 Place inoperable signal processor in lockout.	4 hours
E. One or more actuation devices inoperable.	E.1 Restore actuation device to OPERABLE status.	48 hours
F. Required Action and associated Completion Time of Condition A, B, C, D, or E not met. OR Minimum functional capability specified in Table 3.3.1-1 not maintained.	F.1 Enter the applicable Condition referenced in Table 3.3.1-1.	Immediately

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
G. As required by Required Action F.1 and referenced in Table 3.3.1-1.	G.1 Reduce THERMAL POWER to < 70% RTP.	2 hours
H. As required by Required Action F.1 and referenced in Table 3.3.1-1.	H.1 Reduce THERMAL POWER to < 10% RTP.	6 hours
I. As required by Required Action F.1 and referenced in Table 3.3.1-1.	I.1 Be in MODE 2.	6 hours
J. As required by Required Action F.1 and referenced in Table 3.3.1-1.	J.1 Be in MODE 3.	6 hours
K. As required by Required Action F.1 and referenced in Table 3.3.1-1.	K.1 Be in MODE 3. AND K.2 Open the reactor trip breakers.	6 hours 6 hours
L. As required by Required Action F.1 and referenced in Table 3.3.1-1.	L.1 Be in MODE 3. AND L.2 Reduce pressurizer pressure to < 2005 psia.	6 hours 12 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
M. As required by Required Action F.1 and referenced in Table 3.3.1-1.	M.1 Be in MODE 3. AND M.2 Be in MODE 4.	6 hours 12 hours
N. As required by Required Action F.1 and referenced in Table 3.3.1-1.	N.1 Be in MODE 3. AND N.2 Be in MODE 5.	6 hours 36 hours
O. As required by Required Action F.1 and referenced in Table 3.3.1-1.	O.1 Be in MODE 5.	36 hours
P. As required by Required Action F.1 and referenced in Table 3.3.1-1.	P.1 Declare associated EDG inoperable. AND P.2 Enter applicable Conditions and Required Actions of LCOs 3.8.1, "AC Sources - Operating," and 3.8.2, "AC Sources - Shutdown".	Immediately Immediately
Q. As required by Required Action F.1 and referenced in Table 3.3.1-1.	Q.1 Suspend operations involving positive reactivity additions that could result in loss of required SDM or boron concentration.	Immediately

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
R. As required by Required Action F.1 and referenced in Table 3.3.1-1.	R.1 Suspend activities that could reduce RCS inventory.	Immediately
S. As required by Required Action F.1 and referenced in Table 3.3.1-1.	S.1 Declare associated Pressurizer Safety Relief Valve(s) inoperable. AND S.2 Enter applicable Conditions and Required Actions of LCO 3.4.11, "Low Temperature Overpressure Protection (LTOP)".	Immediately Immediately
T. As required by Required Action F.1 and referenced in Table 3.3.1-1.	T.1 Declare associated Control Room Emergency Filtration trains inoperable. AND T.2 Enter applicable Conditions and Required Actions of LCO 3.7.10, "Control Room Emergency Filtration (CREF)".	Immediately Immediately

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 Bottom Position Indicator inoperable.	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 Declare functions on associated Actuation Logic Units inoperable.	Immediately
	AND	
	V.2 Open reactor trip breakers.	1 hour
W. As required by Required Action F.1 and referenced in Table 3.3.1-1.	W.1 Open reactor trip breakers.	1 hour

SURVEILLANCE REQUIREMENTS

---NOTES---

1. Refer to Table 3.3.1-1 to determine which SRs apply for each sensor, manual actuation switch, signal processor, or actuation device.

2. 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 maintains functional capability.

SURVEILLANCE		FREQUENCY
SR 3.3.1.1	---NOTE--- Not required to be performed until 12 hours after THERMAL POWER ≥ 20% RTP. --- Compare results of calorimetric heat balance calculation to power range division output. Adjust power range division output if calorimetric heat balance calculations results exceed power range division output by more than +2% RTP.	24 hours
SR 3.3.1.2	---NOTE--- Not required to be performed until 12 hours after THERMAL POWER ≥ 20% RTP. --- Perform CALIBRATION.	15 effective full power days
SR 3.3.1.3	Perform ACTUATION DEVICE OPERATIONAL TEST.	31 days
SR 3.3.1.4	Perform CALIBRATION.	92 days
SR 3.3.1.5	Perform a SENSOR OPERATIONAL TEST.	24 months

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.6	------------------------------NOTE------------------------------ Neutron detectors are excluded from CALIBRATION. -- Perform a CALIBRATION.	24 months
SR 3.3.1.7	Perform EXTENDED SELF TESTS.	24 months
SR 3.3.1.8	Perform ACTUATION DEVICE OPERATIONAL TEST.	24 months
SR 3.3.1.9	Verify setpoints 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

Table 3.3.1-1 (page 1 of 6)
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 SR 3.3.1.10
2. Boron Concentration - Chemical and Volume Control System (CVCS) Charging Line	4	1,2,3,4 5,6[(b)]	3 2	N Q	SR 3.3.1.4 SR 3.3.1.5 SR 3.3.1.10
3. Boron Temperature - CVCS Charging Line	4	1,2,3,4 5,6[(b)]	3 2	N Q	SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.10
4. CVCS Charging Line Flow	4	1,2,3[(c)],4[(c)] 5[(c)]	3 2	N Q	SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.10
5. Cold Leg Temperature (Narrow Range)	4	1[(d)]	3	H	SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.10
6. Cold Leg Temperature (Wide Range)	4	1,2[(e)],3[(c)],4[(c)], (f)	3	N,S	SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.10
	4	5[(c),(f)]	2	Q,S	SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.10
7. Containment Equipment Compartment Pressure	4	1,2,3[(g)]	3	K	SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.10

(a) During movement of irradiated fuel assemblies.

(b) With Permissive P7 validated (no RCPs in Operation).

(c) With Permissive P7 inhibited (one or mor RCPs in operation).

(d) With Permissive P2 validated.

(e) With Permissive P5 validated.

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

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

Table 3.3.1-1 (page 2 of 6)
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
8. Containment Service Compartment Pressure (Narrow Range)	4	1,2,3[(g)]	3	K	SR 3.3.1.5 SR 3.3.1.6 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 SR 3.3.1.10
10. Hot Leg Pressure (Wide Range)	4	1,2,3,4,(f)	3	N,S	SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.10
	4	5,6,(f)	2	R,S	SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.10
11. Hot Leg Temperature (Narrow Range)	4 per division, 4 divisions	1,2[(e)]	3 per division, 3 divisions	J	SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.10
12. Hot Leg Temperature (Wide Range)	4	1,2,3,4	3	O	SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.10
		5,6	2	R	SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.10
13. Intermediate Range	4	1,2,3[(g)]	3	K	SR 3.3.1.5 SR 3.3.1.6
14. Power Range	2 per division, 4 divisions	1,2,3[(g)]	2 per division, 3 divisions	K	SR 3.3.1.1 SR 3.3.1.5 SR 3.3.1.6
15. Pressurizer Level (Narrow Range)	4	1,2,3,4	3	N	SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.10

(e) With Permissive P5 validated.

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

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

Table 3.3.1-1 (page 3 of 6)
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
16. Pressurizer Pressure (Narrow Range)	4	1,2,3,4[(h)]	3	N	SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.10
17. Radiation Monitor - Containment High Range	4	1,2,3,4	3	N	SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.10
18. Radiation Monitor - Control Room HVAC Intake Activity	4	1,2,3,4	3	T	SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.10
	4	5,6,(i)	2	T	SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.10
19. RCP Current	3 per RCP	1,2,3,4	2 per RCP	N	SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.10
		5,6		Q,R	SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.10
20. RCP Delta Pressure	2 per RCP	1,2,3,4	1 per RCP	N	SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.10
21. RCP Speed	4	1[(d)]	3	H	SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.10
22. Reactor Coolant System (RCS) Loop Flow	4 per division and per loop	1,2[(e)]	3 per division and per loop	J	SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.10

(d) With Permissive P2 validated.

(e) With Permissive P5 validated.

(h) With Permissive P15 inhibited.

(i) During movement of irradiated fuel assemblies.

Table 3.3.1-1 (page 4 of 6)
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
23. RCS Loop Level	4	4(j)	3	O	SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.10
		5,6	2	R	SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.10
24. Reactor Trip Circuit Breaker Position Indication	4	1,2(k),3(k)	3	K	SR 3.3.1.5 SR 3.3.1.8 SR 3.3.1.10
25. Rod Cluster Control Assembly (RCCA) Bottom Position Indicators	89	1(d)	89	U	SR 3.3.1.8
		3(c),4(c),5(c)		Q	SR 3.3.1.8
26. Self-Powered Neutron Detectors	72	1(d)	67	H	SR 3.3.1.2 SR 3.3.1.5
27. Steam Generator (SG) Level (Narrow Range)	4 per SG	1,2,3(k)	3 per SG	M	SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.10
28. SG Level (Wide Range)	4 per SG	1,2,3	3 per SG	M	SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.10
29. SG Pressure	4 per SG	1,2,3,4(l)	3 per SG	N	SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.10

(c) With Permissive P7 inhibited (one or more RCPs in operation)..

(d) With Permissive P2 validated.

(j) With Permissive P15 validated.

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

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

Table 3.3.1-1 (page 5 of 6)
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
B. MANUAL ACTUATION SWITCHES					
1. Reactor Trip	4	1,2	3	K	SR 3.3.1.8
	4	3(g),4(g),5(g)	3	W	SR 3.3.1.8
2. Safety Injection System (SIS) Actuation	4	1,2,3,4	3	N	SR 3.3.1.8
		5,6	3	R	
3. SG Isolation	4 per SG	1,2,3,4(l)	3 per SG	N	SR 3.3.1.8
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	3 per division, 4 divisions	N,P,S,T,U,V	SR 3.3.1.5 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)	2 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)	4	U	SR 3.3.1.5 SR 3.3.1.7
		3(c),4(c),5(c)	4	Q	

(a) During movement of irradiated fuel assemblies.

(c) With Permissive P7 inhibited (one or more RCPs in operation).

(d) With Permissive P2 validated.

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

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

Table 3.3.1-1 (page 6 of 6)
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					
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
		$3^{(g)},4^{(g)},5^{(g)}$		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
		$3^{(m)},4^{(m)},5^{(m)}$		W	SR 3.3.1.3 SR 3.3.1.10

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

(m) With Permissive P12 validated.

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 Trip Setpoint column are included for reviewer information only. A plant-specific setpoint study will be conducted. The values in Limiting Trip Setpoint column will then be replaced after the completion of this study.]

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

(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 Limiting Trip Setpoint (LTSP) 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) With Permissive P2 validated.

(e) As specified in the COLR.

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

(g) With Permissive P5 validated.

(h) With Permissive P3 validated.

Table 3.3.1-2 (page 2 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]	LIMITING TRIP SETPOINT / DESIGN LIMIT	CONDITION
6.b. Low RCS Loop Flow Rate in Two Loops	1[d]	3 divisions	[90% Nominal Flow[b][c]]	H
7. Low Reactor Coolant Pump (RCP) Speed	1[d]	3 divisions	[93% Nominal Speed[b][c]]	H
8. High Neutron Flux (Intermediate Range)	1[i],2,3[f]	3 divisions	[15% RTP[b][c]]	K
9. Low Doubling Time (Intermediate Range)	1[i],2,3[f]	3 divisions	[20 Sec.[b][c]]	K
10. Low Pressurizer Pressure	1[d]	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][j]	3 divisions	[2005 psia[b][c]]	L
14. Steam Generator (SG) Pressure Drop	1,2,3[f]	3 divisions	[29 psi/min; 102 psi<steady state; Max 1088 psia[b][c]]	K
15. Low SG Pressure	1,2,3[f][j]	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[f]	3 divisions	[18.7 psia[b][c]]	K

(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 Limiting Trip Setpoint (LTSP) 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) With Permissive P2 validated.

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

(i) Below 10% RTP.

(j) With Permissive P12 inhibited.

Table 3.3.1-2 (page 3 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]	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.]	K
2.a. Main Feedwater Full Load Isolation on Reactor Trip (All SGs)	1,2[k],3[k]	3 divisions	NA	M
2.b. Main Feedwater Full Load Isolation on High SG Level (Affected SGs)	1,2[k],3[k]	3 divisions	[69% Narrow Range[b][c]]	M
2.c. Startup and Shutdown Feedwater Isolation on SG Pressure Drop (Affected SGs)	1,2[l],3[l]	3 divisions	[29 psi/min; 247 psi<steady state; Max 943 psia[b][c]]	M
2.d. Startup and Shutdown Feedwater Isolation on Low SG Pressure (Affected SGs)	1,2[l],3[j][l]	3 divisions	[580 psia[b][c]]	L
2.e. Startup and Shutdown Feedwater Isolation on High SG Level for Period of Time (Affected SGs)	1,2[l],3[l]	3 divisions	[65% Narrow Range for 10 sec.[b][c]]	M
3.a. SIS Actuation on Low Pressurizer Pressure	1,2,3[j]	3 divisions	[1668 psia[b][c]]	L
3.b. SIS Actuation on Low Delta P_{sat}	3[m],4[n]	3 divisions	[220 psia[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 Limiting Trip Setpoint (LTSP) 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) With Permissive P12 inhibited.

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

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

(m) With Permissive P12 validated.

(n) With Permissive P15 inhibited.

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)]	LIMITING TRIP SETPOINT / DESIGN LIMIT	CONDITION
3.c SIS Actuation on Low RCS Loop Level	4[(o)]	3 divisions	[18.9 in.[(b)(c)]]	O
	5,6	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)]	3 divisions	[1385 psia[(b)(c)]]	N
7.b. MSRT Isolation on Low SG Pressure (Affected SG)	1,2,3[(j)]	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)]	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)(q)]	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 Limiting Trip Setpoint (LTSP) 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) With Permissive P12 inhibited.

(o) With Permissive P15 validated.

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

(q) Except when all MSIVs are closed.

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

(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 Limiting Trip Setpoint (LTSP) 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.

(r) During movement of irradiated fuel assemblies.

(s) With Permissive P7 validated (no RCPs in operation).

Table 3.3.1-2 (page 6 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)]	LIMITING TRIP SETPOINT / DESIGN LIMIT	CONDITION
11.c. CVCS Charging Line Isolation on ADM at Standard Shutdown Conditions	3[(t)],4[(t)]	3 divisions	[(e)(b)(c)]	O
	5[(t)]	2 divisions		Q
11.d CVCS Charging Line Isolation on ADM at Power	1,2	3 divisions	[(e)(b)(c)]	J
12.a. Pressurizer Safety Relief Valve (PSRV) Actuation - First Valve	4[(u)]	3 divisions	[(v)]	S
	5[(u)],6[(u)]	2 divisions		S
12.b. PSRV Actuation - Second Valve	4[(u)]	3 divisions	[(v)]	S
	5[(u)],6[(u)]	2 divisions		S
13. Control Room Heating, Ventilation, and Air Conditioning Reconfiguration to Recirculation Mode on High Intake Activity	1,2,3,4	3 divisions	[≤ 3 x background]	T
	5,6,(r)	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

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

(e) As specified in the COLR.

(r) During movement of irradiated fuel assemblies.

(t) With Permissive P7 inhibited (one or more RCPs in operation).

(u) When PSRV OPERABILITY is required by LCO 3.4.11.

(v) As specified in the Pressure Temperature Limits Report.

Table 3.3.1-2 (page 7 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)]	LIMITING TRIP SETPOINT / DESIGN LIMIT	CONDITION
P7 - RCP Not in Operation	3[(s)],4[(s)]	3 divisions	[50% no load current]	O
	5[(s)],6[(s)]	2 divisions		Q
P8 - Shutdown Rod Cluster Control Assembly Position Lower than Threshold	3[(t)],4[(t)]	3 divisions	[All rods in]	U
	5[(t)]	2 divisions		Q
P12 - Pressurizer Pressure Lower than Threshold	3 (RCS < 2005 psia),4[(n)]	3 divisions	[2005 psia]	O
P14 - Hot Leg Pressure and Hot Leg Temperature Lower than Thresholds	1,2,3,4[(p)]	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[(u)]	3 divisions	[248ºF]	S
	5[(u)],6[(u)]	2 divisions		S

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

(n) With Permissive P15 inhibited.

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

(s) With Permissive P7 validated (no RCPs in operation).

(t) With Permissive P7 inhibited (one or more RCPs in operation).

(u) When PSRV OPERABILITY required by LCO 3.4.11.

All changes in Bases 3.3.1 have been made in response to Question 16-138.

B 3.3 INSTRUMENTATION

B 3.3.1 Protection System (PS)

BASES

---REVIEWER'S NOTE---
The COL applicant may revise the Background, Applicable Safety Analyses, LCO, and Applicability, Actions, and Surveillance Requirements to reflect the use of a Setpoint Control Program.

BACKGROUND

The PS initiates a reactor trip to protect against violating the core specified acceptable fuel design limits and breaching the reactor coolant pressure boundary during anticipated operational occurrences (AOOs). The PS also initiates the Engineered Safety Features (ESF) actuations that are used to mitigate accidents. The ESF actuates necessary safety systems, based upon the values of selected unit parameters, to protect against violating core design limits, maintain the Reactor Coolant System (RCS) pressure boundary, and mitigate the consequences of accidents that could result in potential exposures comparable to the guidelines set forth in 10 CFR 100 during AOOs and ensures acceptable consequences during accidents.

The PS initiates and the Safety Automation System (SAS) controls the necessary safety systems to protect against violating core design limits, maintain the RCS pressure boundary, and mitigate the consequences of accidents that could result in potential exposures comparable to the guidelines set forth in 10 CFR 100 during anticipated operational occurrences and ensures acceptable consequences during postulated accidents.

The four redundant divisions of the PS are physically separated in their respective safeguard buildings. The four divisionally separated rooms containing the PS equipment are in different fire zones. Therefore, in general, the consequences of internal hazards (e.g., fire), would impact only one PS division.

The PS architecture is four-fold redundant for both reactor trip and ESF functions. A single failure during corrective or periodic maintenance, or a single failure and the effects of an internal hazard does not prevent performance of the safety functions. For the reactor trip functions, each PS division actuates one division of the reactor trip devices based on redundant processing performed in four divisions. For ESF functions, the redundancy of the safety function as a whole is defined by the redundancy of the ESF system mechanical trains. In general, this results

BASES

BACKGROUND (continued)

in one PS division actuating one mechanical train of an ESF system based on redundant processing performed in four divisions. The PS not only supports the redundancy of the mechanical trains, but also enhances this redundancy through techniques such as redundant actuation voting.

~~Three~~ In general, three of the four divisions are necessary to meet the redundancy and testability of GDC 21 in 10 CFR 50, Appendix A (Ref. 3). The fourth division provides additional flexibility by allowing one division to be removed from service for maintenance or testing while still maintaining a minimum two-out-of-three logic. ~~Thus, even with a division inoperable, no single additional failure in the PS can either cause an inadvertent trip/ESF or prevent a required trip/ESF from occurring.~~

Table B 3.3.1-1 "Protection System (PS) Functional Dependencies," was compiled to identify functions that could be impacted by the cumulative failures of different sensors in different divisions and those functions that do not have four divisions of Actuation Logic Units (ALU). In general, when a sensor becomes inoperable, the Acquisition and Processing Unit (APU) that receives the signal from the sensor declares the functions supported by that sensor to be invalid (This is not true for Self-Powered Neutron Detectors (SPND) and in some cases where multiple sensors are provided in a division to monitor the same variable [e.g., the Hot Leg Temperature - Narrow Range sensors which provide input to the High Core Power Level and Low Saturation Margin reactor trip functions]). When an inoperable sensor results in the invalidation of a function(s) in a division, the ALUs change the voting logic to reflect the loss of that division. Table B 3.3.1-1 may be used as an aid to assess OPERABILITY in applying Table 3.3.1-2 Footnote (a), which states that "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."

The protection and monitoring systems have been designed to ensure safe operation of the reactor. This is achieved by specifying limiting safety system settings (LSSS) in terms of parameters directly monitored by the PS, as well as LCOs on other reactor system parameters and equipment performance. The subset of LSSS that directly protect against violating the reactor core and RCS pressure boundary safety limits during AOOs are referred to as Safety Limit LSSS (SL-LSSS).

BASES

BACKGROUND (continued)

Technical Specifications are required by 10 CFR 50.36 to contain LSSS defined by the regulation as "...settings for automatic protective devices...so chosen that automatic protective actions will correct the abnormal situation before a Safety Limit (SL) is exceeded." The Analytical Limit is the limit of the process variable at which a safety action is initiated, as established by the safety analysis, to ensure that a SL is not exceeded. Any automatic protection action that occurs on reaching the Analytical Limit therefore ensures that the SL is not exceeded. However, in practice, the actual settings for automatic protective devices must be chosen to be more conservative than the Analytical Limit to account for instrument loop uncertainties related to the setting at which the automatic protective action would actually occur.

-----------------------------------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 is preferred. The trip setpoint (field setting) may be more conservative than the Limiting or Nominal Trip Setpoint.

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 ~~channel~~ division performance.

Licensees are to insert the name of the document(s) controlled under 10 CFR 50.59 that contain the LTSP 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.

BASES

BACKGROUND (continued)

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).

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 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 that has been found to be different from the LTSP due to some drift of the setting 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 of the 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 to account for further drift during the next surveillance interval.

BASES

BACKGROUND (continued)

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 setpoint that a division can have when tested such that a division is OPERABLE if the as-found setpoint is conservative with respect to the Allowable Value during a CALIBRATION. As such, the Allowable Value differs from the Nominal Trip Setpoint 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 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 ~~channel~~ division is OPERABLE under these circumstances, the setpoint must be left adjusted to a value within the as-left tolerance, and confirmed to be operating within the statistical allowances of the uncertainty terms assigned (as-found). If the actual setting of the device is found to be non-conservative with respect to the Allowable Value, the device 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.

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. 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.

BACKGROUND (continued)

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 ~~Self-Powered Neutron Detectors (Self-Powered Neutron Detectors (~~SPNDs~~)~~ and distribute these signals;
  - ~~Acquisition and Processing Units (~~APUs~~)~~, which perform calculations and make setpoint comparisons;~~ and~~
  - ~~Actuation Logic Units (~~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
- Actuation Devices, which includes the reactor trip breakers and contactors and the~~ Priority and Actuator Control Systems (PACS) control modules for the~~ Reactor Coolant Pump (RCP) bus and trip breakers.

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 trip, ESF functions, and Permissives.

Sensors

Measurement ~~channels~~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.

The ~~Power Density Detector~~Incore Instrumentation System, which uses SPNDs and RAUs, provides the in-core monitoring function. The Power Range, Intermediate Range, and Source Range monitors provide the ex-core monitoring functions.

BASES

BACKGROUND (continued)

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 ~~channel~~ 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.

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

BASES

BACKGROUND (continued)

Manual Actuation Switches

~~Manual controls necessary to perform the manual operator actions credited in the safety analysis are included within the scope of the Technical Specifications.~~ 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 ~~redundant~~ message and service interface computers to interface with each division.

The measurement ~~channels~~ 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 ~~closed-loop control~~ 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.

BASES

BACKGROUND (continued)

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 a signal processor 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" 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.

For the reactor trip function, both ALUs in a division, if OPERABLE, must vote for an actuation. This provides protection against spurious trips. However, if only one ALU in a division is OPERABLE, the division 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 votes for an actuation. This provides protection against ESF unavailability.

Reactor Trip Logic

Critical plant parameters such as temperatures, pressures, and levels are sensed, acquired, and converted to electrical signals by the PS. These signals are sent to various reactor trip functions in the PS where they are processed. When prohibited operating conditions exist, a reactor trip signal is generated from the reactor trip functions. Besides being generated automatically from the PS, a reactor trip signal can also be generated from the following systems:

- Automatic reactor trip from ~~SAS in the event that the PS is lost~~ the Diverse Actuation System (DAS) in the unlikely event of a software common cause failure of the PS;

- ~~Manual trip from the Safety Information and Control System (SICS) panel. Four reactor trip switches are provided, which correspond to each of the four divisions;~~

BASES

BACKGROUND (continued)

- Manual trip from the control room; and
- Manual trip from the RSS. Note that the RSS manual trip is not part of the required circuits for LCO 3.3.1.

The reactor trip functions will utilize voting logic in order to screen out potential upstream failures of sensors or processing units. The architecture of the PS, as well as logic implemented in the system, will guard against spurious reactor trip orders while ensuring that those orders will be available when needed.

Single failures upstream of the ALU layer that could result in an invalid signal being used in the reactor trip actuation are ~~marked as faulted~~accommodated by modifying the vote in the ALU layer. For the reactor trip functions, the vote is always modified toward actuation.

The reactor trip outputs of the two redundant ALUs in a subsystem are combined in a hardwired functional AND configuration. This requires both ALUs to output the reactor trip order for the associated reactor trip device to be actuated. The outputs of the functional AND from both subsystems within a division are combined in a functional OR logic. The functional AND provides protection against spurious reactor trip while maintaining the ability to actuate a trip if an ALU has failed.

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.

BASES

BACKGROUND (continued)

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 activation. Otherwise, the function is modified toward activation.

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 can actuate an ESF function.

Actuation Devices

Reactor Trip Actuation Devices

The reactor trip actuation is performed by interrupting electrical power to the Control Rod Drive Mechanism (CRDM). Electrical power to the CRDM is delivered by the Control Rod Drive Power Supply System (CRDPSS). The CRDPSS consists of 220 V DC distribution boards which are fed from the Uninterruptible Power Supply System.

The power supply of the ~~CDRM~~ CRDM can be switched off via the following features:

- Four main trip breakers distributed in two electrical divisions. Two breakers are located in Division 2, two others in Division 3. The main trip breakers can be opened by two coils: one with a de-energized logic using an under voltage coil and the other with an energized logic using a shunt trip coil.

  – The under voltage coil of the main trip breakers is actuated by the automatic reactor trip signals of the PS and the manual trip from the Safety Information and Control System (SICS) panel. The shunt coil of the main trip breakers is actuated by the automatic reactor trip signal from the DAS and the manual trip signal from the RSS.

BASES

BACKGROUND (continued)

- The reactor trip signal generated automatically by the PS and the manual trip signal generated from the SICS panel can actuate the trip contactors.

- There are 23 sets of four trip contactors, each set capable of removing power to four CRDM power supplies. Eleven sets of contactors are located in physical division one and twelve sets are located in physical division four. Each division of the PS is assigned to one contactor in each of the 23 sets. Each set of four contactors is arranged to require two out of four PS reactor trip orders to drop the rods assigned to the contactor set.

- The electronics of the ~~RodPilot~~ Control Rod Drive Control System (CRDCS) can switch-off the power supply of four CRDMs. ~~Two groups of four commands can actuate this electronic module, one with low active and one with high active logic.~~ The electronics of the ~~RodPilot is~~CRDCS are ~~a~~ non-safety ~~device of the reactor trip~~ but ~~is~~ are the fastest switching device and allow~~s~~ the contactors and the trip breaker to open without stress.

Once open, the reactor trip breakers require manual closure and they cannot be manually closed until the reactor trip signal is cleared by the PS.

- ~~The under voltage coil of the main trip breakers is actuated by the automatic reactor trip signals of the PS and the manual trip from the SICS panel. The shunt coil of the main trip breakers is actuated by the automatic reactor trip signal from the SAS and the manual trip signal from the RSS. The shunt coil of the trip breakers receives two different signals from SAS and RSS combined in an "OR" logic performed at the level of trip breakers.~~

~~The operator can manually close the breakers by individual controls. This control actuates the closing coil of the breaker via the SAS. In the electronics of the breaker, the opening of trip breaker must have priority to the closing.~~

~~The reactor trip signal generated automatically by the PS and the manual trip signal generated from the SICS panel can actuate the trip contactors.~~

BASES

BACKGROUND (continued)

Engineered Safety Features Actuation Devices

The ~~ESF~~ PS determines the need for ESF actuation in each of the input divisions monitoring each actuation parameter. Once the need for actuation is determined, the condition is transmitted to automatic actuation output logic divisions, which perform the logic to determine the actuation of each end device. ~~Each end device has its own automatic actuation logic.~~

Each of the PS sensors, signal processors, or actuation devices can be placed in lockout, which renders the component inoperable. The digital signals within the PS carry a value and a status. The signal status can be propagated through the software function blocks; therefore, if an input signal to a function block has a faulty status, the output of the function block also has a faulty status. When a signal with a faulty status reaches the voting function block, the signal is disregarded through modification of the voting logic. Individual function computers can be put into a testing and diagnostic mode via the service unit. The function processor that is being tested then behaves like a computer with a “detected fault” for the system. The signal outputs are disabled and those sent via the communication means are marked with the status “TEST” or “ERROR” and therefore masked by selection blocks with active status processing. In this case the receiving function processor behaves as if the transmitting function processor had failed.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

The PS is designed to ensure that the following operational criteria are met:

– The associated actuation will occur when the parameter monitored by each division reaches its setpoint and the specific coincidence logic is satisfied; and

– In general, ~~S~~separation and redundancy are maintained to permit a division to be out of service for testing or maintenance while still maintaining redundancy within the PS instrumentation network.

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 tabulated 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 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.

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).

~~The~~ In general, the PS sensors, manual actuation switches, signal processors, and specified actuation devices that support ~~ESFs~~ 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.

~~The~~ In general, the PS sensors, manual actuation switches, signal processors, and specified actuation devices that support ~~reactor trips~~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.

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) Charging Line Isolation on Anti-Dilution Mitigation (ADM) at Shutdown Condition (RCP not operating),

– ESF 11.c: CVCS Charging Line Isolation on ADM at 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.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The specific safety analysis and OPERABILITY requirements applicable to each PS protective function is identified below. Permissives that enable a credited function 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.

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. ~~Variable~~ 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,
- Increase in reactor coolant inventory,
- 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:

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

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The Low DNBR and (Imbalance or Rod Drop (1/4)) (1.b), ~~Variable~~ 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:

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

The LTSPs are low enough to provide an operating envelope that prevents an unnecessary low DNBR reactor trip. The LTSPs 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.

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 this threshold, the trips are also automatically disabled by 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 ~~accidental transients, for events leading~~ 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.

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:

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

The LTSPs are high enough to provide an operating envelope that prevents unnecessary High Linear Power reactor trips. The LTSPs 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.

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 this threshold, the trip is also automatically disabled by Permissive P2.

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

This function limits the consequences of an excessive reactivity increase from ~~an intermediate power level including nominal power~~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 ~~Reactor Control, Surveillance and Limitation (~~RCSL~~)~~ System capable of withdrawing a RCCA or one or more RCCAs not fully inserted:

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

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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

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~~an intermediate high power level including nominal power~~. 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:

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

The LTSP is high enough to provide an operating envelope that prevents an unnecessary High Core Power Level reactor trip. The LTSP 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.~~intermediate power level and above, up to and including 100 percent power operation.~~

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. The P5 permissive also automatically disables the High Core Power Level Trip below this power.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

5. Low Saturation Margin

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 assures that the High Core Power Level trip function remains valid.

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 ~~monitors~~Detectors~~.~~:

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

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

The P5 permissive automatically enables the Low Saturation Margin Trip when the nuclear power level is greater than or equal to approximately 10^{-5}%. The P5 permissive also automatically disables the Low Saturation Margin Trip below this power.

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.

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 Trip (6.a) 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:

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

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

The P3 permissive automatically enables the Low-Low RCS Loop Flow Rate Trip (One Loop) when the nuclear power level is greater than or equal to approximately 70% RTP. The P3 permissive also automatically disables the Low-Low RCS Loop Flow Rate Trip (One Loop) below this power.

The Low RCS Loop Flow Rate in Two Loops Trip (6.b) 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.

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

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The P2 permissive automatically enables the Low RCS Loop Flow Rate Trip (Two Loops) when the nuclear power level is greater than or equal to approximately 10% RTP. The P2 permissive also automatically disables the Low RCS Loop Flow Rate Trip (Two Loops) when the nuclear power level is below this power.

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:

- RCP Speed ~~Trip~~ sensors,
- APUs, and
- ALUs.

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

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 this threshold, the trip is also automatically disabled by ~~p~~Permissive ~~function~~ P2.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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.

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.

The LTSP is high enough to provide an operating envelope that prevents an unnecessary High Neutron Flux reactor trip. The LTSP 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.

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.

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.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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 ~~when~~ with the RCSL System ~~is~~ capable of withdrawing a RCCA or one or more RCCAs not fully inserted:

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

The LTSP is high enough to provide an operating envelope that prevents an unnecessary Low Doubling Time reactor trip. The LTSP 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.

The P6 permissive automatically enables the Low Doubling Time reactor trip when the power level is less than or equal to approximately 10% RTP.

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:

- 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 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.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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 this threshold, the trip is automatically disabled by ~~p~~Permissive ~~function~~ 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 ~~analyses~~transients.

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:

- ~~Three~~ Pressurizer Pressure (Narrow Range) sensors,
- ~~Three divisions of~~ APUs, and
- ~~Three divisions of~~ ALUs.

The LTSP is set below the nominal lift setting of the Pressurizer Safety Relief Valves (PSRV)~~code safety valves~~, 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 over pressurization 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 over~~-~~filling ~~and to prevent the PSRVs from relieving~~. This trip protects against increases in reactor coolant inventory.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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.

The LTSP 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 over pressurization of the RCS.

The P12 permissive automatically enables the High Pressurizer Level Trip when the pressure is greater than or equal to approximately 2005 psia.

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.

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 greater than or equal to approximately 2005 psia, 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 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.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The P12 permissive automatically enables the Low Hot Leg Pressure Trip when the pressure is greater than or equal to approximately 2005 psia.

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~~and hence a reactivity transient~~. 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.

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.

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. 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.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The setpoint algorithm is:

SP(t) = MIN ~~[~~{1088 *psia, S2(t)*~~]~~}

Where:

S1(t) = P(t) – Δp

S2(t) = MAX ~~[~~{*S1(t), S2(t – Ct) – C1Rl)*~~]~~}

t = current time

P(t) = measured SG pressure

Δ*p* = 102 psi

Ct = processor cycle time in minutes

Rl = 29 psi/minute

SP(t) = variable setpoint

The LTSP 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.

15. Low SG Pressure

In case of steam or feedwater system piping failure, the affected SG depressurizes leading to a RCS cooldown ~~and hence a criticality transient~~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.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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 ~~either~~ 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 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.

The P12 permissive automatically enables the Low SG Pressure Trip when the pressure is greater than or equal to approximately 2005 psia.

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.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The LTSP is set high enough to avoid spurious operation. In case of a loss of the main heat sink, the setpoint 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.

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 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.

The P13 permissive automatically enables the Low SG Level Trip when the hot leg temperature is greater than or equal to approximately 200°F.

18. High SG Level

This trip protects the turbine against 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.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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

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

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 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.

The P13 permissive automatically enables the High SG Level Trip when the hot leg temperature is greater than or equal to approximately 200°F.

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.

The High Containment 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 RCSL System capable of withdrawing a RCCA or one or more RCCAs not fully inserted~~.~~:

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

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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 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.

B. ENGINEERED SAFETY FEATURES ACTUATION SYSTEM (ESFAS) FUNCTIONS

Each of the analyzed accidents or AOOs can be detected by one or more ESF Functions. One of the ESF Functions is the primary actuation signal for that accident. An ESF Function may be the primary actuation signal for more than one type of accident. An ESF Function may also be the secondary, or backup, actuation signal for one or more other accidents. The ESF protective functions are described below.

1. Turbine Trip on Reactor Trip

A turbine trip is required following any reactor trip in order to avoid a mismatch between primary and secondary power, which would result in excessive RCS cooldown with a potential return to critical conditions and power excursion.

The automatic Turbine Trip on Reactor Trip requires four divisions of the following sensors and processors to be OPERABLE in MODE 1:

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

A turbine trip is required following any reactor trip in order to avoid a mismatch between primary and secondary power. Such a mismatch could result in an RCS cooldown transient, with a potential inadvertent return to critical conditions.

There are no automatic permissives associated with this function.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

2. Main Feedwater

a. MFW Full Load ~~Closure~~ Isolation on Reactor Trip (All SGs)

After a reactor trip check-back, a MFW full load isolation is required. This avoids a mismatch between primary and secondary power. Such a mismatch could result in an RCS cooldown transient, with a potential inadvertent return to critical conditions.

The automatic MFW Full Load ~~Closure~~ Isolation on Reactor Trip function ~~requires four divisions of the following processors to be OPERABLE in MODE 1 and MODE 2 except when the MFW full load isolation valves are closed:~~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 automatic permissives associated with this function.

b. MFW Full Load ~~Closure~~ 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.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The automatic MFW Full Load ~~Closure~~ Isolation on High SG Level function ~~requires four divisions of the following sensors and processors to be OPERABLE in MODE 1 and MODES 2 and 3, except when all MFW full load isolation valves are closed:~~ 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.

The MFW Full Load ~~Closure~~ Isolation on High SG Level LTSP 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.

The P13 permissive automatically enables the MFW Full Load ~~Closure~~ Isolation on High SG Level function when the hot leg temperature is greater than or equal to approximately 200°F.

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

The affected SG depressurizes for the listed events, a reactor trip is initiated on an SG pressure drop signal. Also, the Startup and Shutdown Feedwater (SSS) isolation and control valves close in ~~all~~ the affected SG~~s~~.

A complete 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.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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.
- ~~, except when all MFW low load isolation valves are closed, and~~
- ~~MODE 3, except when all MFW low load isolation valves are closed.~~

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

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

The LTSP 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.

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. 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.

The setpoint algorithm is:

SP(t) = MIN ~~[~~{943 psia, S2(t)~~]~~}

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Where:

$S1(t) = P(t) - \Delta p$

$S2(t) = MAX\ \cancel{[}\{S1(t),\ S2(t - Ct) - C1Rl)\cancel{]}\}$

t = current time

$P(t)$ = measured SG pressure

Δp = 247 psi

Ct = processor cycle time in minutes

Rl = 29 psi/minute

$SP(t)$ = variable setpoint

There are no automatic permissives associated with this function.

d. SSS Isolation on Low SG Pressure (Affected SGs)

The affected SG depressurizes in the event of a steam line or 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.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The automatic SSS Feedwater 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.
- ~~MODE 2, except when all MFW low load isolation valves are closed, and~~
- ~~MODE 3 when the pressurizer pressure is greater than or equal to 2005 psia, except when all MFW low load isolation valves are closed.~~

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

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

The LTSP 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.

The P12 permissive automatically enables the SSS Isolation on Low SG Pressure function when the pressurizer pressure is greater than approximately 2005 psia.

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 flow.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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.

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 ~~in MODE 1 and MODES 2 and 3, except when all MFW low load isolation valves are closed~~:

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

The SSS Isolation on High SG Level for Period of Time LTSP 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.

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 approximately 200°F.

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.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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.

The ~~automatic~~ 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:

- ~~Three~~ Pressurizer Pressure (Narrow Range) sensors,
- ~~Three divisions of~~ APUs, and
- ~~Three divisions of~~ ALUs.

The LTSP 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 is high enough to provide an SIS actuation during an RCS depressurization.

The P12 permissive automatically ~~enables~~ disables the SIS Actuation on Low Pressurizer Pressure function when the pressurizer pressure is ~~greater~~ less than ~~or equal to~~ approximately 2005 psia.

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 in the hot and cold shutdown conditions with LHSI / Residual Heat Removal (RHR) in operation and at least one RCP operating.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

This function mitigates the following postulated accidents or AOOs:

- Small break LOCA,
- Large break LOCA, and
- ~~Spurious opening of one Main Steam relief or safety valve,~~
- Inadvertent opening of a pressurizer pilot operated safety valve~~,~~.
- ~~Excessive increase in secondary steam flow, and~~
- ~~MSLB.~~

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 the hot leg temperature is greater than or equal to approximately 350°F:

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

~~These sensors and processors are required to be OPERABLE in MODE 3 when Trip/Actuation Function B.3.a, SIS Actuation on Low Pressurizer Pressure, is disabled.~~

This function ensures SIS actuation in the hot and cold shutdown conditions with LHSI/RHR in operation and at least one of the RCPs are operating.

The LTSP 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.

The P12 permissive automatically enables the SIS Actuation on Low Delta P_{sat} function when the pressurizer pressure is less than or equal to approximately 2005 psia. The P15 permissive automatically 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, and the hot leg temperature is less than approximately 350ºF. ~~The P15 permissive automatically enables the SIS Actuation on Low Delta P_{sat} function when at least two RCPs are running, the hot leg pressure is greater than or equal to 464 psia, and when the hot leg temperature is greater than or equal to 356°F.~~

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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.

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 SIS Actuation on Low RCS Loop Level function requires four divisions of the following sensors and processors:

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

The P15 Permissive automatically 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.

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 ~~automatic~~ 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, ~~and~~ 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).

The LTSP 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.

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.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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.

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).

The P14 permissive automatically enables the Partial Cooldown on SIS Actuation function when the hot leg pressure is greater than or equal to approximately 464 psia and the hot leg temperature is greater than or equal to approximately ~~356~~350°F.

6. Emergency Feedwater System

a. Actuation on Low-Low SG Level (~~All~~ 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~~ Level (Wide Range) sensors,
- APUs, and
- ALUs.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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 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.

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.

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:

- ~~6.9 kV Bus Voltage 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).

This function ensures heat is removed from the primary system through the SGs in the event of a LOCA concurrent with a LOOP.

~~There are no automatic permissives associated with this function.~~
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.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

~~c. Isolation on High SG Level (Affected SG)~~

~~In the case of an increasing SG level event, the EFWS supply to the affected SG is isolated in order to avoid filling the SG, and subsequently introducing water into Main Steam line and MSRT. This function precludes overfilling of the SG.~~

~~The automatic EFWS Isolation on High 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.~~

~~This function ensures the SGs are not overfilled, which could allow radioactive water to be discharged through the MSRTs. The LTSP is high enough to provide an operating envelope that prevents unnecessary isolations but low enough to ensure the SGs are not over-filled.~~

~~The P13 permissive automatically enables the EFWS Isolation on High SG Level function when the hot leg temperature is greater than or equal to 200°F.~~

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:

- ~~Excessive increase in secondary steam flow,~~
- Total loss of load and/or turbine trip,
- Loss of main heat sink (condenser),
- Inadvertent closure of a ~~Main Steam Isolation Valve (~~MSIV~~)~~,
- ~~MSLB,~~
- RCP seizure (locked rotor) or RCP shaft break, and
- Feedwater system piping failure.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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, ~~and~~ 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.

The LTSP 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 over pressurization limits are reached.

~~There are no automatic permissives associated with this function.~~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.

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

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The LTSP 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.

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.

8. MSIV ~~Closure~~Isolation

a. ~~Closure~~ Isolation on SG Pressure Drop (All SGs)

In case of a secondary side Steam Line or 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.

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 ~~Closure~~ Isolation on SG Pressure Drop function requires four divisions of the following sensors and processors to be OPERABLE in MODES ~~1, 2, and 3~~1 and 2, and in MODE 3 except when all MSIVs are closed:

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

The LTSP for the MSIV ~~Closure~~ 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.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

A SG pressure drop is detected by using a variable low setpoint equal to the actual SG pressure minus a fixed value, with a limitation placed on the rate of decrease of the setpoint. The maximum value of the setpoint is also limited in order to avoid MSIV ~~closure~~ isolation during a SG pressure decrease following reactor trip and turbine trip, which could result in a SG overpressure condition.

The setpoint algorithm is:

SP(t) = MIN ~~[~~{1088 psia, S2(t)~~]~~}

Where:

S1(t) = P(t) – Δp

S2(t) = MAX ~~[~~{S1(t), S2(t – Ct) – C1Rl)~~]~~}

t = current time

P(t) = measured SG pressure

Δ*p* = 102 psi

Ct = processor cycle time in minutes

Rl = 29 psi/minute

SP(t) = variable setpoint

There are no automatic permissives associated with this function.

b. ~~Closure~~ 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 ~~closure on SG pressure drop~~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.

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 automatic MSIV ~~Closure~~ 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~~ Pressure sensors,
- APUs, and
- ALUs.

The LTSP for the MSIV ~~Closure~~ 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.

The P12 permissive automatically enables the MSIV ~~Closure~~ Isolation on Low SG Pressure function when the pressurizer pressure is greater than or equal to approximately 2005 psia.

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. Safeguards Building HVAC is also reconfigured to process air through High Efficiency Particulate Air (HEPA) filters to ensure 10 CFR 50.34 and 10 CFR 100.21 limits are not exceeded.

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, ~~and~~ 3, and 4:

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

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The LTSP 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 automatic 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. Safeguards Building HVAC is also reconfigured to process air through HEPA filters to ensure 10 CFR 50.34 and 10 CFR 100.21 limits are not exceeded.

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.

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 automatic 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.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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, ~~and~~ 3 and 4:

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

The LTSP 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 automatic permissives associated with this function.

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.

d. Isolation (Stage 1) on High Containment Radiation

In case of a 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.

This function mitigates the following postulated accidents or AOOs:

- Rod ejections,
- LOCA,
- MSLB inside containment, and
- Feedwater line break inside containment.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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.

The LTSP 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 automatic permissives associated with this function.

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.

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, ~~and 4 or when the associated EDG is required to be OPERABLE in accordance with LCO 3.8.2, "AC Sources - Shutdown":~~4, 5, and 6, and during movement of irradiated fuel assemblies:

- 6.9 kV ~~voltage~~ Bus Voltage sensors,
- APUs, and
- ALUs.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

This function ensures AC Power is available to mitigate a postulated concurrent design basis event.

The LTSP 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 automatic permissives associated with this function.

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.

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, ~~and 4 or when the associated EDG is required to be OPERABLE in accordance with LCO 3.8.2, "AC Sources - Shutdown":~~ 4, 5, and 6, and during movement of irradiated fuel assemblies:

- 6.9 kV ~~voltage~~ Bus Voltage sensors,
- APUs, and
- ALUs.

This function ensures AC Power is available to mitigate a postulated concurrent design basis event.

The LTSP 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.

There are no automatic permissives associated with this function.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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.

11. Chemical and Volume Control System Charging Line Isolation

a. 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.

This function protects against a CVCS malfunction that causes an increase in RCS water inventory.

The automatic CVCS Charging Line Isolation on High-High Pressurizer Level function requires ~~four divisions of~~ the following sensors and processors to be OPERABLE in MODES 1, 2, ~~and~~ 3, and 4:

- Pressurizer Level (Narrow Range) sensors (4 divisions),
- APUs (4 divisions), and
- ALUs (Divisions 1 and 4).

The LTSP 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.

The P17 permissive automatically disables the CVCS Charging Line Isolation on High-High Pressurizer Level function when the cold leg temperature is less than or equal to approximately 248°F.

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.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The automatic CVCS Charging Line Isolation on ADM - Shutdown Condition (RCP not operating) function is required to be OPERABLE in MODES 3, 4, 5, and 6 with no RCPs in operation~~:~~.

- ~~MODE 5, with two or less RCPs in operation, and~~
- ~~MODE 6~~

The automatic CVCS Charging Line 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).

The LTSP 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.

This function is required to be accompanied by Permissive P7, which represents a RCP ~~speed shutdown condition, or an ATWS signal~~not in operation condition.

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 Charging Line 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~~:~~.

- ~~MODE 3,~~
- ~~MODE 4, with three or more RCPs in operation, and~~
- ~~MODE 5, with three or more RCPs in operation.~~

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The automatic CVCS Charging Line 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).

The LTSP 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.

This function is ~~required to be accompanied by a~~enabled by Permissive ~~signal,~~ P8, which represents a reactor shutdown condition as indicated by RCCA position indication and disabled by the Permissive P7, which represents a RCP ~~shutdown~~ not in operation condition.

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 Charging Line 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).

The LTSP is low enough to provide an operating envelope that prevents unnecessary isolations but high enough to mitigate a dilution event at power.

This function is disabled by Permissive P8, which represents a reactor shutdown condition as indicated by RCCA position indication.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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.

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 when the PSRVs are required to be OPERABLE by LCO 3.4.11, "Low Temperature Overpressure Protection (LTOP)":

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

The LTSPs for the PSRV Actuation function are high enough to prevent spurious operation but low enough to prevent RCS over pressurization.

The P17 permissive automatically enables the PSRV Actuation function when the cold leg temperature is less than or equal to approximately 248°F.

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.

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.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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.

The LTSP 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 automatic permissives associated with this function.

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.

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 automatic 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).

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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: ~~Variable~~ 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:

- 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. 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% ~~Nuclear Power~~RTP).

The P3 permissive is utilized in Reactor Trip 6.a: Low-Low RCS Flow Rate in One Loop.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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:

- 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).

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).

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:

- Intermediate Range Detectors,
- APUs, and
- ALUs.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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 ~~in~~ 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).

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.

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 or anticipated operational occurrence, nor to keep the plant in an analyzed condition. Since Permissive P6 only disables functions when the permissive is validated, it is not within the scope of 10 CFR 50.36, Criterion 3, and is not required to be OPERABLE.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

5. P7 - RCP ~~Speed~~ Not in Operation~~Lower than Threshold~~

The P7 permissive defines when reactor coolant pumps (RCPs) are no longer in operation. The P7 permissive is utilized in the following reactor trips or ESF functions:

- ESF 11.b: CVCS Charging Line Isolation on ADM at Shutdown Condition (RCP not operating), and
- ESF 11.c: CVCS Charging Line Isolation on ADM at 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.

The RCP current measurements (three per RCP) from different pumps are compared to a setpoint (less than approximately 50% no load current). When two out of three of the measurements taken from all four divisions are less than the setpoint, the permissive is validated (i.e., indicates that the RCPs are not in operation).
~~The RCP speed measurements (one per RCP) are compared to a setpoint (91% nominal speed). When two out of four of the measurements are less than the setpoint, the permissive is validated (i.e., indicates that two or more RCPs are turned off).~~

The value of the permissive was selected to establish the requirements for anti-dilution mitigation in a timely manner.

6. P8 - Shutdown RCCA Position Lower than Threshold

The P8 permissive defines the shutdown state with all rods in (ARI). The P8 permissive is utilized in ~~ESF 11.c: CVCS Charging Line Isolation on ADM at Standard Shutdown Conditions.~~:

- ESF 11.c - CVCS Charging Line Isolation on ADM at Standard Shutdown Conditions, and
- ESF 11.d - CVCS Charging Line Isolation on ADM at Power.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The P8 permissive requires four divisions of the following sensors and processors to be OPERABLE in MODES 3, 4, and 5 with one or more RCPs in operation:

- RCCA Bottom Position Indicator sensors,
- RCCAUs,
- APUs, and
- ALUs.

RCCA Bottom Position Indicator sensors are acquired in four different electrical divisions. For each division, when all rods in the shutdown banks reach the lower end position, a signal is generated. When two out of four of divisions indicate all rods in, the permissive is validated.

The P8 Permissive is characteristic of a shutdown state with ARI. With an ARI condition, this permissive enables the Anti-dilution in Standard Shutdown States function and inhibits the Anti-dilution ~~in~~ at Power Condition~~"~~ function.

7. P12 - Pressurizer Pressure Lower than Threshold

The P12 permissive defines the transition from hot shutdown to cold shutdown with respect to RCS pressure. 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 ~~Trip~~,
- ESF 2.d: SSS Isolation on Low SG Pressure (~~All~~ 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 ~~Closure~~ Isolation on Low SG Pressure (All SGs)~~,~~. ~~and~~
- ~~ESF 9.b: Containment Isolation (Stage 1) on SIS Actuation.~~

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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, and the hot leg temperature is greater than or equal to approximately 350ºF:

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

Pressurizer pressure measurements are compared to the P12 setpoint (approximately 2005 psia). The low SG pressure and low hot leg pressure reactor trip functions are automatically activated when the pressurizer pressure rises above the P12 permissive value.

The Permissive P12 reflects the transition from hot shutdown to cold shutdown. P12 ensures 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.

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 ~~Trip17~~ Trip 17: Low SG Level,
– Reactor Trip 18: High SG Level,
– ESF 2.b: MFW Full Load ~~Closure~~ 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 (~~All~~ Affected SGs), and
– ESF 6.b: EFWS Actuation on LOOP and SIS Actuation (All SGs).
~~– ESF 6.c: EFWS Isolation on High SG Level (Affected SG).~~

Hot Leg Temperature (WR) measurements are compared to the P13 setpoint (approximately 200°F).

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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 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 Permissive P13 only disables functions when the permissive is validated, it is not within the scope of 10 CFR 50.36, Criterion 3, and is not required to be OPERABLE.

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 ESF 5: Partial Cooldown Actuation on SIS Actuation.~~

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).

At pressures and temperatures below the setting of the P14 permissive (approximately 464 psia and approximately 350 °F), 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.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

10. P15 - ~~RCPs Shutdown and P14~~Hot Leg Pressure and Hot Leg Temperature Lower than Thresholds and RCPs Shutdown

The P15 permissive defines when SI actuation due to ~~delta~~ Delta P_{sat} is disabled and SI actuation due to ~~low loop level~~ 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 9.b: Containment Isolation (Stage 1) on SIS Actuation.~~
- 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.

The value for 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 an RCP)~~The value for Permissive P15 (50% no load current and P14 is true)~~ 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.

11. P16 - Hot Leg Pressure and Delta P_{sat} Lower than Thresholds, RCP Not in Operation, and Time Elapsed since Safety Injection Start

The P16 permissive defines when Safety Injection may be aligned from the cold leg to the hot leg to mitigate the consequences of a LOCA. The P16 permissive requires four division of the following sensors and processors to be OPERABLE in MODES 1, 2, 3, and 4:

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

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The value for Permissive P16 (Hot leg pressure below approximately 290 psia, Delta P_{sat} below approximately 73 psi, less than approximately 50% no load current on an RCP, and approximately 1.5 hours since Safety Injection initiated) represents the threshold for switching from cold leg injection to hot leg injection.

~~11~~12. P17 - Cold Leg Temperature Lower than Threshold

The P17 permissive corresponds to the temperature conditions where brittle fracture protection is required. The P17 permissive is utilized in the following reactor trips or ESF functions:

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

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

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

The value for Permissive P17 is the threshold for activation of cold overpressure mitigation systems.

D. SENSORS, MANUAL ACTUATION SWITCHES, SIGNAL PROCESSORS, AND ACTUATION DEVICES

The relationship between sensors, manual actuation switches, signal processors, and actuation devices is provided below:

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

SENSORS

1. 6.9 kV Bus Voltage

Three 6.9 kV Bus Voltage sensors per EDG are required to be OPERABLE in MODES 1, 2, 3, 4, 5, 6, and during movement of irradiated fuel assemblies~~and when the associated EDG is required to be OPERABLE by LCO 3.8.2~~. These sensors support the following functions:

- ~~ESF 6.b: EFWS Actuation on LOOP and SIS Actuation (All SGs),~~
- ESF 10.a: EDG Start on Degraded Grid Voltage, and
- ESF 10.b: EDG Start on LOOP.

2. Boron Concentration - CVCS Charging Line

Four Boron Concentration - CVCS Charging Line sensors are required to be OPERABLE in MODES 1, 2, 3, 4, 5, and in MODE 6 with no RCPs in operation. ~~3 and 4 with three or more RCPs in operation and in MODES 5 and 6.~~ These sensors support the following functions:

- ESF 11.b: CVCS Charging Line Isolation on ADM at Shutdown Condition (RCP not operating),~~ and~~
- ESF 11.c: CVCS Charging Line Isolation on ADM at Standard Shutdown Conditions~~.~~, and
- ESF 11.d: CVCS Charging Line Isolation on ADM at Power.

3. Boron Temperature - CVCS Charging Line

Four Boron Temperature - CVCS Charging Line sensors are required to be OPERABLE in MODES 1, 2, 3, 4, 5, and in MODE 6 with no RCPs in operation.~~ 3 and 4 with three or more RCPs in operation and in MODES 5 and 6.~~ These sensors support the following functions:

- ESF 11.b: CVCS Charging Line Isolation on ADM at Shutdown Condition (RCP not operating),~~ and~~
- ESF 11.c: CVCS Charging Line Isolation on ADM at Standard Shutdown Conditions~~.~~, and
- ESF 11.d: CVCS Charging Line Isolation on ADM at Power.

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 ~~3, 4, and 5 when three or more RCPs are in operation~~1 and 2, and in MODES 3, 4, and 5 with one or more RCPs in operation. These sensors support ~~ESF 11.c: CVCS Charging Line Isolation on ADM at Standard Shutdown Conditions~~ the following functions:

- ESF 11.c: CVCS Charging Line Isolation on ADM at Standard Shutdown Conditions, and
- ESF 11.d: CVCS Charging Line 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:

- Reactor Trip 1.a: Low DNBR,
- Reactor Trip 1.b: Low DNBR and (Imbalance or Rod Drop (1/4)),
- Reactor Trip 1.c: ~~Variable~~ 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
- 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:

- MODE 1,
- MODE 2, when power is greater than or equal to approximately 10^{-5}% as shown on the Intermediate Range Detectors, ~~and in~~
- ~~MODES 3, 4, 5, and 6 with three or more RCPs in operation.~~
- 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)".

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 Charging Line Isolation on ADM at Standard Shutdown Conditions, and
- 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 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 Reactor Trip 19: High Containment Pressure function.

8. Containment Service Compartment Pressure (Narrow Range)

Four Containment Service Compartment Pressure (Narrow Range) sensors 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 Reactor Trip 19: High Containment Pressure function.

9. Containment Service Compartment Pressure (Wide Range)

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

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

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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

- ~~Reactor Trip 19: High Containment Pressure,~~
- ~~ESF 9.a: Containment Isolation (Stage 1) on High Containment Pressure, and~~
- ~~ESF 9.c: Containment Isolation (Stage 2) on High-High Containment Pressure.~~

~~8~~10. Hot Leg Pressure (Wide Range)

Four Hot Leg Pressure (Wide Range) sensors are required to be OPERABLE in ~~Modes 1, 2, and 3~~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,
- Permissive P6: Thermal Core Power Higher than Threshold,
- Permissive P14: Hot Leg Pressure and Hot Leg Temperature Lower than Thresholds, ~~and~~
- Permissive P15: Hot Leg Pressure and Hot Leg Temperature Lower than Thresholds and RCPs Shutdown, and ~~RCPs Shutdown and P14.~~
- Permissive P16: Hot Leg Pressure and Delta P_{sat} Lower than Thresholds, RCP Not in Operation, and Time Elapsed since Safety Injection Start.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

~~9~~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:

- Reactor Trip 4: High Core Power Level,
- Reactor Trip 5: Low Saturation Margin, and
- Permissive P6: Thermal Core Power Higher than Threshold.

~~10~~12. Hot Leg Temperature (Wide Range)

Four Hot Leg Temperature (Wide Range) sensors are required to be OPERABLE in MODES ~~3~~ 1, 2, 3, 4, 5, and 6~~when Trip/Actuation Function B.3.a, SIS Actuation on Low Pressurizer Pressure, is disabled~~. 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),
- Permissive P13: Hot Leg Temperature Lower than Threshold,
- Permissive P14: Hot Leg Pressure and Hot Leg Temperature Lower than Thresholds, ~~and~~
- Permissive P15: Hot Leg Pressure and Hot Leg Temperature Lower than Thresholds and RCPs Shutdown, and
- Permissive P16: Hot Leg Pressure and Delta P_{sat} Lower than Thresholds, RCP Not in Operation, and Time Elapsed since Safety Injection Start.

~~11~~13. Intermediate Range

Four Intermediate Range sensors are required to be OPERABLE in:

- MODE 1, ~~when power is less than or equal to 10% RTP,~~
- MODE 2, and ~~in~~
- MODE 3 with the RCSL System capable of withdrawing a RCCA or one or more RCCAs not fully inserted.

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
- Permissive P5: Flux (Intermediate Range) Measurement Higher than Threshold.

~~12~~14. Power Range

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,
- Permissive P2: Flux (Power Range) Measurement Higher than First Threshold, and
- Permissive P3: Flux ~~Measurement~~ (Power Range) Measurement Higher than Second Threshold.

~~13~~15. Pressurizer Level (Narrow Range)

Four Pressurizer Level (Narrow Range) sensors are required to be OPERABLE in MODES 1, 2, 3, and ~~3~~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.

~~14~~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, and greater than approximately 50% no load current on an RCP.~~1 and 2 and MODE 3 when the pressurizer pressure is greater than or equal to 2005 psia.~~ These sensors support the following functions and Permissives:

- Reactor Trip 1.a: Low DNBR,
- Reactor Trip 1.b: Low DNBR and (Imbalance or Rod Drop (1/4)),

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

- Reactor Trip 1.c: ~~Variable~~ 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
- Permissive P12: Pressurizer Pressure Lower than Threshold.

~~15~~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.

~~16~~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 ~~the~~ 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.

~~17~~19. RCP Current

Three RCP Current sensors per RCP (12 total) are required to be OPERABLE in MODES 1, 2, ~~and~~ 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, ~~and~~
- Permissive P7: RCP Not in Operation, and
- Permissive P15: Hot Leg Pressure and Hot Leg Temperature Lower than Thresholds and ~~Reactor Coolant Pumps~~RCPs Shutdown.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

~~18~~20. RCP Delta Pressure~~ Sensors~~

Two RCP Delta Pressure sensors per pump (8 total) are required to be OPERABLE in MODES 1, 2, ~~and~~ 3, and 4. These sensors support ESF 4: RCP Trip on Low Delta Pressure across RCP with SIS Actuation function.

~~19~~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~~ and Permissives~~:

- Reactor Trip 1.a: Low DNBR
- Reactor Trip 1.b: Low DNBR and (Imbalance or Rod Drop (1/4)),
- Reactor Trip 1.c: ~~Variable~~ 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.~~, and~~
- ~~Permissive P7: RCP Speed Lower than Threshold.~~

~~20~~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 ~~power~~ 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:

- Reactor Trip 1.a: Low DNBR,
- Reactor Trip 1.b: Low DNBR and (Imbalance or Rod Drop 1/4)),
- Reactor Trip 1.c: ~~Variable~~ 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
- Permissive P6: Thermal Core Power Higher than Threshold.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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.

~~21~~24. RTCB Position Indication

Four RTCB Position Indication sensors are required to be OPERABLE in MODE 1, and in MODES 2 and 3 ~~with the RCSL System capable of withdrawing a RCCA or one or more RCCAs not fully inserted.~~except when all MFW Full Load lines are isolated. These sensors support the following functions:

- ESF 1: Turbine Trip on Reactor Trip,
- ESF 2.a: MFW Full Load ~~Closure~~ Isolation on Reactor Trip (All SGs), and
- ESF 2.e: ~~MFW and~~ SSS Isolation on High SG Level for Period of Time (Affected SGs).

25. Rod Cluster Control Assembly (RCCA) Bottom Position Indicator

Eighty-nine RCCA Bottom Position Indicator sensors are required to be OPERABLE in:

- MODE 1 when RTP is greater than or equal to approximately 10%,
- 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 the following functions and Permissives:

- 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.e: Low DNBR - High Quality and (Imbalance or Rod Drop (1/4)), and
- Permissive P8: Shutdown RCCA Position Lower than Threshold.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

~~22~~26. 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:

- Reactor Trip 1.a: Low DNBR,
- Reactor Trip 1.b: Low DNBR and (Imbalance or Rod Drop (1/4)),
- Reactor Trip 1.c: ~~Variable~~ 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.

~~23~~27. SG Level (Narrow Range)

Four SG Level (Narrow Range) sensors per SG (16 total) are required to be OPERABLE in MODES 1 and ~~in MODES~~ 2, and in MODE 3~~,~~ except when all MFW ~~isolation~~ full load and low load ~~valves are closed~~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 ~~Closure~~ Isolation on High SG Level (Affected SGs), and
- ESF 2.e: SSS Isolation on High SG Level for Period of Time (Affected SGs).

~~24~~28. 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 ~~the following functions:~~ESF 6.a: EFWS Actuation on Low-Low SG Level (~~All~~ Affected SGs).~~, and~~
~~ESF 6.c: EFWS Isolation on High SG Level (Affected SG).~~

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

~~25~~29. SG Pressure

Four SG Pressure sensors per SG (16 total) are required to be OPERABLE in MODES 1, 2, ~~and~~ 3, and in MODE 4 when the SGs are relied upon for heat removal. These 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 (~~All~~ Affected SGs),
- ESF 2.d: SSS Isolation on Low SG Pressure (~~All~~ 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 ~~Closure~~ Isolation on SG Pressure Drop (All SGs), and
- ESF 8.b: MSIV ~~Closure~~ Isolation on Low SG Pressure (All SGs).

MANUAL ACTUATION SWITCHES

1. Reactor Trip

Four manual Reactor Trip switches are required to be OPERABLE in: ~~MODES 1 and 2 and in MODES 3, 4, and 5 with the RCSL System capable of withdrawing a RCCA or one or more RCCAs not fully inserted.~~

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

These switches support all reactor trip functions.

2. SIS Actuation

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

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

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

3. SG Isolation

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

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

~~SIGNAL PROCESSORS~~

~~1. Remote Acquisition Units~~

~~Two RAUs per division (8 total) are required to be OPERABLE when RTP is greater than or equal to 10%. These signal processors support the following functions:~~

- ~~Reactor Trip 1.a: Low DNBR,~~
- ~~Reactor Trip 1.b: Low DNBR and Imbalance or Rod Drop,~~
- ~~Reactor Trip 1.c: Variable Low DNBR and Rod Drop,~~
- ~~Reactor Trip 1.d: Low DNBR - High Quality,~~
- ~~Reactor Trip 1.e: Low DNBR - High Quality and Imbalance or Rod Drop, and~~
- ~~Reactor Trip 2: High Linear Power Density.~~

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

SIGNAL PROCESSORS

~~2~~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.

~~3~~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 ~~the~~ 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%. 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

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.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

These signal processors support the following functions and Permissives:

- 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
- Permissive P8: Shutdown RCCA Position Lower than Threshold.

ACTUATION DEVICES

1. RCP Bus and Trip Breakers

Two RCP Bus and Trip Breakers per pump (8 total) are required to be OPERABLE in MODES 1, 2, 3, and 4. These actuation devices support ESF 4: RCP Trip on Low Delta P across RCP with SIS.

2. Reactor Trip Circuit Breakers

Four RTCBs are required to be OPERABLE in:

- MODES 1 and 2, and
- MODES 3, 4, and 5 with the RCSL System capable of withdrawing a RCCA or one or more RCCAs not fully inserted.~~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 actuation devices support the reactor trip functions.

3. Reactor Trip Contactors

Twenty-three sets of four Reactor Trip Contactors (92 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 actuation devices support the reactor trip functions.~~

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

These actuation devices support the reactor trip functions.

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 trip setpoint is non-conservative with respect to the Allowable Value, the division is declared inoperable immediately, and the appropriate Condition(s) must be entered immediately.

In the event 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.

<u>A.1 and A.2</u>

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.

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

Condition C applies to one or more APUs inoperable due to the LTSP for one or more Trip/Actuation Functions 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 LTSP for either the EDG Start on Degraded Grid Voltage or the EDG Start on LOOP (Trip/Actuation Functions 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." 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 LTSP to OPERABLE status within 24 hours for all other Trip/Actuation Functions is a reasonable timeframe considering the time necessary to change the setpoint parameter, load corrected software, or replace the unit. If the LTSP cannot be restored to OPERABLE status, the associated Trip/Actuation Function must be placed in lockout in the associated APU.

D.1 and D.2

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 Functions 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

ACTIONS (continued)

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.

G.1

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) ~~is~~ or associated 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% in an orderly manner and without challenging unit systems.

BASES

ACTIONS (continued)

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 ~~ESF functions~~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% in an orderly manner and without challenging unit 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 ~~or ESF functions~~ 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 unit 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, ~~or~~ 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 unit systems.

K.1 and K.2

If Table 3.3.1-1 or Table 3.3.1-2 directs entry into Condition K, the unit must be brought to a MODE in which the supported reactor trips or ESF functions 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 open the reactor trip breakers without challenging unit systems.

ACTIONS (continued)

L.1 and L.2

If Table 3.3.1-1 or Table 3.3.1-2 directs entry into Condition L, the unit must be brought to a MODE in which the supported reactor trips or ESF functions are not required to be OPERABLE. The allowed Completion Times are reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and then reduce the pressurizer pressure to less than 2005 psia without challenging unit systems.

M.1 and M.2

If Table 3.3.1-1 or Table 3.3.1-2 directs entry into Condition M, the unit must be brought to a MODE in which the supported ~~reactor trips or~~ ESF functions are not required to be OPERABLE. The allowed Completion Time of 6 hours to reach MODE 3 and 12 hours to reach MODE 4 is reasonable, based on operating experience, to reach the required MODES from full power conditions in an orderly manner and without challenging unit systems.

N.1 and N.2

If Table 3.3.1-1 or Table 3.3.1-2 directs entry into Condition N, the unit must be brought to a MODE in which the supported reactor trips, ~~or~~ ESF functions, or Permissives are not required to be OPERABLE. The allowed Completion Time of 6 hours to reach MODE 3 and 36 hours to reach MODE 5 is reasonable, based on operating experience, to reach the required MODES from full power conditions in an orderly manner and without challenging unit systems.

O.1

If Table 3.3.1-1 or Table 3.3.1-2 directs entry into Condition O, the unit must be brought to a MODE in which the supported ESF functions or Permissives are not required to be OPERABLE. The allowed Completion Time of 36 hours to reach MODE 5 is reasonable, based on operating experience, to reach the required MODE in an orderly manner and without challenging unit systems.

BASES

ACTIONS (continued)

~~O.1~~P1 and P2

If Table 3.3.1-1 or Table 3.3.1-2 directs entry into Condition ~~O~~P, the Conditions specified in LCO 3.8.1, "AC Sources - Operating," or LCO 3.8.2, "AC Sources - Shutdown," for the EDG made inoperable by failure of the 6.9 kV Bus Voltage sensors are required to be entered immediately. The actions of those LCOs provide adequate compensatory actions to assure unit safety.

Q.1

If Table 3.3.1-1 or Table 3.3.1-2 directs entry into Condition Q, the automatic mitigation of dilution events may be impacted. Operations involving positive reactivity additions that could result in loss of required SDM or boron concentration shall be suspended immediately. Suspending positive reactivity additions that could result in failure to meet the minimum SDM or boron concentration limit is required to assure continued safe operation. Introduction of coolant inventory must be from sources that have a boron concentration greater than that what would be required in the RCS for minimum SDM or refueling boron concentration. This may result in an overall reduction in RCS boron concentration, but provides acceptable margin to maintaining subcritical operation. Introduction of temperature changes including temperature increases when operating with a positive MTC must also be evaluated to ensure they do not result in a loss of required SDM. Suspension of these activities does not preclude completion of actions to establish a safe conservative condition. These actions minimize the probability or the occurrence of postulated events. The Completion Time of immediately is consistent with the required times for actions requiring prompt attention.

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 be 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.

BASES

ACTIONS (continued)

~~P.1~~

~~If Table 3.3.1-1 directs entry into Condition P, the associated CVCS isolation valves are immediately declared inoperable. The actions of LCO 3.4.9, "Pressurizer," provide adequate compensatory actions to assure unit safety.~~

~~Q~~S.1 and S.2

If Table 3.3.1-1 or Table 3.3.1-2 directs entry into Condition ~~Q~~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.

~~R.1~~T.1 and T.2

If Table 3.3.1-1 or Table 3.3.1-2 directs entry into Condition ~~R~~T, ~~both~~ 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

If Table 3.3.1-1 or Table 3.3.1-2 directs entry into Condition U, the RCCA Bottom Position Indicator sensors are immediately declared inoperable. During power operations, the actions of LCO 3.1.7, "Rod Control Cluster Assembly (RCCA) Position Indication," provide adequate compensatory actions to assure unit safety.

V.1 and V.2

If Table 3.3.1-1 directs entry into Condition V, the associated ALUs must be immediately declared inoperable. If the ALUs 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.

BASES

ACTIONS (continued)

~~S.1~~W.1

If Table 3.3.1-1 directs entry into Condition ~~S~~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.

~~T.1~~

~~If Table 3.3.1-1 directs entry into Condition T, the associated ALUs must be immediately declared inoperable. If the ALUs 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.

----------------------------------REVIEWER'S NOTE----------------------------------
The Notes in Table 3.3.1-~~1~~ 2 requiring reset of the division to a predefined as-left tolerance and the verification of the as-found tolerance are only associated with SL-LSSS values. ~~Therefore, the Notes are placed at the top of the LTSP column in the Table and applied to all Functions with LTSPs in the table. The Notes may be applied to specific SRs for the associated functions in the SR column only.~~

SURVEILLANCE REQUIREMENTS (continued)

----------------------------------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.

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.

BASES

SURVEILLANCE REQUIREMENTS (continued)

The Limiting Trip Setpoint column for reactor trip functions is modified by two Notes as identified in Table 3.3.1-2. The selected Functions are those Functions that are LSSS for protection system instrument functions that protect reactor core or RCS pressure boundary SLs. 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 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 components that can be trended, the remaining components must be evaluated in accordance with the Notes.

The first Note requires evaluation of Trip/Actuation Function's performance for the condition where the as-found setting for the setpoint is outside its as-found tolerance but conservative with respect to the Allowable Value. For digital ~~channel~~ 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 Trip/Actuation Function'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.

The second Note requires that the as-left setting for the instrument be returned to within the as-left tolerance of the LTSP. Where a setpoint more conservative than the 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 Trip/Actuation Function shall be declared inoperable. The second Note 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.

BASES

SURVEILLANCE REQUIREMENTS (continued)

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 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.

SR 3.3.1.1

SR 3.3.1.1 compares the calorimetric heat balance calculation to the power range division output every 24 hours. If the calorimetric heat balance calculation results exceed the power range division output by more than 2% RTP, the power range division is not declared inoperable, but must be adjusted. The power range division output shall be adjusted consistent with the calorimetric heat balance calculation results if the calorimetric calculation exceed the power range division output by more than +2% RTP. If the power range division output cannot be properly adjusted, the division is declared inoperable.

If the calorimetric is performed at part power (< 70% RTP), adjusting the power range division indication in the increasing power direction will assure a reactor trip below the safety analysis limit (< 11% RTP). Making no adjustment to the power range division in the decreasing power direction due to a part power calorimetric assures a reactor trip consistent with the safety analyses.

BASES

SURVEILLANCE REQUIREMENTS (continued)

This allowance does not preclude making indicated power adjustments, if desired, when the calorimetric heat balance calculation is less than the power range division output. To provide close agreement between indicated power and to preserve operating margin, the power range divisions are normally adjusted when operating at or near full power during steady-state conditions. However, discretion must be exercised if the power range division output is adjusted in the decreasing power direction due to a part power calorimetric (< 70% RTP). This action may introduce a non-conservative bias at higher power levels. The cause of the potential non-conservative bias is the decreased accuracy of the calorimetric at reduced power conditions. The primary error contributor to the instrument uncertainty for a secondary side power calorimetric measurement is the feedwater flow measurement, which is typically a delta P measurement across a feedwater venturi. While the measurement uncertainty remains constant in delta P as power decreases, when translated into flow, the uncertainty increases as a square term. Thus a 1% flow error at 100% power can approach a 10% flow error at 30% RTP even though the delta P error has not changed.

An evaluation of extended operation at part power conditions would conclude that it is prudent to administratively adjust the setpoint of the High Neutron Flux Rate of Change when: 1) the power range division output is adjusted in the decreasing power direction due to a part power calorimetric below 70% RTP; or 2) for a post refueling startup. The evaluation of extended operation at part power conditions would also conclude that the potential need to adjust the indication of the High Neutron Flux Rate of Change in the decreasing power direction is quite small, primarily to address operation in the intermediate range about 10% RTP to allow enabling of the High Neutron Flux Rate of Change reactor trips. Before the High Neutron Flux Rate of Change setpoint is reset, the power range division adjustment must be confirmed based on a calorimetric performed at ≥ 70% RTP.

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). The Frequency of every 24 hours is adequate. It is based on unit operating experience, considering instrument reliability and operating history data for instrument drift. Together these factors demonstrate that a difference between the calorimetric heat balance calculation and the power range division output of more than +2% RTP is not expected in any 24 hour period.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.2

Space- and time- dependent power density distribution of the U.S. EPR is accurately assessed using the SPNDs inside the core. For neutron flux measurement, incore neutron detectors are more accurate than excore neutron detectors. CALIBRATION of SPND instrumentation is performed to compensate for a decrease in SPND sensitivity during the fuel cycle and to account for peak power density factor change over the fuel cycle. The Aeroball Measurement System (AMS) assists in generating the measured relative neutron flux density in the core, which is used in conjunction with the predicted power distribution based on actual core operation to calibrate the incore SPND instrumentation. Because both the power-to-signal ratio of an SPND and the reference power distribution change with core burnup, SPND signals are matched to reference signals provided by the AMS every 15 EFPD (Ref. 7).

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.

BASES

SURVEILLANCE REQUIREMENTS (continued)

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 division 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.

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. 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 sensor 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.

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.

SR 3.3.1.9

SR 3.3.1.9 verifies that the Limiting Trip Setpoint, Design Limits, and 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.

Response time may be verified by actual response time tests in any series of sequential, overlapping or total division measurements, or by the summation of allocated sensor, signal processing and actuation logic response times with actual response time tests on the remainder of the division. Allocations for sensor response times may be obtained from: (1) historical records based on acceptable response time tests (hydraulic, noise, or power interrupt tests), (2) in place, onsite, or offsite (e.g., vendor) test measurements, or (3) utilizing vendor engineering specifications.

BASES

SURVEILLANCE REQUIREMENTS (continued)

The allocations for sensor, signal conditioning, and actuation logic response times must be verified prior to placing the component in operational service and re-verified following maintenance that may adversely affect response time. In general, electrical repair work does not impact response time provided the parts used for repair are of the same type and value. One example where response time could be affected is replacing the sensing assembly of a transmitter.

As appropriate, each division's response must be verified every 24 months on a STAGGERED TEST BASIS. Testing of the final actuation devices is included in the testing. Response times cannot be determined during unit operation because equipment operation is required to measure response times. Experience has shown that these components usually pass this surveillance when performed at the 24 month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

SR 3.3.1.10 is modified by a Note stating that neutron detectors are excluded from PS RESPONSE TIME testing. The Note is necessary because of the difficulty in generating an appropriate detector input signal. Excluding the detectors is acceptable because the principles of detector operation ensure a virtually instantaneous response.

REFERENCES

1. ANP-10275P-A, "U.S. EPR Instrument Setpoint Methodology Topical Report," February 2008.
2. 10 CFR 100.
3. 10 CFR 50, Appendix A, GDC 21.
4. ANP-10287P, "Incore Trip Setpoint and Transient Methodology for U.S. EPR Topical Report," November 2007.
5. FSAR Chapter 15.
6. 10 CFR 50.49.
7. ANP-10282P, "POWERTRAX/E Online Core Monitoring Software for the U.S. EPR Technical Report," November 2007.
8. EMF-2341(P), Revision 1, "Generic Strategy for Periodic Surveillance Testing of TELEPERM XS Systems in U.S. Nuclear Generating Stations," March 2000.

Table B 3.3.1-1 (page 1 of 11)
Protection System (PS) Functional Dependencies

TRIP/ACTUATION FUNCTION	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)]	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 division and per loop) / Two Remote Acquisition Units per division 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 division and per loop) / Two Remote Acquisition Units per division 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 division and per loop) / Two Remote Acquisition Units per division 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 division and per loop) / Two Remote Acquisition Units per division Acquisition and Processing Unit Actuation Logic Unit (3 of 4)

(d) With Permissive P2 validated

Table B 3.3.1-1 (page 2 of 11)
Protection System (PS) Functional Dependencies

TRIP/ACTUATION FUNCTION	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)]	3	All 89 RCCA Position Indicators in the four divisions 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 division and per loop) / RCCA Unit Two Remote Acquisition Units Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	All 89 RCCA Position Indicators in the four divisions 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 division and per loop) / RCCA Unit Two Remote Acquisition Units Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	All 89 RCCA Position Indicators in the four divisions 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 division and per loop) / RCCA Unit Two Remote Acquisition Units Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	All 89 RCCA Position Indicators in the four divisions 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 division and per loop) / RCCA Unit Two Remote Acquisition Units Acquisition and Processing Unit Actuation Logic Unit (3 of 4)

(d) With Permissive P2 validated.

Table B 3.3.1-1 (page 3 of 11)
Protection System (PS) Functional Dependencies

TRIP/ACTUATION FUNCTION	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)]	3	A total of 67 Self-Powered Neutron Detectors (SPND) in any of the four divisions / Two Remote Acquisition Units 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 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 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 Acquisition and Processing Unit Actuation Logic Unit (3 of 4)
A.4. High Core Power Level	1,2[(g)]	3	Cold Leg Temperature (WR) Hot Leg Temperature (NR) (3 of 4) Hot Leg Pressure (WR) RCS Loop Flow (3 of 4 per division and 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 division and 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 division and 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 division and per loop) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)

(d) With Permissive P2 validated.

a

(g) With Permissive P5 validated.

Table B 3.3.1-1 (page 4 of 11)
Protection System (PS) Functional Dependencies

TRIP/ACTUATION FUNCTION	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)]	3	Cold Leg Temperature (WR) Hot Leg Temperature (NR) (3 of 4) Hot Leg Pressure (WR) RCS Loop Flow (3 of 4 per division and 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 division and 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 division and 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 division and per loop) / Acquisition and Processing Unit Actuation Logic Unit (3 of 4)

(g) With Permissive P5 validated.

Table B 3.3.1-1 (page 5 of 11)
Protection System (PS) Functional Dependencies

TRIP/ACTUATION FUNCTION	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(f)	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 Isolation on Steam Generator Level High for Period of Time (Affected SGs)	1,2(l),3(l)	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)

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

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

Table B 3.3.1-1 (page 6 of 11)
Protection System (PS) Functional Dependencies

TRIP/ACTUATION FUNCTION	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}	$3^{(m)},4^{(n)}$	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)
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) With Permissive P12 validated.

(n) With Permissive P15 inhibited.

Table B 3.3.1-1 (page 7 of 11)
Protection System (PS) Functional Dependencies

TRIP/ACTUATION FUNCTION	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)	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	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)

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

Table B 3.3.1-1 (page 8 of 11)
Protection System (PS) Functional Dependencies

TRIP/ACTUATION FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	COMPLETE DIVISIONS FOR FUNCTIONAL CAPABILITY SENSORS / PROCESSORS	DIVISION 1	DIVISION 2	DIVISION 3	DIVISION 4
11.b. CVCS Charging Line Isolation on Anti-Dilution Mitigation (ADM) at Shutdown Condition (RCP not operating)	$3^{(s)}$,$4^{(s)}$, $5^{(s)}$,$6^{(s)}$	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
	$3^{(s)}$,$4^{(s)}$, $5^{(s)}$,$6^{(s)}$	2	Actuation Logic Unit (3 of 4)			Actuation Logic Unit (3 of 4)
11.c. CVCS Charging Line Isolation on ADM at Standard Shutdown Conditions	$3^{(t)}$,$4^{(t)}$, $5^{(t)}$	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
	$3^{(t)}$,$4^{(t)}$, $5^{(t)}$	2	Actuation Logic Unit (3 of 4)			Actuation Logic Unit (3 of 4)

(s) With Permissive P7 validated (no RCPs in operation).

(t) With Permissive P7 inhibited (one or more RCPs in operation).

Table B 3.3.1-1 (page 9 of 11)
Protection System (PS) Functional Dependencies

TRIP/ACTUATION FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	COMPLETE DIVISIONS FOR FUNCTIONAL CAPABILITY SENSORS / PROCESSORS	DIVISION 1	DIVISION 2	DIVISION 3	DIVISION 4
11.d. CVCS Charging Line 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						
Permissive P8 - Shutdown RCCA Position Lower than Threshold	$3^{(t)}$,$4^{(t)}$, $5^{(t)}$	3 2	RCCA Bottom Position Indicators / Two RCCA Units Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	RCCA Bottom Position Indicators / Two RCCA Units Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	RCCA Bottom Position Indicators / Two RCCA Units Acquisition and Processing Unit Actuation Logic Unit (3 of 4)	RCCA Bottom Position Indicators / Two RCCA Units Acquisition and Processing Unit Actuation Logic Unit (3 of 4)

(d) With Permissive P2 validated.

(t) With Permissive P7 inhibited (one or more RCPs in operation).

Table B 3.3.1-1 (page 10 of 11)
Protection System (PS) Functional Dependencies

TRIP/ACTUATION FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	COMPLETE DIVISIONS FOR FUNCTIONAL CAPABILITY SENSORS / PROCESSORS	DIVISION 1	DIVISION 2	DIVISION 3	DIVISION 4
Permissive P14 - Hot Leg Pressure and Hot Leg Temperature Lower than Thresholds	1,2,3,4[(p)]	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)
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)

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

Table B 3.3.1-1 (page 11 of 11)
Protection System (PS) Functional Dependencies

TRIP/ACTUATION FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	COMPLETE DIVISIONS FOR FUNCTIONAL CAPABILITY SENSORS / PROCESSORS	DIVISION 1	DIVISION 2	DIVISION 3	DIVISION 4
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)

~~Table B 3.3.1-1 (page 1 of 7)~~
~~Protection System (PS) Functional Dependencies~~

~~TRIP/ACTUATION FUNCTION~~	~~APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS~~	~~COMPLETE DIVISIONS FOR FUNCTIONAL CAPABILITY SENSORS / PROCESSORS~~	~~DIVISION 1~~	~~DIVISION 2~~	~~DIVISION 3~~	~~DIVISION 4~~
~~A. REACTOR TRIP~~						
~~1. Low Departure from Nucleate Boiling Ratio (DNBR)~~ ~~a. Low DNBR~~ ~~d. High Quality~~	~~≥ 10% RTP~~	~~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 Speed (1 of 2)~~ ~~Reactor Coolant System Loop Flow (3 of 4)~~ ~~/~~ ~~Two Remote Acquisition Units per division with a required OPERABLE SPND~~ ~~Acquisition and Processing Unit~~	~~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 Speed (1 of 2)~~ ~~Reactor Coolant System Loop Flow (3 of 4)~~ ~~/~~ ~~Two Remote Acquisition Units per division with a required OPERABLE SPND~~ ~~Acquisition and Processing Unit~~	~~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 Speed (1 of 2)~~ ~~Reactor Coolant System Loop Flow (3 of 4)~~ ~~/~~ ~~Two Remote Acquisition Units per division with a required OPERABLE SPND~~ ~~Acquisition and Processing Unit~~	~~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 Speed (1 of 2)~~ ~~Reactor Coolant System Loop Flow (3 of 4)~~ ~~/~~ ~~Two Remote Acquisition Units per division with a required OPERABLE SPND~~ ~~Acquisition and Processing Unit~~

~~Table B 3.3.1-1 (page 2 of 7)~~
~~Protection System (PS) Functional Dependencies~~

~~TRIP/ACTUATION FUNCTION~~	~~APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS~~	~~COMPLETE DIVISIONS FOR FUNCTIONAL CAPABILITY SENSORS / PROCESSORS~~	~~DIVISION 1~~	~~DIVISION 2~~	~~DIVISION 3~~	~~DIVISION 4~~
~~1. Low Departure from Nucleate Boiling Ratio (DNBR)~~ ~~b. Low DNBR and Imbalance or Rod Drop~~ ~~c. Variable Low DNBR and Rod Drop~~ ~~e. High Quality and Imbalance or Rod Drop~~	~~≥ 10% RTP~~	~~3~~	~~A total of 65 RCCA Position Indicators in any of the four divisions~~ ~~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 Speed (1 of 2)~~ ~~Reactor Coolant System Loop Flow (3 of 4)~~ ~~/~~ ~~One RCCA Unit per division with a required OPERABLE RCCA position indicator~~ ~~Two Remote Acquisition Units per division with a required OPERABLE SPND~~ ~~Acquisition and Processing Unit~~	~~A total of 65 RCCA Position Indicators in any of the four divisions~~ ~~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 Speed (1 of 2)~~ ~~Reactor Coolant System Loop Flow (3 of 4)~~ ~~/~~ ~~One RCCA Unit per division with a required OPERABLE RCCA position indicator~~ ~~Two Remote Acquisition Units per division with a required OPERABLE SPND~~ ~~Acquisition and Processing Unit~~	~~A total of 65 RCCA Position Indicators in any of the four divisions~~ ~~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 Speed (1 of 2)~~ ~~Reactor Coolant System Loop Flow (3 of 4)~~ ~~/~~ ~~One RCCA Unit per division with a required OPERABLE RCCA position indicator~~ ~~Two Remote Acquisition Units per division with a required OPERABLE SPND~~ ~~Acquisition and Processing Unit~~	~~A total of 65 RCCA Position Indicators in any of the four divisions~~ ~~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 Speed (1 of 2)~~ ~~Reactor Coolant System Loop Flow (3 of 4)~~ ~~/~~ ~~One RCCA Unit per division with a required OPERABLE RCCA position indicator~~ ~~Two Remote Acquisition Units per division with a required OPERABLE SPND~~ ~~Acquisition and Processing Unit~~

~~Table B 3.3.1-1 (page 3 of 7)~~
~~Protection System (PS) Functional Dependencies~~

~~TRIP/ACTUATION FUNCTION~~	~~APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS~~	~~COMPLETE DIVISIONS FOR FUNCTIONAL CAPABILITY SENSORS / PROCESSORS~~	~~DIVISION 1~~	~~DIVISION 2~~	~~DIVISION 3~~	~~DIVISION 4~~
~~2. High Linear Power Density~~	~~≥ 10% RTP~~	~~3~~	~~A total of 67 Self-Powered Neutron Detectors (SPND) in any of the four divisions~~ ~~/~~ ~~Two Remote Acquisition Units per division with a required OPERABLE SPND~~ ~~Acquisition and Processing Unit~~	~~A total of 67 Self-Powered Neutron Detectors (SPND) in any of the four divisions~~ ~~/~~ ~~Two Remote Acquisition Units per division with a required OPERABLE SPND~~ ~~Acquisition and Processing Unit~~	~~A total of 67 Self-Powered Neutron Detectors (SPND) in any of the four divisions~~ ~~/~~ ~~Two Remote Acquisition Units per division with a required OPERABLE SPND~~ ~~Acquisition and Processing Unit~~	~~A total of 67 Self-Powered Neutron Detectors (SPND) in any of the four divisions~~ ~~/~~ ~~Two Remote Acquisition Units per division with a required OPERABLE SPND~~ ~~Acquisition and Processing Unit~~
~~4. High Core Power Level~~	~~1,2[(a)]~~	~~3~~	~~Cold Leg Temperature (WR)~~ ~~Hot Leg Temperature (NR) (3 of 4)~~ ~~Hot Leg Pressure (WR)~~ ~~Reactor Coolant System Loop Flow (3 of 4)~~ ~~/~~ ~~Acquisition and Processing Unit~~	~~Cold Leg Temperature (WR)~~ ~~Hot Leg Temperature (NR) (3 of 4)~~ ~~Hot Leg Pressure (WR)~~ ~~Reactor Coolant System Loop Flow (3 of 4)~~ ~~/~~ ~~Acquisition and Processing Unit~~	~~Cold Leg Temperature (WR)~~ ~~Hot Leg Temperature (NR) (3 of 4)~~ ~~Hot Leg Pressure (WR)~~ ~~Reactor Coolant System Loop Flow (3 of 4)~~ ~~/~~ ~~Acquisition and Processing Unit~~	~~Cold Leg Temperature (WR)~~ ~~Hot Leg Temperature (NR) (3 of 4)~~ ~~Hot Leg Pressure (WR)~~ ~~Reactor Coolant System Loop Flow (3 of 4)~~ ~~/~~ ~~Acquisition and Processing Unit~~

~~(a) ≥ 10^{-5} % power on the intermediate range detectors.~~

~~Table B 3.3.1-1 (page 4 of 7)~~
~~Protection System (PS) Functional Dependencies~~

~~TRIP/ACTUATION FUNCTION~~	~~APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS~~	~~COMPLETE DIVISIONS FOR FUNCTIONAL CAPABILITY SENSORS / PROCESSORS~~	~~DIVISION 1~~	~~DIVISION 2~~	~~DIVISION 3~~	~~DIVISION 4~~
~~5. Low Saturation Margin~~	~~1,2[(a)]~~	~~3~~	~~Cold Leg Temperature (WR)~~ ~~Hot Leg Temperature (NR)~~ ~~Hot Leg Pressure (WR)~~ ~~Reactor Coolant System Loop Flow (3 of 4)~~ ~~/~~ ~~Acquisition and Processing Unit~~	~~Cold Leg Temperature (WR)~~ ~~Hot Leg Temperature (NR)~~ ~~Hot Leg Pressure (WR)~~ ~~Reactor Coolant System Loop Flow (3 of 4)~~ ~~/~~ ~~Acquisition and Processing Unit~~	~~Cold Leg Temperature (WR)~~ ~~Hot Leg Temperature (NR)~~ ~~Hot Leg Pressure (WR)~~ ~~Reactor Coolant System Loop Flow (3 of 4)~~ ~~/~~ ~~Acquisition and Processing Unit~~	~~Cold Leg Temperature (WR)~~ ~~Hot Leg Temperature (NR)~~ ~~Hot Leg Pressure (WR)~~ ~~Reactor Coolant System Loop Flow (3 of 4)~~ ~~/~~ ~~Acquisition and Processing Unit~~

~~(a) $\geq 10^{-5}$ % power on the intermediate range detectors.~~

~~Table B 3.3.1-1 (page 5 of 7)~~
~~Protection System (PS) Functional Dependencies~~

~~TRIP/ACTUATION FUNCTION~~	~~APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS~~	~~COMPLETE DIVISIONS FOR FUNCTIONAL CAPABILITY SENSORS / PROCESSORS~~	~~DIVISION 1~~	~~DIVISION 2~~	~~DIVISION 3~~	~~DIVISION 4~~
~~B. ENGINEERED SAFETY FEATURES ACTUATION SYSTEM (ESFAS) SIGNALS~~						
~~2.e. Main Feedwater / Startup and Shutdown Feedwater Isolation on Steam Generator Level High for Period of Time (Affected Steam Generators)~~	~~1,2~~[(b)]~~,3~~[(b)]	~~3~~	~~Steam Generator Level (NR)~~ ~~Reactor Trip Circuit Breaker Position Indication~~ ~~/~~ ~~Acquisition and Processing Unit~~	~~Steam Generator Level (NR)~~ ~~Reactor Trip Circuit Breaker Position Indication~~ ~~/~~ ~~Acquisition and Processing Unit~~	~~Steam Generator Level (NR)~~ ~~Reactor Trip Circuit Breaker Position Indication~~ ~~/~~ ~~Acquisition and Processing Unit~~	~~Steam Generator Level (NR)~~ ~~Reactor Trip Circuit Breaker Position Indication~~ ~~/~~ ~~Acquisition and Processing Unit~~
~~3.b. ESF - Safety Injection System (SIS) Actuation on Low Delta~~ ~~P_{sat}~~	~~3~~[(c)]	~~3~~	~~Hot Leg Pressure (WR)~~ ~~Hot Leg Temperature (WR)~~ ~~/~~ ~~Acquisition and Processing Unit~~	~~Hot Leg Pressure (WR)~~ ~~Hot Leg Temperature (WR)~~ ~~/~~ ~~Acquisition and Processing Unit~~	~~Hot Leg Pressure (WR)~~ ~~Hot Leg Temperature (WR)~~ ~~/~~ ~~Acquisition and Processing Unit~~	~~Hot Leg Pressure (WR)~~ ~~Hot Leg Temperature (WR)~~ ~~/~~ ~~Acquisition and Processing Unit~~

~~(b) Except when all MFW low load isolation valves are closed.~~

~~(c) When Trip/Actuation Function B.3.a, SIS Actuation on Low Pressurizer Pressure, is disabled.~~

~~Table B 3.3.1-1 (page 6 of 7)~~
~~Protection System (PS) Functional Dependencies~~

~~TRIP/ACTUATION FUNCTION~~	~~APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS~~	~~COMPLETE DIVISIONS FOR FUNCTIONAL CAPABILITY SENSORS / PROCESSORS~~	~~DIVISION 1~~	~~DIVISION 2~~	~~DIVISION 3~~	~~DIVISION 4~~
~~4. ESF - Reactor Coolant Pump (RCP) Trip on Low Delta P across RCP with Safety Injection System Actuation~~	~~1,2,3~~	~~3~~	~~RCP Current (2 of 3)~~ ~~RCP Delta P (1 of 2)~~ ~~/~~ ~~Acquisition and Processing Unit~~	~~RCP Current (2 of 3)~~ ~~RCP Delta P (1 of 2)~~ ~~/~~ ~~Acquisition and Processing Unit~~	~~RCP Current (2 of 3)~~ ~~RCP Delta P (1 of 2)~~ ~~/~~ ~~Acquisition and Processing Unit~~	~~RCP Current (2 of 3)~~ ~~RCP Delta P (1 of 2)~~ ~~/~~ ~~Acquisition and Processing Unit~~
~~11a. ESF - Chemical and Volume Control System (CVCS) Charging Line Isolation on High-High Pressurizer Level~~	~~1,2,3~~	~~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~~	~~2~~	~~Actuation Logic Unit (1 of 2)~~			~~Actuation Logic Unit (1 of 2)~~

~~Table B 3.3.1-1 (page 7 of 7)~~
~~Protection System (PS) Functional Dependencies~~

~~TRIP/ACTUATION FUNCTION~~	~~APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS~~	~~COMPLETE DIVISIONS FOR FUNCTIONAL CAPABILITY SENSORS / PROCESSORS~~	~~DIVISION 1~~	~~DIVISION 2~~	~~DIVISION 3~~	~~DIVISION 4~~
~~11b. ESF - Chemical and Volume Control System (CVCS) Charging Line Isolation on Anti-Dilution Mitigation (ADM) at Shutdown Condition (RCP not operating)~~	~~5[d],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[d],6~~	~~2~~	~~Actuation Logic Unit (1 of 2)~~			~~Actuation Logic Unit (1 of 2)~~
~~11c. ESF - Chemical and Volume Control System (CVCS) Charging Line Isolation on ADM at Standard Shutdown Conditions~~	~~3,4[e],5[e]~~	~~3~~	~~Boron Concentration~~ ~~Boron Temperature~~ ~~Chemical and Volume Control System (CVCS) Charging Line Flow~~ ~~Cold Leg Temperature (WR)~~ ~~/~~ ~~Acquisition and Processing Unit~~	~~Boron Concentration~~ ~~Boron Temperature~~ ~~Chemical and Volume Control System (CVCS) Charging Line Flow~~ ~~Cold Leg Temperature (WR)~~ ~~/~~ ~~Acquisition and Processing Unit~~	~~Boron Concentration~~ ~~Boron Temperature~~ ~~Chemical and Volume Control System (CVCS) Charging Line Flow~~ ~~Cold Leg Temperature (WR)~~ ~~/~~ ~~Acquisition and Processing Unit~~	~~Boron Concentration~~ ~~Boron Temperature~~ ~~Chemical and Volume Control System (CVCS) Charging Line Flow~~ ~~Cold Leg Temperature (WR)~~ ~~/~~ ~~Acquisition and Processing Unit~~
	~~3,4[e],5[e]~~	~~2~~	~~Actuation Logic Unit (1 of 2)~~			~~Actuation Logic Unit (1 of 2)~~

~~(d) With two or less RCPs in operation.~~
~~(e) With three or more RCPs in operation.~~