ArevaEPRDCPEm Resource

From: WELLS Russell D (AREVA NP INC) [Russell.Wells@areva.com]
Sent: Thursday, March 19, 2009 5:14 PM
To: Getachew Tesfaye
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. 110, FSAR Ch 16, Supplement 1
Attachments: RAI 110 Supplement 1 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 21 of the 33 questions of RAI No. 110 on December 1, 2008. The attached file, "RAI 110 Supplement 1 Response US EPR DC.pdf" provides technically correct and complete responses to 9 of the remaining 12 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 110 Questions 16-212, 16-222, 16-227, 16-228, 16-237, and 16-241.

The following table indicates the respective pages in the response document, "RAI 110 Supplement 1 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 110 — 16-212	2	2
RAI 110 — 16-213	3	3
RAI 110 — 16-222	4	4
RAI 110 — 16-223	5	5
RAI 110 — 16-227	6	7
RAI 110 — 16-228	8	8
RAI 110 — 16-236	9	9
RAI 110 — 16-237	10	11
RAI 110 — 16-241	12	12

The schedule for response to RAI 110 – 16-215 has been changed from March 19, 2009 to June 30, 2009. The schedule for technically correct and complete responses to the remaining questions is provided below:

Question #	Response Date
RAI 110 — 16-215	June 30, 2009
RAI 110 — 16-217	June 30, 2009
RAI 110 — 16-226	June 30, 2009

Sincerely,

(Russ Wells on behalf of)

Ronda Pederson
ronda.pederson@areva.com
Licensing Manager, U.S. EPR Design Certification
New Plants Deployment
AREVA NP, Inc.
An AREVA and Siemens company
3315 Old Forest Road

Lynchburg, VA 24506-0935
Phone: 434-832-3694
Cell: 434-841-8788

From: Pederson Ronda M (AREVA NP INC)
Sent: Monday, December 01, 2008 3:39 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. 110 (1295, 1331),FSAR Ch. 16

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 110 Response US EPR DC.pdf," provides technically correct and complete responses to 21 of the 33 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 110 Questions 16-214, 16-219, 16-220, 16-221, 16-224, 16-225, 16-231, 16-232, 16-234, and 16-242.

The following table indicates the respective pages in the response document, "RAI 110 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 110 — 16-210	2	2
RAI 110 — 16-211	3	4
RAI 110 — 16-212	5	5
RAI 110 — 16-213	6	6
RAI 110 — 16-214	7	7
RAI 110 — 16-215	8	8
RAI 110 — 16-216	9	9
RAI 110 — 16-217	10	10
RAI 110 — 16-218	11	11
RAI 110 — 16-219	12	12
RAI 110 — 16-220	13	13
RAI 110 — 16-221	14	14
RAI 110 — 16-222	15	15
RAI 110 — 16-223	16	16
RAI 110 — 16-224	17	17
RAI 110 — 16-225	18	18
RAI 110 — 16-226	19	19
RAI 110 — 16-227	20	20
RAI 110 — 16-228	21	21
RAI 110 — 16-229	22	22
RAI 110 — 16-230	23	24
RAI 110 — 16-231	25	25
RAI 110 — 16-232	26	26
RAI 110 — 16-233	27	27
RAI 110 — 16-234	28	28
RAI 110 — 16-235	29	30
RAI 110 — 16-236	31	31
RAI 110 — 16-237	32	32
RAI 110 — 16-238	33	33

RAI 110 — 16-239	34	34
RAI 110 — 16-240	35	35
RAI 110 — 16-241	36	36
RAI 110 — 16-242	37	37

A complete answer is not provided for 12 of the 33 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 110 — 16-212	March 19, 2009
RAI 110 — 16-213	March 19, 2009
RAI 110 — 16-215	March 19, 2009
RAI 110 — 16-217	June 30, 2009
RAI 110 — 16-222	March 31, 2009
RAI 110 — 16-223	March 31, 2009
RAI 110 — 16-226	June 30, 2009
RAI 110 — 16-227	March 31, 2009
RAI 110 — 16-228	March 31, 2009
RAI 110 — 16-236	March 31, 2009
RAI 110 — 16-237	June 30, 2009
RAI 110 — 16-241	March 31, 2009

Sincerely,

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

From: Getachew Tesfaye [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Tuesday, October 28, 2008 9:57 AM
To: ZZ-DL-A-USEPR-DL
Cc: Robert Prato; Michael Marshall; Peter Hearn; Joseph Colaccino; John Rycyna
Subject: U.S. EPR Design Certification Application RAI No. 110 (1295, 1331),FSAR Ch. 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: 317

Mail Envelope Properties (1F1CC1BBDC66B842A46CAC03D6B1CD41DC7E15)

Subject: Response to U.S. EPR Design Certification Application RAI No. 110, FSAR Ch 16, Supplement 1
Sent Date: 3/19/2009 5:14:13 PM
Received Date: 3/19/2009 5:14:17 PM
From: WELLS Russell D (AREVA NP INC)

Created By: Russell.Wells@areva.com

Recipients:
"Pederson Ronda M (AREVA NP INC)" <Ronda.Pederson@areva.com>
Tracking Status: None
"BENNETT Kathy A (OFR) (AREVA NP INC)" <Kathy.Bennett@areva.com>
Tracking Status: None
"DELANO Karen V (AREVA NP INC)" <Karen.Delano@areva.com>
Tracking Status: None
"Getachew Tesfaye" <Getachew.Tesfaye@nrc.gov>
Tracking Status: None

Post Office: AUSLYNCMX02.adom.ad.corp

Files	**Size**	**Date & Time**
MESSAGE	5922	3/19/2009 5:14:17 PM
RAI 110 Supplement 1 Response US EPR DC.pdf		360682

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

Response to

Request for Additional Information No. 110, Supplement 1

10/28/2008

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

QUESTIONS for Technical Specification Branch (CTSB)

Question 16-212:

Provide a summary of the analysis or identify the summary of the anaylsis in the EPR FSAR.

In the EPR FSAR add a summary of the analysis (if needed) and identify in the EPR Bases, Section B 3.3.2 where the summary of the analysis can be found in the EPR FSAR to ensure that the EPR GTS, Table 3.3.2-1, Post Accident Monitoring Instrumentation includes the entire population of instruments required by GDC 13, 19 and 64 and the guidance included in IEEE 497-2002 and Regulatory Guide 1.97. that established the required instrumentation for post accident monitoring.

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

Response to Question 16-212:

U.S. EPR FSAR Tier 2, Section 7.5.2.2.1 states:

> "The guidance of RG 1.97, Revision 4, will be used to select the accident monitoring variables during detailed design. With clarifying regulatory positions, RG 1.97, Revision 4, endorses Reference 1, which provides performance-based criteria for selecting variables and recommends determining the variable type according to its accident management function. The accident management function is to be identified by its use in the Emergency Procedure Guidelines (EPG), Emergency Operating Procedures (EOP), and Abnormal Operating Procedures (AOP). The development of these guidelines and procedures is discussed in Section 13.5. When these procedures are complete and verified, they will be used to develop a complete accident monitoring instrumentation list."

The development of these procedures is identified in U.S. EPR FSAR Tier 2, Table 1.8-2, "U.S. EPR Combined License Information Items," COL Item No. 13.5-1.

Since the list of Post Accident Monitoring Instrumentation is plant-specific, the current list and associated discussions will be removed from U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Section 3.3.2 "Post Accident Monitoring (PAM) Instrumentation" and U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases Section B 3.3.2 Post Accident Monitoring (PAM) Instrumentation." The development of this information is identified in U.S. EPR FSAR Tier 2, Table 1.8-2, "U.S. EPR Combined License Information Items," COL Item No. 16.0-1.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Section 3.3.2 "Post Accident Monitoring (PAM) Instrumentation" and U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases Section B 3.3.2 "Post Accident Monitoring (PAM) Instrumentation" will be revised as described in the response and as indicated on the enclosed markup.

Question 16-213:

Provide additional information needed to clarify information in the EPR Bases, Section B 3.3.2, regarding secondary loop cooling.

The EPR Bases, Section B 3.3.2, LCO Section (pg B 3.3.2-3 and 4), Item 1, Cold Leg Temperature (Wide Range) states that "the key variables for monitoring core cooling are Hot Leg Temperature, Core Exit Temperature, and Steam Generator Pressure. Cold Leg Temperature provides backup temperature monitoring to Hot Leg Temperature and Core Exit Temperature when forced or verified natural circulation exists. Cold Leg Temperature is used with Hot Leg Temperature and Core Exit Temperature to verify natural circulation. Cold Leg Temperature is compared to the saturation temperature for steam generator pressure (Tsat) to determine primary to secondary loop coupling. Item 9, Hot Leg Temperature (Wide Range) states that "Hot Leg Temperature is required to monitor core cooling, to verify natural circulation, and to verify primary to secondary loop coupling along with steam generator pressure. Hot Leg temperature and RCS pressure are used to determine loop subcooling margin if the calculation is not available." Provide addition information to the EPR Bases, Section B 3.3.2, needed to clarify how Hot Leg Temperature can be used to confirm secondary loop cooling without Cold Leg Temperature.

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

Response to Question 16-213:

The subject text is now bracketed as described in the response to Question 16-212.

FSAR Impact:

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

Question 16-222:

Explain what is meant by the statement on page B 3.3.1-9, "The implementation of manual system level actuation of ESF functions and the priority between the automatic functions of the PS and the manual system level initiation is determined on a case-by-case basis." Describe the complience with requirements for manual initiation identified in IEEE Std 603-1998. Revise the text accordingly.

IEEE Std 603-1998, "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations," Section 6.2, "Manual control," requires in part that "Means shall be provided in the control room to implement manual initiation at the division level of the automatically initiated protective actions." This is a fundamental functional and design requirement, which contains no consideration of priorities between automatic functions and manual system level initiation as suggested by the proposed Bases.

Response to Question 16-222:

Topical report ANP-10281(P) “U.S. EPR Digital Protection System Topical Report” (TAC MD 4977) Section 8.5 describes the system-level initiation of protective actions required by Clause 6.2a of IEEE Std. 603-1998. The December 3, 2007 response to RAI 18 (ML073410604) regarding this topical report (ANP-10281(P)) modified the Section 8.5 descriptions by describing three different means of implementing the system-level manual functionality. This response describes compliance of these three means of implementation with the requirements of IEEE Std. 603-1998.

The statement from U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases Page B.3.3.1-9, “The implementation of manual system level actuation of ESF functions… is determined on a case-by-case basis” refers to the selection of one of the three implementation types for each manual system-level function.

The statement from U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases Page B.3.3.1-9, “…the priority between the automatic functions of the PS and the manual system level initiation is determined on a case-by-case basis” refers to specific situations where contradictory protective actions could simultaneously be requested for a given engineered safety feature (ESF) actuator. For example, a low steam generator level condition will cause the protection system (PS) to automatically open the emergency feedwater isolation valve to allow flow to the steam generator. The operator is given the ability to manually close this same isolation valve as part of the manual system-level emergency feedwater isolation function. Both functions are safety-related, ESF initiations. The possibility exists for contradictory protective orders (one automatic, one manual) to be given to the emergency feedwater isolation valve simultaneously. Therefore, priority must be established between the two functions.

The statement in question on Page B.3.3.1-9 is not necessary to the technical specification bases discussion and could be confusing. Therefore, the statement will be deleted.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases Section B 3.3.1 "Protection System (PS)" will be revised as described in the response and indicated on the enclosed markup.

Question 16-223:

Describe the bases for LCOs and surveillance testing of the hardwired "AND" logic for reactor trip functions, and the hardwired "OR" logic for ESF actuation functions. Identify the specific LCO conditions and surveillance(s) that are credited for the instrumentation supporting these functions. Modify the text and Table 3.3.1-1, "Protection System Sensors, Manual Actuation Switches, Signal Processors, and Actuation Devices," as necessary to provide or clarify this information.

FSAR Figure 7.2-1, "Typical RT Actuation," and Figure 7.3-1, "Typical ESF Actuation," identify hardwired logic downstream of the ALUs. FSAR 7.2.2.2, Failure Modes and Effects Analysis, notes that failures in the hardwired output logic are generally not detected automatically by the PS. This implies that the hardwired "AND" logic for reactor trip, the hardwired "OR" logic for ESF actuation functions, and other downstream logic require periodic surveillance. The specific LCO conditions and surveillances applicable to this instrumentation were not evident from the Bases or from Table 3.3.1-1.

Response to Question 16-223:

Refer to the response to RAI 103, Question 16-193 for a figure entitled “Summary of Protection System Testing”, which indicates that the Actuation Device Operational Test (ADOT) covers equipment from the actuation computers to, and including, the actuation device.

As shown in U.S. EPR FSAR Tier 2, Figures 7.2-1 and 7.3-1, the hardwired logic is located between the actuation computers and the final actuation devices. The hardwired logic will be periodically tested as part of U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Surveillance Requirements (SR) 3.3.1.3 (for reactor trip functions) and 3.3.1.8 (for ESF functions).

The limiting conditions for operation (LCO) for each actuation device governs the hardwired logic associated with the device (i.e., if the hardwired logic is removed from service, the downstream actuation device is declared inoperable).

FSAR Impact:

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

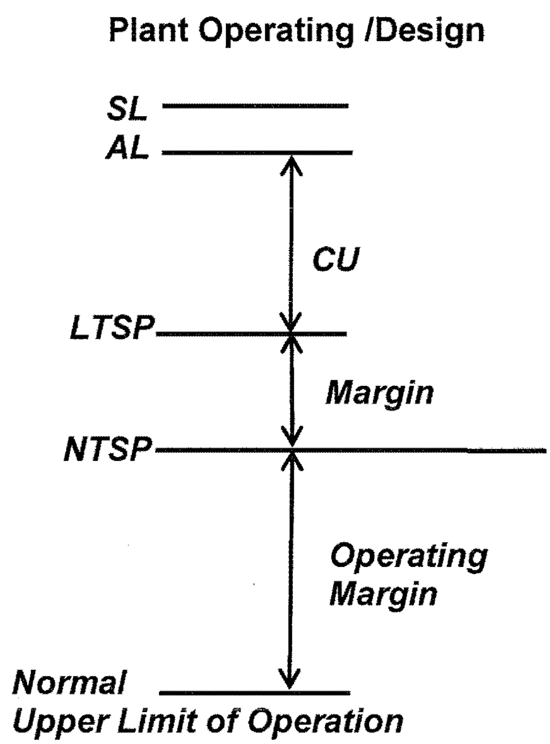
Question 16-227:

Correct as necessary the inequality signs associated with the limiting trip setpoints identified in Table 3.3.1-2.

In a few cases, the inequality sign associated with the proposed limiting trip setpoint (LTSP) was reversed. For example: the LTSP for reactor trip function 17, low steam generator level, is shown as ≤ 20% narrow range, rather than ≥ 20% narrow range; the LTSP for reactor trip function 19 (high containment pressure) does not include an inequality sign.

Response to Question 16-227:

The setpoint relationships for a typical increasing process are shown below:



Where:

SL = Safety Limit
LTSP = Limiting Trip Setpoint
AL = Analytical Limit
NTSP = Nominal Trip Setpoint
CU = Channel Uncertainty

As shown, there is no margin between the AL and the LTSP. The LTSP is strictly the difference between the analytical limit and the instrument uncertainty. Therefore, the LTSP values In U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Table 3.3.1-2 should not include the less than or equal to (≤) or greater than or equal to (≥) symbols. For example, if 100 percent is the AL for a given trip function and the uncertainty is ± 4 percent, the LTSP would be 96 percent, not ≤ 96 percent. It could not be 95 percent when the uncertainty is only 4 percent since the LTSP cannot include margin. The actual NTSP would be ≤ 96 percent.

There are design limits in U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Table 3.3.1-2 that are not explicitly supporting an AL, and the use of the ≤ or ≥ symbols would be appropriate. For example, the LTSP shown for the Control Room HVAC Reconfiguration to Recirculation Mode on High Intake Activity is less than or equal to three times background. Design calculations do not show that control room operator dose limits would be exceeded if this function actuated at a slightly higher value. Rather, 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 provide assurance that offsite dose consequences are maintained below acceptable limits. Therefore, symbols are specified for design limits. Column headings and the placement of relevant footnotes will be revised to reflect the distinction between values associated with LTSPs and design limits.

In accordance with Section 4.2 of TSTF-GG-05-01, "Writer's Guide for Plant-Specific Improved Technical Specifications," the Bases will still discuss the individual limits and their relationship to the protection of the fuel cladding, pressure boundary, or containment integrity. Corrections will be made to some of the descriptions in the Bases.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Section 3.3.1 "Protection System (PS)" and U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases Section B 3.3.1 "Protection System (PS)" will be revised as described in the response and indicated on the enclosed markup.

Question 16-228:

Revise the Bases description of the low saturation margin reactor trip, to more closely reflect the accident analysis basis.

The Bases described for the low saturation margin trip (p. B 3.3.1-17, reactor trip no. 5) is presented as identical to the high core power level trip, but there is a significant difference. Per FSAR 7.2.1.2.4, "Reactor Trip on High Core Power Level or Low Saturation Margin," the high core power trip function calculates core thermal power from an enthalpy balance, using thermal hydraulic conditions. If saturation were to occur in a hot leg, this calculation would be invalid. This is a basis for the additional low saturation margin trip.

Response to Question 16-228:

The U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases Section B 3.3.1 "Protection System (PS)" will be revised to clarify the basis of the Low Saturation Margin reactor trip function.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases Section B 3.3.1 "Protection System (PS)" will be revised as described in the response and as indicated on the enclosed markup.

Question 16-236:

Confirm EPR EDG fuel oil capacity.

Confirm that 1350 gallons fuel oil tank capacity is sufficient for one EDG in each train to carry the alternate feed and operating loads for an entire division. The EPR GTS, SR 3.8.1.4, requires a minimum of 1350 gallons in each EDG day tank. This is required to ensure adequate fuel oil will be available.

Technical justification is needed to ensure the accuracy and completeness of the EPR GTS.

Response to Question 16-236:

In response to RAI 74, Question 16-29, U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Section 3.8.1 "AC Sources - Operating," Surveillance Requirement (SR) 3.8.1.4 was revised to require the verification that each day tank contains greater than or equal to 700 gallons of fuel oil. This SR provides verification that the level of fuel oil in the day tank is at or above the level at which fuel oil is automatically added. The level is expressed as an equivalent volume in gallons, and is selected to make sure there is adequate fuel oil for a minimum of one hour of emergency diesel generator (EDG) operation at full load plus 10 percent. Full load includes powering the alternately fed loads. These loads are shown in U.S. EPR FSAR Tier 2, Tables 8.3-4, "Division 1 Emergency Diesel Generator Nominal Loads," through 8.3-7, "Division 4 Emergency Diesel Generator Nominal Loads".

FSAR Impact:

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

Question 16-237:

Provide additional information to confirm that the EPR EDG voltage acceptance criteria will result in acceptable voltage for all safety-related loads.

Surveillance Requirement 3.8.1.2 provided non-bracketed acceptance criteria for EDG steady state voltage and frequency indicating those values were applicable for all EPR sites. The BASES refers to American National Standards Institute Standard ANSI 84.1, Electric Power Systems and Equipment - Voltage Ratings (60 Hz), as the reference for the acceptance for the permissible tolerances for voltage. ANSI C84.1 references National Electrical Manufacturers Association standard, NEMA MG-1, Motors and Generators. NEMA MG-1 provides minimum operating parameters specifically for motors and generators. NEMA MG-1 states that the acceptable voltage range is nominal voltage +/- 10% and the acceptable frequency range is 60 Hertz +/- 5%. However, NEMA MG-1 does not recognize using both extremes of voltage and frequency simultaneously. NEMA MG-1 does permit variations in both voltage and frequency if the total variation does not exceed a total of +/- 10 %. The applicant proposes to limit voltage to +5/- 10 % and limit frequency to +/- 2 %. This could result in a total negative variation of -12 % which is outside the total range permitted by NEMA MG-1. This is required to ensure that the safety related loads connected to the EDG will not require derating.

This technical justification is needed to ensure the accurace and completeness of the EPR GTS.

Response to Question 16-237:

The U.S. EPR emergency diesel generator (EDG) steady state output voltage acceptance criteria will be revised to indicate an allowable minimum voltage of -5 percent.

A number of Surveillance Requirements (SR) in addition to U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications SR 3.8.1.2 indicate a minimum EDG steady state output voltage that is required to be obtained to satisfactorily meet the surveillance requirement. These SR are:

- SR 3.8.1.7
- SR 3.8.1.9
- SR 3.8.1.11
- SR 3.8.1.12
- SR 3.8.1.15
- SR 3.8.1.18
- SR 3.8.1.19

The listed Surveillance Requirements in addition to SR 3.8.1.2 will be changed to indicate a minimum EDG output voltage of ≥ 6555 V. The revised allowable voltage range is within the cumulative total variation of voltage and frequency range permitted by NEMA MG 1-2006 (Reference 1). U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases Section B 3.8.1, Surveillance Requirements Bases will be revised to provide additional information related to the minimum voltage requirements.

Additionally, U.S. EPR FSAR Tier 2, Section 8.3.1.1.5 will be revised to indicate a minimum EDG output voltage of ≥ 6555 V. The EDG output voltage indicated in U.S. EPR FSAR Tier 2, Section 8.3.1.1.5 was changed as a result of RAI 11, Question 8.3.1-5. The change as reflected in this RAI Question represents the current EDG output voltage value and is consistent with Technical Specifications.

The minimum steady-state EDG output voltage was described in the response to RAI 74 Question 16-2. The response to Question 16-237 provides an updated minimum steady state EDG output voltage.

U.S. EPR FSAR Tier 1, Table 2.5.4-4 "Emergency Diesel Generator ITAAC", Item 5.3 acceptance criteria will be revised to add, “each EDG provides the minimum required operating voltage at the supplied safety-related equipment with the EDG steady state output voltage at ± 5 percent and frequency at ± 2 percent of nominal.” The indicated analysis verifies the as-built EDG provides the minimum voltage at supplied safety-related loads at the indicated voltage and frequency variances.

References for Question 16-237:

1. NEMA MG 1-2006, “NEMA Standards Publication MG 1-2006 Motors and Generators,“ National Electrical Manufacturers Association, 2006.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 8.3.1.1.5, and U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Section 3.8.1 "AC Sources - Operating," U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Bases Section B 3.8.1 "AC Sources - Operating," and U.S. EPR FSAR Tier 1, Section 2.5.4 will be revised as described in the response and indicated in the enclosed markup.

Question 16-241:

Provide rationale for omitting COLR limitations on the combination of THERMAL POWER, Reactor Coolant System (RCS) highest loop average temperature and pressurizer pressure from the EPR GTS, Section 2.1.1.

The EPR GTS, Section 2.1.1, Reactor Core SLs, COLR limitations on the combination of THERMAL POWER, Reactor Coolant System (RCS) highest loop average temperature and pressurizer pressure are not delineated in the technical specification. (Note: The EPR Bases, Section B 2.1.1 also discusses COLR requirements.)

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

Response to Question 16-241:

The rationale for omitting core operating limits report (COLR) limitations on the combination of THERMAL POWER, Reactor Coolant System (RCS) highest loop average temperature and pressurizer pressure is based on the safety limits established for the low departure from nucleate boiling ratio and high linear power density trip setpoints that come from analyses of various combinations of power level, pressure, flow, inlet temperature, and power distribution. As such, the combination of THERMAL POWER, RCS highest loop average temperature and pressurizer pressure is indirectly covered by the alternate safety limits.

The information presented in the APPLICABLE SAFETY ANALYSES and SAFETY LIMITS portions of the U.S. EPR FSAR Tier 2, Technical Specifications Bases Section B 2.1.1 has been updated and is consistent with the U.S. EPR incore trip setpoint and transient methodology topical report (ML073410587) submitted November 27, 2007. This update includes additional information relating to the type I, II, and III transients. The discussion includes the various parameter, protection channels and associated setpoints. The methodology is the basis for the calculation and dynamic confirmation of the incore setpoints which are designed to protect against violation of the specified safety limits during normal operation and anticipated operational occurrences.

FSAR Impact:

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Section 2.1.1, and Bases Section B 2.1.1 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

2.0 SAFETY LIMITS (SLs)

2.1 SLs

16-241

2.1.1 Reactor Core SLs

In MODES 1 and 2:

2.1.1.1 The departure from nucleate boiling ratio (DNBR) shall be above 1.0 with 95% probability at a 95% confidence level~~maintained ≥ 1.246 when using the ACH-2 DNB correlation and ≥ 1.21 when using the BWU-N correlation~~; and

2.1.1.2 The peak fuel centerline temperature shall be < 4901°F, decreasing by 14°F per 10,000 MWD/MTU of burnup.

2.1.2 RCS Pressure SL

In MODES 1, 2, 3, 4, and 5, the RCS pressure shall be ≤ 2803 psia.

2.2 SL VIOLATIONS

2.2.1 If SL 2.1.1.1 or 2.1.1.2 is violated, be in MODE 3 within 1 hour.

2.2.2 If SL 2.1.2 is violated:

2.2.2.1 In MODE 1 or 2, restore compliance and be in MODE 3 within 1 hour.

2.2.2.2 In MODE 3, 4, or 5, restore compliance within 5 minutes.

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

16-227

TRIP/ACTUATION FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	MINIMUM REQUIRED FOR FUNCTIONAL CAPABILITY(a)	LIMITING TRIP SETPOINT / DESIGN LIMIT(b)(c)	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	430 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.

Table 3.3.1-2 Notes will not spill over onto following pages when tracking is turned off.

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

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	TRIP/ACTUATION FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	MINIMUM REQUIRED FOR FUNCTIONAL CAPABILITY[a]	LIMITING TRIP SETPOINT / DESIGN LIMIT ~~LIMITING TRIP SETPOINT[b][c]~~	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<~~ss~~steady state; Max 1088 psia (b) (c)	J
15.	Low SG Pressure	1,2,3[e][h]	3 divisions	~~≥~~ 725 psia (b) (c)	L~~M~~
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) ~~for 10 sec.~~	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.

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

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TRIP/ACTUATION FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	MINIMUM REQUIRED FOR FUNCTIONAL CAPABILITY[(a)]	LIMITING TRIP SETPOINT / DESIGN LIMIT ~~LIMITING TRIP SETPOINT[(b)(c)]~~	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) ~~for 10 sec.~~	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<~~ss~~steady state; Max 943 psia (b) (c)	M
2.d. Startup and Shutdown Feedwater Isolation on Low SG Pressure (~~All~~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	~~≥ 69%~~ 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 Psat	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.

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

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	TRIP/ACTUATION FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	MINIMUM REQUIRED FOR FUNCTIONAL CAPABILITY[(a)]	LIMITING TRIP SETPOINT / DESIGN LIMIT ~~LIMITING TRIP SETPOINT[(b)(c)]~~	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<~~ss~~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

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TRIP/ACTUATION FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	MINIMUM REQUIRED FOR FUNCTIONAL CAPABILITY[a]	LIMITING TRIP SETPOINT / DESIGN LIMIT LIMITING TRIP SETPOINT[(b)(c)]	CONDITION
10.a. Emergency Diesel Generator (EDG) Start on Degraded Grid Voltage	1,2,3,4,(m) (m)	NA4 divisions 2 divisions	≥ 6210 V and ≤ 6350 V; ≥ 7 sec. and ≤ 11 sec. w/SIS, ≥ 270 sec. and ≤ 300 sec. wo/SIS	NAO O
10.b. EDG Start on LOOP	1,2,3,4,(m) (m)	NA4 divisions 2 divisions	≥ 4830 V and ≤ 4970 V; ≥ 0.4 sec. and ≤ 0.6 sec.	NAO 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

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TRIP/ACTUATION FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	MINIMUM REQUIRED FOR FUNCTIONAL CAPABILITY[(a)]	LIMITING TRIP SETPOINT / DESIGN LIMIT ~~LIMITING TRIP SETPOINT[(b)(c)]~~	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.

~~[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.]~~

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

~~FUNCTION~~	~~REQUIRED NUMBER OF DIVISIONS~~
~~1.Cold Leg Temperature (Wide Range)~~	~~1 per loop~~
~~2.Containment Isolation Valve Position Indication~~	~~2(a)(b)~~
~~3.Containment Pressure~~	~~2~~
~~4.Emergency Feedwater Storage Pool Level~~	~~1 per pool~~
~~5.Emergency Feedwater System Flow~~	~~1 per loop~~
~~6.Extra Boration System Flow~~	~~2~~
~~7.Hot Leg Injection Flow~~	~~1 per loop~~
~~8.Hot Leg Pressure (Wide Range)~~	~~1 per loop~~
~~9.Hot Leg Temperature (Wide Range)~~	~~1 per loop~~
~~10.In-containment Refueling Water Storage Tank Level~~	~~2~~
~~11.Incore Temperature~~	~~2 per quadrant~~
~~12.Power Range Monitors~~	~~2~~
~~13.Pressurizer Level~~	~~2~~
~~14.Radiation Monitor - Containment High Range~~	~~2~~
~~15.Radiation Monitor - Main Steam Line Activity~~	~~1 per line~~
~~16.Source Range Monitors~~	~~2~~
~~17.Steam Generator Level (Wide Range)~~	~~2 per SG~~
~~18.Steam Generator Pressure~~	~~2 per SG~~

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

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

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.1.1	Verify correct breaker alignment and indicated power availability for each offsite circuit.	7 days
SR 3.8.1.2	-----------------------------NOTES---------------------------- 1. All EDG starts may be preceded by an engine prelube period and followed by a warmup period prior to loading. 2. A modified EDG start involving idling and gradual acceleration to synchronous speed may be used for this SR as recommended by the manufacturer. When modified start procedures are not used, the time, voltage, and frequency tolerances of SR 3.8.1.7 must be met. --- 16-237 Verify each EDG starts from standby conditions and achieves steady state voltage ≥ ~~6210~~ 6555 V and ≤ 7260 V, and frequency ≥ 58.8 Hz and ≤ 61.2 Hz.	31 days
SR 3.8.1.3	-----------------------------NOTES---------------------------- 1. EDG loadings may include gradual loading as recommended by the manufacturer. 2. Momentary transients outside the load range do not invalidate this test. 3. This Surveillance shall be conducted on only one EDG at a time. 4. This SR shall be preceded by and immediately follow without shutdown a successful performance of SR 3.8.1.2 or SR 3.8.1.7. --- Verify each EDG is synchronized and loaded and operates for ≥ 60 minutes at a load ≥ 8550 kW and ≤ 9500 kW.	31 days

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.4	Verify each day tank contains ≥ ~~1350~~ 700 gal of fuel oil.	31 days
SR 3.8.1.5	Check for and remove accumulated water from each day tank.	31 days
SR 3.8.1.6	Verify each fuel oil transfer system operates to automatically transfer fuel oil from storage tank to the day tank.	~~92~~ 31 days
SR 3.8.1.7	-----------------------------NOTE------------------------------ All EDG starts may be preceded by an engine prelube period. --- Verify each EDG starts from standby condition and achieves: a. In ≤ 15 seconds, voltage ≥ ~~6210~~ 6555 V and frequency ≥ 58.8 Hz; and b. Steady state voltage ≥ ~~6210~~ 6555 V and ≤ 7260 V, and frequency ≥ 58.8 Hz and ≤ 61.2 Hz. 16-237	 184 days
SR 3.8.1.8	-----------------------------NOTE------------------------------ This Surveillance shall not normally be performed in MODE 1 or 2. However, this Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR. --- Verify automatic and manual transfer of AC power sources from the normal offsite circuit to the alternate offsite circuit.	 24 months

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.8.1.9	------------------------------NOTE------------------------------ If performed with the EDG synchronized with offsite power, it shall be performed at a power factor ≤ 0.9. However, if grid conditions do not permit, the power factor limit is not required to be met. Under this condition the power factor shall be maintained as close to the limit as practicable. --- Verify each EDG rejects a load greater than or equal to its associated single largest post-accident load, and: a. Following load rejection, the frequency is ≤ ~~64.5~~<u>63</u> Hz; 16-237 b. Within 3 seconds following load rejection, the voltage is ≥ ~~6210~~ <u>6555</u> V and ≤ 7260 V; and c. Within 3 seconds following load rejection, the frequency is ≥ 58.8 Hz and ≤ 61.2 Hz.	24 months
SR 3.8.1.10	------------------------------NOTE------------------------------ If performed with EDG synchronized with offsite power, it shall be performed at a power factor ≤ 0.9. However, if grid conditions do not permit, the power factor limit is not required to be met. Under this condition the power factor shall be maintained as close to the limit as practicable. --- Verify each EDG does not trip and voltage is maintained ≤ 8280 V during and following a load rejection of ≥ 8550 kW and ≤ 9500 kW.	24 months

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.11	-----------------------------NOTES---------------------------- 1. All EDG starts may be preceded by an engine prelube period. 2. This Surveillance shall not normally be performed in MODE 1, 2, 3, or 4. However, portions of the Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR. ---	
	Verify on an actual or simulated loss of offsite power signal: a. De-energization of emergency buses; b. Load shedding from emergency buses; c. Each EDG auto-starts from standby condition, and: 1. Energizes permanently connected loads in ≤ 15 seconds; 2. Energizes auto-connected shutdown loads through the Protection System; 3. Maintains steady state voltage ≥ ~~6210~~ 6555 V and ≤ 7260 V; [16-237] 4. Maintains steady state frequency ≥ 58.8 Hz and ≤ 61.2 Hz; and 5. Supplies permanently connected and auto-connected shutdown loads for ≥ 5 minutes.	24 months

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.12	-----------------------------NOTE------------------------------ All EDG starts may be preceded by prelube period. --- Verify on an actual or simulated Safety Injection System actuation signal each EDG auto-starts from standby condition and: a. In ≤ 15 seconds after auto-start and during tests, achieves voltage ≥ ~~6210~~ 6555 V and frequency ≥ 58.8 Hz; b. Achieves steady state voltage ≥ ~~6210~~ 6555 V and ≤ 7260 V and frequency ≥ 58.8 Hz and ≤ 61.2 Hz; c. Operates for ≥ 5 minutes; and d. Permanently connected loads remain energized from the offsite power system. e. Emergency loads are energized from the offsite power system.	24 months 16-237
SR 3.8.1.13	Verify each EDG's noncritical automatic trips are bypassed on an actual or simulated Loss of Offsite Power signal on the emergency bus concurrent with an actual or simulated Safety Injection System actuation signal.	24 months

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.14	-----------------------------NOTES----------------------------- 1. Momentary transients outside the load and power factor ranges do not invalidate this test. 2. If performed with EDG synchronized with offsite power, it shall be performed at a power factor ≤ 0.9. However, if grid conditions do not permit, the power factor limit is not required to be met. Under this condition the power factor shall be maintained as close to the limit as practicable. ---	
	Verify each EDG operates for ≥ 24 hours: a. For ≥ 2 hours loaded ≥ 9975 kW and ≤ 10,450 kW; and b. For the remaining hours of the test loaded ≥ 8550 kW and ≤ 9500 kW.	24 months
SR 3.8.1.15	-----------------------------NOTES----------------------------- 1. This Surveillance shall be performed within 5 minutes of shutting down the EDG after the EDG has operated ≥ 2 hours loaded ≥ 8550 kW and ≤ 9500 kW. Momentary transients outside of load range do not invalidate this test. 2. All EDG starts may be preceded by an engine prelube period. ---	
	Verify each EDG starts and achieves: a. In ≤ 15 seconds, voltage ≥ ~~6210~~ 6555 V and frequency ≥ 58.8 Hz; and b. Steady state voltage ≥ ~~6210~~ 6555 V, and ≤ 7260 V and frequency ≥ 58.8 Hz and ≤ 61.2 Hz. 16-237	24 months

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.18	------------------------------NOTES------------------------------ 1. All EDG starts may be preceded by an engine prelube period. 2. This Surveillance shall not normally be performed in MODE 1, 2, 3, or 4. However, portions of the Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR. ---	
	Verify on an actual or simulated loss of offsite power signal in conjunction with an actual or simulated Safety Injection System actuation signal: a. De-energization of emergency buses; b. Load shedding from emergency buses; and c. Each EDG auto-starts from standby condition; and: 1. Energizes permanently connected loads in ≤ 15 seconds; 2. Energizes auto-connected emergency loads through the Protection System; 3. Achieves steady state voltage ≥ ~~6210~~ 6555 V and ≤ 7260 V; [16-237] 4. Achieves steady state frequency ≥ 58.8 Hz and ≤ 61.2 Hz; and 5. Supplies permanently connected and auto-connected emergency loads for ≥ 5 minutes.	24 months

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.19	-----------------------------NOTE------------------------------ All EDG starts may be preceded by an engine prelube period. --- Verify when started simultaneously from standby condition, each EDG achieves: a. In ≤ 15 seconds, voltage ≥ ~~6210~~ 6555 V and frequency ≥ 58.8 Hz; and b. Steady state voltage ≥ ~~6210~~ 6555 V and ≤ 7260 V, and frequency ≥ 58.8 Hz and ≤ 61.2 Hz. 16-237	10 years

B 2.0 SAFETY LIMITS (SLs)

B 2.1.1 Reactor Core

BASES

BACKGROUND

GDC 10 (Ref. 1) require that specified acceptable fuel design limits are not exceeded during steady state operation, normal operational transients, and anticipated operational occurrences (AOOs). This is accomplished by having a departure from nucleate boiling (DNB) design basis, which corresponds to a 95% probability at a 95% confidence level (the 95/95 DNB criterion) that DNB will not occur and by requiring that fuel centerline temperature stays below the melting temperature.

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The restrictions of these SLs prevent overheating of the fuel and cladding, as well as possible cladding perforation, which would result in the release of fission products to the reactor coolant. Overheating of the fuel is prevented by maintaining the ~~steady state~~ peak linear heat rate (LHR) below the level ~~at which~~that could cause fuel centerline ~~melting occurs~~temperature to reach the fuel rod melt temperature limit. Overheating of the fuel cladding is prevented by restricting fuel operation to within the nucleate boiling regime, where the heat transfer coefficient is large and the cladding surface temperature is slightly above the coolant saturation temperature.

Fuel centerline melting occurs when the local LHR, or power peaking, in a region of the fuel is high enough to cause the fuel centerline temperature to reach the melting point of the fuel. Expansion of the pellet upon centerline melting may cause the pellet to stress the cladding to the point of failure, allowing an uncontrolled release of activity to the reactor coolant.

Operation above the boundary of the nucleate boiling regime could result in excessive cladding temperature because of the onset of DNB and the resultant sharp reduction in heat transfer coefficient. Inside the steam film, high cladding temperatures are reached, and a cladding water (zirconium water) reaction may take place. This chemical reaction results in oxidation of the fuel cladding to a structurally weaker form. This weaker form may lose its integrity, resulting in an uncontrolled release of activity to the reactor coolant.

The proper functioning of the Protection System (PS), ~~and~~ main steam safety valves (MSSVs), and main steam relief trains (MSRTs) prevents violation of the reactor core SLs.

BASES

APPLICABLE SAFETY ANALYSES

The fuel cladding must not sustain damage as a result of normal operation and AOOs. The reactor core SLs are established to preclude violation of the following fuel design criteria:

a. There must be at least 95% probability at a 95% confidence level (the 95/95 DNB criterion) that the hot fuel rod in the core does not experience DNB; and

b. The hot fuel pellet in the core must not experience centerline fuel melting.

The PS Limiting Trip Setpoints in LCO 3.3.1, Protection System (PS) ~~Sensors and Signal Processors,~~ in combination with all the LCOs, are designed to prevent any anticipated combination of transient conditions for Reactor Coolant System (RCS) temperature, pressure, RCS Flow, AO, and THERMAL POWER level that would result in a departure from nucleate boiling ratio (DNBR) of less than the DNBR limit and preclude the existence of flow instabilities.

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For DNBR limiting normal operation and AOO transients, three types of transients can be distinguished:

a. Type I: Transients from power for which the low DNBR protection channel of the PS is effective. These transients are protected by the Low DNBR Channel (LCO 3.3.1);

b. Type II: Transients for which the low DNBR protection is not effective. During these events protection is provided by another PS channel. This protection and the reserved DNBR margin included in LCO 3.2.3 “DNBR” make sure that the DNBR value at the initiation of the transient is greater than or equal to the value assumed in the safety analyses;

c. Type III: Transients for which neither the “Low DNBR” protection channel nor the LCO 3.2.3 “DNBR” are sufficient.

For type I transients:

The parameters that influence DNBR during the transient are taken into account in the low DNBR protection channel. The rate of change of the core boundary conditions is slow enough to be protected by the low DNBR protection channel. When the DNBR value calculated by the PS reaches the value of the trip setpoint, a reactor trip signal is issued. The probability that the actual DNBR value is higher than 1.0 is 95% with a 95% confidence level. Uncertainties and penalties are accounted for in

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APPLICABLE SAFETY ANALYSES (continued)

the Low DNBR reactor trip setpoint in the incore static setpoint methodology.

For type II transients:

The transient is too rapid to be resolved by the low DNBR protection channel, so sufficient DNBR margin must be reserved at transient initiation to provide time for other plant trips to intercede and provide the needed protection. This is the purpose of LCO 3.2.2 "DNBR". The DNBR LCO is established based on a combination of inherent system uncertainties and the results of the worst case transient DNBR degradation for those transients that are not protected by a Low DNBR trip.

During normal operation, if the LCO 3.2.2 is satisfied, the DNBR will remain higher than 1.0 with probability of 95% and a confidence level of 95% during a type II transient. Uncertainties and penalties are accounted for in the Low DNBR reactor trip setpoint in the incore static setpoint methodology.

For type III transients:

The "Low DNBR" protection channel and LCO 3.2.3 "DNBR" do not provide the required protection for the transient. For these transients, evaluations of the DNB performance during the event are performed using the approved sub-channel analysis code. Limiting conditions for core thermal power, core exit pressure, core inlet temperature, and core inlet mass flux are accounted for in these analyses. The minimum DNBR must remain greater than the DNBR design limit for the applicable critical heat flux correlation to make sure that the probability of preventing DNB is 95% with a 95% confidence level.

~~Automatic enforcement of these reactor core SLs is provided by the appropriate operation of the PS and the main steam safety valves.~~

~~The SLs represent a design requirement for establishing the PS Limiting Trip setpoints identified previously. LCO 3.4.1, "RCS Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits," or the assumed initial conditions of the safety analyses (as indicated in FSAR Section 7.2, Ref. 2) provide more restrictive limits to ensure that the SLs are not exceeded.~~

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SAFETY LIMITS SL 2.1.1.1 is the DNBR safety criterion of 1.0.

SL 2.1.1.2 makes sure that fuel centerline temperature remains below the fuel melt temperature of [4901] ºF during normal operating conditions or design AOOs with an adjustment for burnup. An adjustment of [14 ºF per 10,000 MWD/MTU] has been established in Ref. 3 for both UO_2 and UO_2:Gd_2O_3 fuel. Maintaining the dynamically adjusted peak LPD below the limit specified in the COLR ensures that fuel centerline melt will not occur during normal operating conditions or design AOOs.

For transients directly protected by the "High Linear Power Density" and "Low DNBR" protection channels, the LPD and DNBR PS setpoints will be set sufficiently higher (in the case of DNBR) or lower (in the case of LPD) with respect to the safety limit to account for the effects of various uncertainties. For DNBR, the correlation uncertainty is statistically taken into consideration when establishing the PS trip setpoint and the LCO setpoint.

SAFETY LIMITS The figure provided in the COLR shows the loci of points of THERMAL POWER, RCS pressure, and average temperature for which the minimum DNBR is not less than the safety analyses limit, that fuel centerline temperature remains below melting, that the average enthalpy in the hot leg is less than or equal to the enthalpy of saturated liquid, or that the exit quality is within the limits defined by the DNBR correlation.

The reactor core SLs are established to preclude violation of the following fuel design criteria:

a. There must be at least a 95% probability at a 95% confidence level (the 95/95 DNB criterion) that the hot fuel rod in the core does not experience DNB; and

b. There must be at least a 95% probability at a 95% confidence level that the hot fuel pellet in the core does not experience centerline fuel melting.

The reactor core SLs are used to define the various PS Functions such that the above criteria are satisfied during steady state operation, normal operational transients, and anticipated operational occurrences (AOOs). To ensure that the PS precludes the violation of the above criteria, additional criteria are applied to the Linear Power Density and DNB Ratio protection functions. That is, it must be demonstrated that the average enthalpy in the hot leg is less than or equal to the saturation enthalpy and that the core exit quality is within the limits defined by the DNBR correlation. Appropriate functioning of the PS ensures that for variations in the THERMAL POWER, RCS Pressure, RCS temperature, RCS flow rate, and AO that the reactor core SLs will be satisfied during steady state operation, normal operational transients, and AOOs.

BASES

APPLICABILITY

SLs 2.1.1.1 and 2.1.1.2 only apply in MODES 1 and 2 because these are the only MODES in which the reactor is critical. Automatic protection functions are required to be OPERABLE during MODES 1 and 2 to ensure operation within the reactor core SLs. The ~~main steam safety valves~~MSSVs, MSRTs, or automatic protection actions serve to prevent RCS heatup to the reactor core SL conditions or to initiate a reactor trip function, which forces the unit into MODE 3. Setpoints for the PS functions are specified in LCO 3.3.1, "Protection System (PS)." In MODES 3, 4, 5, and 6, Applicability is not required since the reactor is not generating significant THERMAL POWER.

SAFETY LIMIT VIOLATIONS

The following SL violation responses are applicable to the reactor core SLs. If SLs 2.1.1.1 or 2.1.1.2 is violated, the requirement to go to MODE 3 places the unit in a MODE in which this SL is not applicable. This ensures completion within 10 CFR 50.36(~~d~~c)(1)(i)(a), which requires a shutdown when safety limits are violated.

The allowed Completion Time of 1 hour recognizes the importance of bringing the unit to a MODE of operation where this SL is not applicable, and reduces the probability of fuel damage.

REFERENCES

1. 10 CFR 50, Appendix A, GDC 10.

2. ~~2.~~ FSAR Section 7.2.

3. BAW-10231P-A, Revision 1, “COPERNIC Fuel Rod Design Computer Code,” Framatone ANP, September 2004.

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BASES

BACKGROUND (continued)

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 initiate 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.

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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. ~~The implementation of manual system level actuation of ESF functions and the priority between the automatic functions of the PS and the manual system level initiation is determined on a case-by-case basis.~~

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.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

- SPNDs,
- RCP speed sensor,
- Pressurizer Pressure (Narrow Range) sensor,
- Cold leg temperature (Narrow Range) sensor,
- RCS loop flow sensors,
- RAU,
- APUs, and
- ALUs.

The Low DNBR and Imbalance or Rod Drop (1.b), Variable Low DNBR and Rod Drop (1.c), and Low DNBR-High Quality and Imbalance or Rod Drop (1.e) trips require four divisions of the following sensors and processors to be OPERABLE when the reactor power level is greater than or equal to 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.

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The LTSPs are ~~high~~ low enough to provide an operating envelope that prevents an unnecessary low DNBR reactor trip. The LTSPs are ~~low~~ 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 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 to an uncontrolled increase of the linear power density.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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 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 10^{-5}% power as indicated on the Intermediate Range monitors:

- Cold Leg Temperature sensors (Wide Range),
- 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 ~~an~~ intermediate ~~high~~ power levels and above, up to and including 100 percent power operation ~~including nominal power~~.

The P5 permissive automatically enables the High Core Power Level Trip when the nuclear power level is greater than or equal to 10^{-5}% power. The P5 permissive also automatically disables the High Core Power Level Trip below this power.

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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.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Therefore, the Low Saturation Margin reactor trip function assures that the High Core Power Level trip function remains valid.
~~This function limits the consequences of an excessive reactivity increase from an intermediate high power level including nominal power. This trip protects against the following postulated accidents or AOOs:~~

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~~– Increase in heat removal by the secondary system, and~~

~~– Reactivity and power distribution anomalies.~~

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 10^{-5}% power as indicated on the Intermediate Range monitors.:

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

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The LTSP is ~~high~~low enough to provide an operating envelope that prevents an unnecessary Low Saturation Margin reactor trip. The LTSP is ~~low~~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 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.

These trips protect against the following postulated accidents or AOOs:

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

- 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 when the reactor power level is greater than or equal to 70% RTP:

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

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

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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 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 10% RTP:

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

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

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 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 RCP's, 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

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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 when the reactor power level is greater than or equal to 10% RTP:

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

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The LTSP is ~~high~~low enough to provide an operating envelope that prevents unnecessary Low RCP Speed reactor trips. The LTSP is ~~low~~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 10% RTP. When nuclear power is below this threshold, the trip is also automatically disabled by permissive function P2.

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 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.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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.

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

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

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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 abovebelow the full load operating value so as not to interfere with normal plant operation, but still lowhigh 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 200ºF.

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:

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

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

- Containment Equipment Compartment and Containment Service Compartment pressure sensors,
- APUs, and
- ALUs.

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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The LTSP is lowhigh enough to preclude spurious operation but highlow 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:

$$SP(t) = MIN\ [943\ psia,\ S_2(t)]$$

Where:

$S_1(t) = P(t) - \Delta p$

$S_2(t) = MAX\ [S_1(t),\ S_2(t - C_t) - C_1 R_l]$

t = current time

$P(t)$ = measured SG pressure

Δp = 247 psi

C_t = processor cycle time in minutes

R_l = 29 psi/minute

$SP(t)$ = variable setpoint

There are no automatic permissives associated with this function.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

d. SSS Isolation on Low SG Pressure (~~All~~ 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.

The automatic SSS Feedwater Isolation on Low SG Pressure function is required to be OPERABLE in:

– MODE~~S~~ 1,
– 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.

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The LTSP is low~~high~~ enough to preclude spurious operation but high~~low~~ 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 2005 psia.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

This function mitigates the following postulated accidents or AOOs:

- Small break LOCA,
- Large break LOCA,
- 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_{sa} function requires four divisions of the following sensors and processors:

- 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.

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The LTSP for the Low Delta P_{sat} function is set lowhigh enough to avoid spurious operation but highlow 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 2005 psia. 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 356ºF.

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.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

4. RCP Trip on Low Delta-Pressure across ~~the~~ 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.

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:

- RCP Delta-Pressure sensors,
- RCP Current sensors,
- APUs, and
- ALUs.

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The LTSP for the RCP Trip on Low Delta-Pressure across RCP with SIS Actuation function is set low~~high~~ enough to avoid spurious operation but high~~low~~ 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.

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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 LTSP for the Partial Cooldown Actuation on SIS Actuation function is set high enough to avoid spurious operation but low enough to ensure adequate flow from the MHSI pumps to maintain core cooling.~~

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

6. Emergency Feedwater System

a. Actuation on Low-Low SG Level (All SGs)

In case of loss of MFW, the Emergency Feedwater System (EFWS) is actuated to remove residual heat via secondary side. With an EFWS actuation signal, SG blowdown is also isolated to conserve SG inventory. This function mitigates the following postulated accidents or AOOs:

- Loss of normal feedwater flow,
- Feedwater system piping failure, and
- LOOP.

The automatic EFWS Actuation on Low-Low SG Level function requires four divisions of the following sensors and processors to be OPERABLE in MODES 1, 2 and 3:

- SG level (Wide Range) sensors,
- APUs, and
- ALUs.

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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~~high~~ enough to provide an operating envelope that prevents unnecessary actuations but high~~low~~ enough to ensure sufficient make-up is provided to the SGs.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

This function mitigates the following postulated accidents or AOOs:

- Excessive increase in secondary steam flow,
- Spurious opening of one SG safety or relief valve,
- Steam system piping failure, and
- Feedwater system piping failure.

The automatic MSIV Closure on SG Pressure Drop function requires four divisions of the following sensors and processors to be OPERABLE in MODES 1, 2, and 3:

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

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The LTSP for the MSIV Closure on SG Pressure Drop function is set lowhigh enough to avoid SG pressure fluctuations during normal operation and highlow enough to isolate an SG and limit the blowdown to the value assumed in the safety analysis.

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

The setpoint algorithm is:

$$SP(t) = MIN\ [1088\ psia,\ S_2(t)]$$

Where:

$S_1(t) = P(t) - \Delta p$

$S_2(t) = MAX\ [S_1(t),\ S_2(t - C_t) - C_1 R_l)]$

t = current time

$P(t)$ = measured SG pressure

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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

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

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The LTSP for the MSIV Closure on Low SG Pressure function is set low~~high~~ enough to avoid SG pressure fluctuations during normal operation and high~~low~~ 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 on Low SG Pressure function when the pressurizer pressure is greater than or equal to 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:

- Containment Service Compartment Pressure monitors,
- Containment Equipment Compartment Pressure monitors,
- APUs, and
- ALUs.

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.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The automatic EDG Start on Degraded Grid Voltage requires four divisions of the following 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”:

- 6.9 kV voltage sensors,
- APUs, and
- ALUs.

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

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The LTSP for the EDG Start on Degraded Grid Voltage is set low~~high~~ enough to avoid spurious operation but high~~low~~ 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.

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 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”:

- 6.9 kV voltage sensors,
- APUs, and
- ALUs.

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

16-227

The LTSP for the EDG Start on LOOP is set low~~high~~ enough to avoid spurious operation but high~~low~~ 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.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

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).

16-227

The LTSP is lowhigh enough to provide an operating envelope that prevents unnecessary isolations but highlow 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.

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, with thee or more RCPs in operation,
- MODES 4, with three or more RCPs in operation, and
- MODES 5, with three or more RCPs in operation.

B 3.3 INSTRUMENTATION

B 3.3.2 Post Accident Monitoring (PAM) Instrumentation

BASES

BACKGROUND

The primary purpose of the PAM instrumentation is to provide operators with information that is needed during accidents.

The OPERABILITY of PAM instrumentation ensures that there is sufficient information available on selected plant parameters to monitor and assess plant status and behavior following accidents and transients when the use of the Emergency Operating Procedures (EOPs) is required.

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The PAM instruments ~~included in Table 3.3.2-1, Postaccident Monitoring Instrumentation,~~ are required for the following reasons:

1. Perform the diagnosis specified in the emergency operating procedures (these variables are restricted to preplanned actions for the primary success path of DBAs), e.g., loss of coolant accident (LOCA);

2. Take the specified, pre-planned, manually controlled actions, for which no automatic control is provided, and that are required for safety systems to accomplish their safety function;

3. Provide information to indicate whether plant safety functions are being accomplished for reactivity control, core cooling, maintaining reactor coolant system integrity, and maintaining containment integrity (including radioactive effluent control);

4. Provide information to indicate the potential for being breached or the actual breach of the barriers to fission product releases (i.e., fuel cladding, primary coolant pressure boundary, and containment); and

5. Enable the operator to recognize which heat transfer symptom is occurring: 1) loss of subcooling margin, 2) lack of heat transfer, 3) excessive heat transfer, and 4) Steam Generator Tube Rupture.

The PAM instrumentation is displayed through the Safety Information and Control Systems (SICS), which includes the Qualified Display System (QDS). The Safety Automation System (SAS) communication with the QDS (as part of SICS) is realized through the Monitoring and Service Interfaces (MSI), and the Panel Interfaces (PI). The PI's are part of the SICS, the MSI's are part of the SAS. The SAS also provides outputs for analog meters, illuminated buttons etc., and receives inputs from Conventional Instrumentation and Controls which is included in the SICS.

BASES

LCO (continued)

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PAM variables are required to meet design and qualification requirements for seismic and environmental qualification, single failure criterion, utilization of emergency standby power, immediately accessible display, continuous readout, and recording of display.

------------------------------- REVIEWER'S NOTE --------------------------------
The Bases must contain a description of variables typical of those identified by the unit specific Regulatory Guide 1.97 analyses. The description in unit specific Technical Specifications (TS) shall list all required variables identified by the unit specific Regulatory Guide 1.97 analyses, as amended by the NRC's Safety Evaluation Report (SER).

Listed below are discussions of the specified instrument Functions: listed in Table 3.3.2-1.[.]

1. Cold Leg Temperature (Wide Range)

The key variables for monitoring core cooling are Hot Leg Temperature, Core Exit Temperature, and Steam Generator Pressure. Cold Leg Temperature provides backup temperature monitoring to Hot Leg Temperature and Core Exit Temperature when forced or verified natural circulation exists. Cold Leg Temperature is used with Hot Leg Temperature and Core Exit Temperature to verify natural circulation. Cold Leg Temperature is compared to the saturation temperature for steam generator pressure (Tsat) to determine primary to secondary loop coupling.

2. Containment Isolation Valve Position Indication

Containment isolation valve position verifies Containment isolation and is required to ensure Containment integrity in event of a LOCA.

3. Containment Pressure

Containment pressure is a key measurement used for detection of a LOCA, verification of Engineered Safety Features mitigation, and detection of a potential breach of Containment.

BASES

LCO (continued)

16-212

~~4. Emergency Feedwater Storage Pool Level~~

~~Emergency feedwater pool level is a key variable to ensure adequate EFW pump net positive suction head (NPSH) is satisfied.~~

~~5.Emergency Feedwater System Flow~~

~~Emergency Feedwater flow indication is required when throttling feedwater flow to the steam generators. Control of flow is required to control the rate of steam generator heat removal to maintain Reactor Coolant temperature profiles within limits for cooldown.~~

~~6.Extra Boration System Flow~~

~~The Extra Boration System flow provides verification that the appropriate system alignment has been completed. The negative reactivity additions performed by this system require verfication of correct system operation.~~

~~7.Hot Leg Injection Flow~~

~~Hot Leg Injection flow provides verification that the appropriate system alignment has been completed. Hot leg injection is required to prevent the buildup of sufficient boron concentration in the core coolant channels to impede long term core cooling.~~

~~8.Hot Leg Pressure (Wide Range)~~

~~RCS pressure is required to monitor reactor coolant integrity and assess core cooling. RCS pressure and either RCS hot leg or incore temperature is used to determine subcooling margin if the calcuation is not available.~~

~~9.Hot Leg Temperature (Wide Range)~~

~~Hot Leg Temperature is required to monitor core cooling, to verify natural circulation, and to verify primary to secondary loop coupling along with steam generator pressure. Hot Leg temperature and RCS pressure are used to determine loop subcooling margin if the calculation is not available.~~

BASES

LCO (continued)

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10. In-containment Refueling Water Storage Tank Level

In-Containment storage tank level is monitored during operation to ensure that adequate pump NPSH is maintained during the recirculation phase of LOCA mitigation for long term core cooling requirements. In addition, level instrumentation is used to assess level loss due to leakage on Safety Injection piping located outside of Containment and interfacing systems (Inter-system LOCA) as well as level rise due to dilution mechanisms.

11. Incore Temperature

Core cooling is monitored by RCS and incore thermocouple temperatures. Loss of subcooling margin (SCM) is identified by a combination of RCS pressure and either hot leg temperature or incore thermocouple temperature depending on plant conditions, (e.g., RCPs on/off). Incore Temperature is monitored for verification and surveillance of long term core cooling and to detect potential breach of fuel cladding.

12. Power Range Monitors

Power Range Neutron Flux is used to verify that reactor trip has resulted in "Reactor Shutdown". Once "Reactor Shutdown" is verified following reactor trip, all subsequent EOP action is based on a shutdown reactor. Power Range indication is used during a steam generator tube rupture to determine when core power is within the Main Steam bypass capability, at which point a reactor trip can be performed without challenge to the Main Steam relief capabilities.

13. Pressurizer Level

Pressurizer level provides information for the operator to maintain RCS pressure and inventory control, with the exception of a few accident situations, such as large break LOCA. Pressurizer level is a key variable required to ensure proper operation of the pressurizer heaters to maintain the pressurizer in a saturated state.

BASES

LCO (continued)

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14. Radiation Monitor - Containment High Range Activity

Containment high range radiation instrumentation is used to assess the potential for significant radiation releases and to provide release assessment for determining the need to invoke site emergency plans.

15. Radiation Monitor - Main Steam Line Activity

Main Steam Line radiation levels are a key variable for detection of a breach between the primary to secondary loop boundary.

16. Source Range Monitors

Source Range instrumentation is used to ensure that the reactor remains subcritical. Once "Reactor Shutdown" is verified following reactor trip, all subsequent EOP action is based on a shutdown reactor. Source range can be used to assess if a return to critical condition is approached during plant cooldown and whether mitigation efforts are required to maintain the reactor in a shutdown condition.

17. Steam Generator Level (Wide Range)

Both steam generator level and pressure are monitored to assess primary to secondary heat transfer. An upper level limit is specified to prevent moisture carryover into the steam lines which could damage control components used for controlling RCS cooldown.

18. Steam Generator Pressure

Steam Generator pressure is a key parameter used to identify upsets in heat transfer and evaluate primary-to-secondary heat transfer.

APPLICABILITY

The PAM instrumentation LCO is applicable in MODES 1, 2, and 3. These variables are related to the diagnosis and preplanned actions required to mitigate postulated accidents. The applicable postulated accidents are assumed to occur in MODES 1, 2, and 3. In MODES 4, 5, and 6, plant conditions are such that the likelihood of an event occurring that would require PAM instrumentation is low; therefore, PAM instrumentation is not required to be OPERABLE in these MODES.

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BASES

ACTIONS

A Note has been added in the ACTIONS to clarify the application of Completion Time rules. The Conditions of this Specification may be entered independently for each Function ~~listed in Table 3.3.2-1~~. The Completion Time(s) of the inoperable division(s) of a Function will be tracked separately for each Function starting from the time the Condition was entered for that Function.

A.1

When one or more Functions have one required division that is inoperable, the required inoperable division must be restored to OPERABLE status within 30 days. The 30 day Completion Time is based on operating experience and takes into account the remaining OPERABLE division (or in the case of a Function that has only one required division, other non-Regulatory Guide 1.97 instrument divisions to monitor the Function), the passive nature of the instrument (no critical automatic action is assumed to occur from these instruments), and the low probability of an event requiring PAM instrumentation during this interval.

B.1

This Required Action specifies initiation of actions in accordance with Specification 5.6.5, which requires a written report to be submitted to the Nuclear Regulatory Commission. This report discusses the results of the root cause evaluation of the inoperability and identifies proposed restorative Required Actions. This Required Action is appropriate in lieu of a shutdown requirement, given the likelihood of plant conditions that would require information provided by this instrumentation. Also, alternative Required Actions are identified before a loss of functional capability condition occurs.

C.1

When one or more Functions have two required divisions inoperable (i.e., two divisions inoperable in the same Function), one division in the Function should be restored to OPERABLE status within 7 days. The Completion Time of 7 days is based on the relatively low probability of an event requiring PAM instrumentation operation and the availability of alternate means to obtain the required information. Continuous operation with two required divisions inoperable in a Function is not acceptable because the alternate indications may not fully meet all performance qualification requirements applied to the PAM instrumentation. Therefore, requiring restoration of one inoperable division of the Function limits the risk that the PAM Function will be in a degraded condition should an accident occur.

BASES

ACTIONS (continued)

D.1 and D.2

If the Required Action and associated Completion Time of Condition C are not met ~~and Table 3.3.2-1 directs entry into Condition E~~, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 4 within 12 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

A Note at the beginning of the SR Table specifies that the following SR applies to each PAM instrumentation Function ~~found in Table 3.3.2-1~~.

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SR 3.3.2.1

A CALIBRATION is performed every 24 months or approximately every refueling. CALIBRATION is a complete check of the instrument division including the sensor. The Surveillance verifies the function responds to the measured parameter within the necessary range and accuracy. ~~A Note allows exclusion of the neutron detectors from the CALIBRATION. The requirements for CALIBRATION of neutron detectors is Specified in Specification 3.3.1," Protection System and Safety Automation System".~~

The Frequency is based upon operating experience and consistency with the typical industry refueling cycle and is justified by the assumption of a 24 month CALIBRATION interval for the determination of the magnitude of equipment drift.

~~SR 3.3.2.2~~

~~A SOT on each Safety Information and Control System performing the PAM functions listed in Table 3.3.2-1 is performed every 24 months to ensure the entire division will perform its 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 adjustments, as necessary, of the required alarm, interlock, and trip setpoints required for division OPERABILITY such that the setpoints are within the necessary range and accuracy. The SOT may be performed by means of any series of sequential, overlapping, or total steps.~~

BASES

ACTIONS (continued)

G.1 and G.2

If any Required Action and associated Completion Time of Conditions A, B, C, D, E, or F cannot be met, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging plant systems.

H.1

Condition H corresponds to a level of degradation in which all redundancy in the AC electrical power supplies may have been lost. At this severely degraded level, any further losses in the AC electrical power system may cause a loss of function. Therefore, no additional time is justified for continued operation. The unit is required by LCO 3.0.3 to commence a controlled shutdown.

SURVEILLANCE REQUIREMENTS

The AC sources are designed to permit inspection and testing of all important areas and features, especially those that have a standby function, in accordance with 10 CFR 50, Appendix A, GDC 18 (Ref. 8). Periodic component tests are supplemented by extensive functional tests during refueling outages (under simulated accident conditions). The SRs for demonstrating the OPERABILITY of the EDGs are in accordance with the recommendations of Regulatory Guide 1.9 (Ref. 3) and Regulatory Guide 1.137 (Ref. 9), as addressed in FSAR Section 1.9.

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Where the SRs discussed herein specify voltage and frequency tolerances, the following values satisfy the motor terminal voltages and frequency requirements as indicated in NEMA MG 1-2006 (Ref. 1)~~is applicable~~. The minimum steady state output voltage of ~~6210~~ 6555 V is ~~90~~95% of the nominal 6.9 kV output voltage. This value~~, which is specified in ANSI C84-1,~~ allows for a combined variation in voltage and frequency of 60% when considering voltage drop to the terminals of 6600 V motors whose minimum operating voltage is specified as 90% or 5940 V. It also allows for a combined variation in voltage and frequency of 10% when considering voltage drops to motors and other equipment down through the 120 V level where minimum operating voltage is also usually specified as 90% of name plate rating. The specified maximum steady state output voltage of 7260 V is equal to the maximum operating voltage specified for 6600 V motors. It ensures that for a lightly loaded distribution system, the voltage at the terminals of 6600 V motors is no more than the maximum rated operating voltages.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.1.19

This Surveillance demonstrates that the EDG starting independence has not been compromised. Also, this Surveillance demonstrates that each engine can achieve proper speed within the specified time when the EDGs are started simultaneously.

The 10 year Frequency is consistent with the recommendations of Regulatory Guide 1.9 (Ref. 3), Table 1.

This SR is modified by a Note. The reason for the Note is to minimize wear on the EDG during testing. For the purpose of this testing, the EDGs must be started from standby conditions, that is, with the engine coolant and oil continuously circulated and temperature maintained consistent with manufacturer recommendations.

REFERENCES

1. 10 CFR 50, Appendix A, GDC 17.
2. FSAR Chapter 8.
3. Regulatory Guide 1.9, Rev. 4.
4. FSAR Chapter 6.
5. FSAR Chapter 15.
6. Regulatory Guide 1.93, Rev. 0, December 1974.
7. Generic Letter 84-15, "Proposed Staff Actions to Improve and Maintain Diesel Generator Reliability," July 2, 1984.
8. 10 CFR 50, Appendix A, GDC 18.
9. Regulatory Guide 1.137, Rev. 1, October 1979.
10. ~~10.~~ IEEE Standard 308-2001.
11. NEMA MG 1-2006, “NEMA Standards Publication MG 1-2006 Motors and Generators,” National Electrical Manufacturers Association, 2006.

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Table 2.5.4-~~3~~4—Emergency Diesel Generator ~~Inspections, Tests, Analyses, and Acceptance Criteria~~ITAAC (~~4~~ ~~6~~8 Sheets)

Commitment Wording		Inspections, Tests ~~or~~, ~~Analysis~~ Analyses	Acceptance Criteria
5.1	The EDG control power is provided by the EUPS system from the respective division.	A test will be performed on each EDG system by providing a test signal in only one division.	The test signal exists in only the EDG system under test when a test signal is applied in each EDG system.
5.2	~~Equipment loads listed~~ The components identified as Class 1E in Table 2.5.4-2 are powered from the Class 1E ~~power supplies~~division listed in Table 2.5.4-2.	A test will be performed ~~on~~ for components ~~designated~~ identified as Class 1E in Table 2.5.4-2 by providing a test signal in each division.	The test signal provided in ~~the~~ each division is present at the respective Class 1E components ~~loads~~ identified in Table 2.5.4-2.
5.3	Each EDG output rating is ~~sized to provide power to~~greater than the analyzed ~~the~~ loads assigned in the respective EPSS division and loads capable of being connected to the EPSS division through ~~an~~ the alternate feed.	An ~~test~~ analysis will be performed. 16-237	An analysis concludes: a. Each ~~each~~ EDG output rating is ~~capable of supplying~~greater than the analyzed loads assigned in the respective EPSS division and loads capable of being connected to the EPSS division through ~~an~~ the alternate feed. b. Each EDG provides the minimum required operating voltage at the supplied safety-related equipment with the EDG steady-state output voltage at ± 5 percent and steady-state frequency at ± 2 percent of nominal.
5.4	Valves listed in Table 2.5.4-2 fail to the position as shown in Table 2.5.4-2 on loss of power.	Testing will be performed for the valves listed in Table 2.5.4-2 to verify the position of valves on loss of power.	Following the loss of power, the valves listed in Table 2.5.4-2 fail to the position as shown in Table 2.5.4-2.
6.1	Each EDG is started by a protection system LOOP signal from the respective EPSS division medium voltage bus.	A test will be performed.	Each EDG is started by a protection system LOOP signal from the respective EPSS division medium voltage bus, achieves rated speed and voltage and connects to the assigned EPSS bus in ≤ 15 Seconds.

response under simulated design basis events (DBE)), the complete generator protection is available to prevent equipment damage to the engine or generator if a component malfunction occurs.

Preoperational site acceptance testing is conducted to demonstrate the ability of the EDGs ability to perform its intended function. Testing is consistent with the test described in RG 1.9, Table 1 for the preoperational test program and conducted in accordance with IEEE Std 387-1995 (Reference 8) for site acceptance testing. Testing includes a minimum of 25 valid start and load tests without failure on each EDG to demonstrate reliability. Diesel generator designs not previously used as stand-by power sourcesd for nuclear power generating stations will be qualified and type--tested in accordance with the guidance of Reference 8.

The load acceptance test demonstrates the ability of the load sequencer to properly sequence loads listed in Table 8.3-4, Table 8.3-5, Table 8.3-6 and Table 8.3-7 onto the EDGs within the specified time, while the EDG maintains and restores voltage and frequency within specifications.

Load tests are performed to verify an EDG output of 9500 kW or greater while maintaining steady-state voltage at 6.9 kV, ± 0.5 percent and steady-state frequency at 60 Hz ± 0.52 percent and steady-state output voltage between 6555 VAC and 7260 VAC. The EDG continuous rating is sufficient to supply the safety-related and non-safety-related loads assigned to each EDG per Table 8.3-4, Table 8.3-5, Table 8.3-6 and Table 8.3-7 for the respective EDG when derated for ambient air temperatures and essential service water temperatures. Additionally, periodic load tests are performed at a load of 105-110 percent to demonstrate capability to operate at the short term rating of 110 percent for a period of two hours.

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Emergency Diesel Generator Reliability Program

EDG minimum reliability targets are described in Section 8.4.2.6.1. A COL applicant that references the U.S. EPR design certification will monitor and maintain EDG reliability during plant operations to verify the selected reliability level target is being achieved as intended by RG 1.155. Surveillance testing of the EDGs is in accordance with the availability testing described in RG 1.9, and is detailed in Chapter 16.

The EDGs will beare procured from a diesel generator manufacturer which meets the requirements of RG 1.9 and considers the recommendations of NUREG/CR-0660 (Reference 9). Specific included design recommendations of NUREG/CR-0660 (Reference 9) which are included:

- The starting air system air dryer minimizes moisture, as described in Section 9.5.6.2.2.