**Comanche Peak Nuclear Power Plant, Units 3 & 4
COL Application**

Part 4

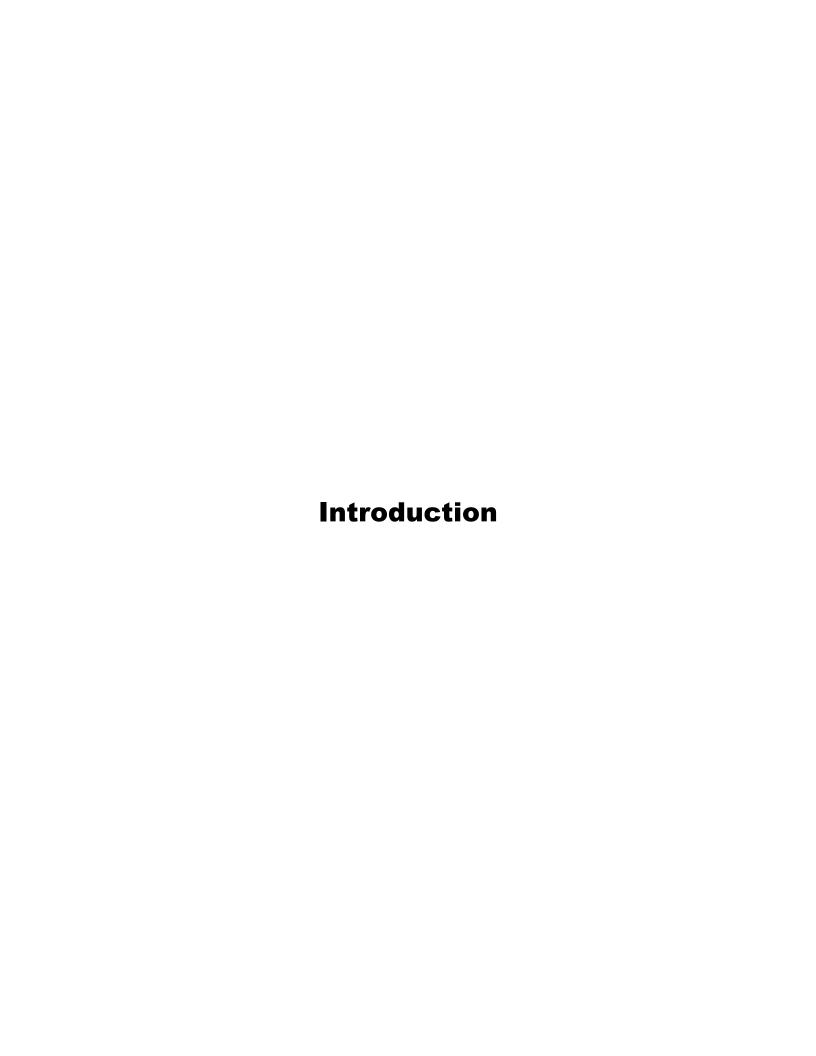# Technical Specifications Revision 2

Update Tracking Report

Revision 0

Revision History

Revision	Date	Update Description
-	6/28/2011	COLA Revision 2 Transmittal See Luminant Letter no. TXNB-11044 Date 6/28/2011
-	11/14/2011	Updated Section: 1 See Luminant Letter no. TXNB-11079 Date 11/14/2011 Incorporated responses to following RAIs: No. 235
0	5/22/2012	Updated Chapters: Introduction Specification 1.1, 3.1.9, 3.3.1, 3.3.2, 3.3.3, 3.3.4, 3.3.5, 3.3.6, 3.4.6, 3.4.7, 3.4.8, 3.4.9, 3.4.12, 3.4.14, 3.5.4, 3.7.1, 3.7.7, 3.7.9, 5.5, 5.6 Bases B 3.1.4, B 3.1.6, B 3.1.9, B 3.2.1, B 3.2.3, B 3.3.1, B 3.3.2, B 3.3.3, B 3.3.4, B 3.3.5, B 3.3.6, B 3.4.1, B 3.4.3, B 3.4.6, B 3.4.7, B 3.4.8, B 3.4.9, B 3.4.12, B 3.4.14, B 3.4.16, B 3.5.1, B 3.5.2, B 3.6.3, B 3.7.5, B 3.7.7, B 3.7.9, B 3.7.10, B 3.7.11, B 3.7.13, B 3.7.15, B 3.9.2, B 3.9.4, B 3.9.8

Introduction

Introduction – Tracking Report Revision List

Change ID No.	Section	TS Rev 2 Page*	Reason for change	Change Summary	Rev. of T/R
RCOL2_01-7	1	1	Response to RAI No.235 Luminant Letter no. TXNB-1107 Date 11/14/2011	Deleted the reference to COL Holder Items from the introduction to Part 4.	-
MIC-03-16-00007	A	2-3 [2-4]	Consistency with DCD changes identified by MIC-03-16-00007.	Added and deleted COL item information consistent with DCD changes.	0
CTS-01485	A	7[8]	Editorial	Changed comma to period	0
CTS-01486	A	8[9]	Correction	Changed "e" to "d"	0

*Page numbers for the attached marked-up pages may differ from the revision 1 page numbers due to text additions and deletions. When the page numbers for the attached pages do differ, the page number for the attached page is shown in brackets.

Justification
The bracketed descriptions for RMTS were fixed to reflect the adoption of RMTS.

CP COL 16.1(2)
Surveillance Frequency Control Program

US-APWR TS Wording in DCD
The Surveillance Frequencies in Section 3 and associated Bases to which SFCP is applied read:

[(Deterministic value) OR In accordance with Surveillance Frequency Control Program]

[(Bases for the deterministic value). OR The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.]

Subsection 5.5.19 placed in brackets [ ] with a sentence "Not used OR" at the beginning of the description.

PSTS Wording
Replaced the bracketed Surveillance Frequencies and associated Bases with the following:

In accordance with Surveillance Frequency Control Program

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

The brackets and the sentence "Not used OR" in Subsection 5.5.19 were removed.

Justification
The bracketed Surveillance Frequencies, associated Bases and the definition of SFCP were fixed to reflect the adoption of SFCP.

CP COL 16.1_3.3.2(2)
LCO 3.3.2 and associated Bases for hazardous chemical are to be confirmed by the evaluation with site-specific condition

US-APWR TS Wording in DCD
The "emergency mode" for Condition V, W, X and Y placed in [ ].

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PSTS Wording
The description in [ ] were deleted.

Justification
The environment condition for CPNPP Unit 3 and 4 is such that Toxic Gas is not necessary to be considered as site-specific condition.

CP COL 16.1_3.3.4(1)
Components controls and instrumentation required for safe shutdown related to the Ultimate Heat Sink in Tables B 3.3.4-1 and B 3.3.4-2 to be specified

US-APWR TS Wording in DCD
Descriptions for site-specific design for Ultimate Heat Sink are in [ ].

PSTS Wording
The description in Table B3.3.4-1 and B 3.3.4-2 were revised to reflect the site-specific information.

Justification
The description of "Ultimate Heat Sink" was provided bases on the site-specific information.

CP COL 16.1_3.3.5(1)
Loss of Power (LOP) Class 1E Gas Turbine Generator (GTG) Start Instrumentation

US-APWR TS Wording in DCD
The time delays of SR 3.3.5.3 placed in brackets [ ].

PSTS Wording
The brackets [ ] were removed and 0.8sec and 20 sec of time delays were replaced with 2sec and 10sec for loss of voltage and degraded voltage, respectively.

Justification:
Establishes consistency with CPNPP Units 1 and 2 Technical Requirements Manual

The purpose of loss of voltage protection is to protect voltage sensitive loads, such as motors, whenever the bus voltage drops below the acceptable value. For equipment protection, only a short time is allowed to give the grid a chance to recover. Since the transmission system for Units 3 and 4 is provided by the same Transmission Service Provider and associated with the same

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~~power pool as Units 1 and 2, the setting of loss of voltage protection of Units 1 and 2 was duplicated.~~

~~The purpose of degraded voltage protection is to assure that the plant equipment is not impacted by voltage degradation in the local grid (no faults present). Therefore a longer time is allowed to give the grid a chance to recover. Since all Comanche Peak Units are equipped with similar plant equipment, the setting of degraded voltage protection of Units 1 and 2 was duplicated.~~

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CP COL 16.1_3.7.9(1)
Ultimate Heat Sink

US-APWR TS Wording in DCD
All of design data and description related site specific design are in CDI brackets.

PSTS Wording
LCO and Bases for 3.7.9, "Ultimate Heat Sink" was revised to incorporate the site-specific information.

Justification
The description of LCO and Bases for 3.7.9, "Ultimate Heat Sink" was provided based on the site-specific information.

CP COL 16.1_3.7.10(1)
Main Control Room HVAC System

US-APWR TS Wording in DCD
The bracket information in LCO 3.7.10 and associated Bases of US-APWR TS address the site-specific control room habitability analysis during a postulated hazardous chemical release.

shall be designated to assume the control room command function. During any absence of the [Shift Supervisor] from the control room while the unit is in MODE 5 or 6, an individual with an active SRO license or Reactor Operator license shall be designated to assume the control room command function.

PSTS Wording
Replace the bracketed information in Section 5.1.2 of the US-APWR TS with the following:
The Shift Manager shall be responsible for the control room command function. During any absence of the Shift Manager from the control room while the unit is in MODE 1, 2, 3, or 4, an individual with an active Senior Reactor Operator (SRO) license shall be designated to assume the control room command function. During any absence of the Shift Manager from the control room while the unit is in MODE 5 or 6, an individual with an active SRO license or Reactor Operator license shall be designated to assume the control room command function.

Justification:
Generic titles for members for unit staff are used consistent with the organization description in FSAR Chapter 13.

CP COL 16.1_5.2.1(1)
Onsite and Offsite Organizations

US-APWR TS Wording in DCD
The bracketed information in Section 5.2.1.a of the US-APWR TS reads:
These requirements including the plant-specific titles of those personnel fulfilling the responsibilities of the positions delineated in these Technical Specifications shall be documented in the [FSAR/QA Plan]. CTS-01485

b. The [plant manager] shall be responsible for overall safe operation of the plant and shall have control over those onsite activities necessary for safe operation and maintenance of the plant. CTS-01485

PSTS Wording
Replace the bracketed information in Section 5.2.1.a of the US-APWR TS with the following:
These requirements including the plant-specific titles of those personnel fulfilling the responsibilities of the positions delineated in these Technical Specifications shall be documented in the FSAR.

b. The plant manager shall be responsible for overall safe operation of the plant and shall have control over those onsite activities necessary for safe operation and maintenance of the plant.

Justification:
These requirements are consistent with the organizational description in FSAR Chapter 13.

CP COL 16.1_5.2.2(1)
Unit Staff

US-APWR TS Wording in DCD
The information in Sections 5.2.2c and 5.2.2d of the US-APWR TS reads:

c.   [A radiation protection technician] shall be on site when fuel is in the reactor. The position may be vacant for not more than 2 hours, in order to provide for unexpected absence, provided immediate action is taken to fill the required position.

d.   The [operations manager or assistant operations manager] shall hold an SRO license.

PSTS Wording
Replace the information in Sections 5.2.2c and 5.2.2d of the US-APWR TS with the following:

c.   A radiation protection technician and chemistry technician shall be on site when fuel is in the reactor. The positions may be vacant for not more than 2 hours, in order to provide for unexpected absence, provided immediate action is taken to fill the required positions.

ed.   The Shift Operations Manager shall hold an SRO license.   CTS-01486

Justification:
Generic titles and number for members of the unit staff are used consistent with the organizational description in FSAR Chapter 13.

CP COL 16.1_5.3.1(1)
Unit Staff Qualifications

US-APWR TS Wording in DCD
The bracketed information in Section 5.3.1 of the US-APWR TS reads:
Each member of the unit staff shall meet or exceed the minimum qualifications of [Regulatory Guide 1.8, Revision 2, 1987, or more recent revisions, or ANSI Standard acceptable to the NRC staff]. [The staff not covered by Regulatory Guide 1.8 shall meet or

Specifications

Specifications – Tracking Report Revision List

Change ID No.	Section	TS Rev 2 Page*	Reason for change	Change Summary	Rev. of T/R
MIC-03-16-00007	1.1	1.1-1 through 1.1-5 1.1-7 1.1-8 [1.1-1 through 1.1-8, 1.1-10]	Consistency with DCD changes identified by MIC-03-16-00007.	Revised the sections listed in Section column based on the MHI/NRC DCD Technical Specifications meeting on 1/17/2012.	0
	3.1.9	3.1.9-2			
	3.3.1	3.3.1-1 3.3.1-3 3.3.1-4 3.3.1-6 through 3.3.1-8 3.3.1-9 through 3.3.1-12 [3.3.1-10 through 3.3.1-13]			
	Table 3.3.1-1 (page 1 through 9 [6]of 9[6])	3.3.1-13 through 3.3.1-21 [3.3.1-14 through 3.3.1-22]			
	3.3.2	3.3.2-2 through 3.3.2-10 [3.3.2-2 through			

Change ID No.	Section	TS Rev 2 Page*	Reason for change	Change Summary	Rev. of T/R
		3.3.2-16]			
	Table 3.3.2-1 (page 1 to 10 [11])	3.3.2-11 through 3.3.2-20 [3.3.2-17 through 3.3.2-27]			
	3.3.3	3.3.3-1 through 3.3.3-3 [3.3.3-1 through 3.3.3-4]			
	Table 3.3.3-1 (page 1 of 1)	3.3.3-4 3.3.3-5 [3.3.3-5]			
	3.3.4	3.3.4-1 3.3.4-2			
	3.3.5	3.3.5-1 through 3.3.5-3 [3.3.5-1 through 3.3.5-4]			
	3.3.6	3.3.6-1 through 3.3.6-2 [3.3.6-1 through 3.3.6-3]			
	Table 3.3.6-1 (page 1 to 2 of 2)	3.3.6-4 [3.3.6-5] 3.3.6-5 [3.3.6-6]			

Change ID No.	Section	TS Rev 2 Page*	Reason for change	Change Summary	Rev. of T/R
	5.5.21	5.5-20 through 5.5-22 [5.5-20 through 5.5-23]			
CTS-01487	1.1	1.1-2	Editorial	Removed period	0
DCD_15.4.6-6	3.4.6 3.4.7 3.4.8	3.4.6-1 through 3.4.6-3 3.4.7-1 3.4.7-3 [3.7.1-4] 3.4.8-1 3.4.8-2 [3.4.8-1 through 3.4.8-3]	Reflect Response to DCD RAI No.682	Added new sentences and revised each item in consistency with DCD.	0
DCD_16-298	3.4.9	3.4.9-1 3.4.9-2	Reflect Response to DCD RAI No.399	Added new sentences and revised each item in consistency with DCD.	0
DCD_05.03.02-9	3.4.12	3.4.12-1	Reflect Response to DCD RAI No.693	Added wording in LCO 3.4.12 in consistency with DCD.	0
MAP-16-401	3.4.14	3.4.14-4	Consistency with DCD	Added "In accordance with the Inservice Testing Program, and" in consistency with DCD.	0
DCD_06.02.02-64	3.5.4	3.5.4-2	Reflect Response to DCD RAI No. 740	Revised water volume of SR 3.5.4.2.	0
MAP-16-402	3.7.1	3.7.1-4	Consistency with DCD	Revised Table 3.7.1-2 in consistency with DCD.	0

Change ID No.	Section	TS Rev 2 Page*	Reason for change	Change Summary	Rev. of T/R
DCD_09.02.02-49	3.7.7	3.7.7-2	Reflect Response to DCD RAI No.571	Added surveillance requirement and associated Bases to verify system leakage in consistency with DCD.	0
MAP-16-403	3.7.9	3.7.9-1	Consistency with DCD and correction	Revised water temperature of UHS to 93°F in consistency with DCD. Capitalized the initial character in COMPLETION TIME column.	0
MAP-16-403	3.7.9	3.7.9-2	Consistency with DCD	Changed "level" to "inventory" in consistency with DCD.	0
DCD_14.03.07-55	3.7.11	3.7.11-2	Reflect Response to DCD RAI No.675	Replaced "atmospheric pressure" with "surrounding areas" in consistency with DCD.	0
MIC-03-16-00005	5.5.5 5.6.4	5.5-4 5.6-4	Reflect Response to DCD RAI No. 133	Replaced "the Chapter 3" with "Subsection 3.9.1". Added "LTOP arming,"	0
DCD_16-303	5.5.14	5.5-14	Reflect Response to DCD RAI no. 747 and Correction	Clarified the criteria for changing the TS Bases without prior NRC approval. Changed "either" to "any".	0
DCD-16-136	5.5.11	5.5-10	Reflect Response to DCD amended RAI NO. 161	Added the face velocity "2400 fpm" as test condition at 5.5.11 c.	0

*Page numbers for the attached marked-up pages may differ from the revision 1 page numbers due to text additions and deletions. When the page numbers for the attached pages do differ, the page number for the attached page is shown in brackets.

1.0 USE AND APPLICATION

1.1 Definitions

---NOTE---
The defined terms of this section appear in capitalized type and are applicable throughout these Technical Specifications and Bases.

Term	Definition	
ACTIONS	ACTIONS shall be that part of a Specification that prescribes Required Actions to be taken under designated Conditions within specified Completion Times.	
ACTUATION LOGIC TEST ─Analog (application of test for analog equipment)	An ACTUATION LOGIC TEST ─Analog (the application of the test forwhich is applied to analog equipment) shall be the application of various simulated or actual input combinations in conjunction with each possible interlock logic state required for OPERABILITY of a logic circuit and the verification of the required logic output, including Time Delays. The ACTUATION LOGIC TEST ─Analog, as a minimum, shall include a continuity check of output devices.	MIC-03-16-0 0007 MIC-03-16-0 0007
ACTUATION LOGIC TEST (application of test for digital equipment, PSMS)	An ACTUATION LOGIC TEST is a check of the PSMS software memory integrity to ensure there is no change to the internal PSMS software that would impact its functional operation or the continuous self-test function. The PSMS is self-tested on a continuous basis from the digital side of all input modules to the digital side of all output modules. Self-testing also encompasses all data communications within a PSMS train, between PSMS trains and between the PSMS and PCMS. For the PSMS the self-testing is described in Topical Report, "Safety I&C System Description and Design Process," MUAP-07004 Section 4.3 and Topical Report, "Safety System Digital Platform ─ MELTAC ," MUAP-07005 Section 4.1.5. The software memory integrity test is described in Topical Report, "Safety I&C System Description and Design Process," MUAP-07004 Section 4.4.1 and Topical Report, "Safety System Digital Platform ─ MELTAC ," MUAP-07005 Section 4.1.4.1.c.	MIC-03-16-0 0007
AXIAL FLUX DIFFERENCE (AFD)	AFD shall be the difference in normalized flux signals between the top and bottom halves of a two section excore neutron detector.	

1.1 Definitions

| CHANNEL CALIBRATION | A CHANNEL CALIBRATION shall be the adjustment, as necessary, of ~~the~~ channel ~~output~~<u>measurement devices</u> such that ~~it~~<u>the channel</u> responds within the necessary range and accuracy to known values of the parameter that the channel monitors. | MIC-03-16-0 0007 |

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The CHANNEL CALIBRATION shall encompass all devices in the channel required for channel OPERABILITY. <u>This shall include the processing of the signal within the digital controller to which the channel measurement device is directly interfaced (i.e., RPS, ESFAS or SLS).</u>

CHANNEL CALIBRATION encompasses devices that are subject to drift between surveillance intervals and all input devices that are not tested through continuous ~~automated~~<u>automatic</u> self-testing. Refer to TADOT for output devices that are not tested through continuous ~~automated~~<u>automatic</u> self-testing.

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The performance of a CHANNEL CALIBRATION shall be consistent with ~~s~~<u>S</u>pecification 5.5.2~~.~~1, "Setpoint Control Program" (SCP).

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CTS-01487

~~For analog measurements on each Technical Specification required automatic protection instrumentation function implemented with a digital bistable function,~~ CHANNEL CALIBRATION confirms the accuracy of the channel from sensor to digital Visual Display Unit (VDU) readout~~, as described in Topical Report, "Safety I&C System Description and Design Process," MUAP-07004 Section 4.4.2~~. <u>The digital value read on the VDU originates in the controller that processes the trip, actuation, interlock or safety-related display Functions, and is the same digital value processed for those Functions. The CHANNEL CALIBRATION overlaps with other surveillance requirements to adequately test the PSMS safety Functions.</u>

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<u>For analog measurements,</u> CHANNEL CALIBRATION confirms the ~~analog measurement~~<u>channel</u> accuracy at five calibration settings corresponding to 0%, 25%, 50%, 75% and 100% of the instrument range. ~~During the calibration of the instrument, the analog signal generated by the instrument is confirmed via the calibration settings on any VDU (e.g., Operational VDU or Safety VDU).~~

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1.1 Definitions

| CHANNEL CALIBRATION | ~~For analog measurements on each Technical Specification required automatic protection instrumentation function implemented with analog bistable function, the CHANNEL CALIBRATION confirms the accuracy of the channel from sensor to output device. For these channels, CHANNEL CALIBRATION confirms the analog measurement accuracy at the Nominal Trip Setpoint (NTSP).~~ | MIC-03-16-0 0007 |

For binary measurements, the CHANNEL CALIBRATION confirms the accuracy of the channel's state change~~, as described in Topical Report, "Safety I&C System Description and Design Process," MUAP 07004 Section 4.4.1~~ at the required setpoint.

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Calibration of instrument channels with resistance temperature detector (RTD) or thermocouple sensors may consist of an inplace qualitative assessment of sensor behavior and normal calibration of the remaining ~~adjustable~~ devices in the channel.

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The CHANNEL CALIBRATION may be performed by means of any series of sequential, overlapping, or total channel steps.

| CHANNEL CHECK | A CHANNEL CHECK shall be the qualitative assessment, by observation, of channel behavior during operation. This determination shall include, where possible, comparison of the channel indication and status to other indications or status derived from independent instrument channels measuring the same parameter. A CHANNEL CHECK may be conducted manually or automatically. Either method may be used to satisfy the surveillance frequency requirement. Where the CHANNEL CHECK is conducted automatically, an alarm shall be generated when the agreement criteria are not met. If the automated CHANNEL CHECK function is unavailable, a manual CHANNEL CHECK shall be conducted at the minimum surveillance frequency. | MIC-03-16-0 0007 MIC-03-16-0 0007 |

1.1 Definitions

CHANNEL OPERATIONAL TEST (COT) ~~– Analog (application of test for analog equipment)~~	A COT ~~– Analog~~ shall be the injection of a simulated or actual signal into the channel ~~as close to~~at a point that overlaps with the ~~sensor as practicable~~signal checked during CHANNEL CALIBRATION to verify OPERABILITY of all remaining devices in the channel required for channel OPERABILITY. The COT ~~– Analog~~ shall include adjustments, as necessary, of the required alarm, interlock, and trip setpoints required for channel OPERABILITY such that the setpoints are within the necessary range and accuracy. The COT ~~– Analog~~ may be performed by means of any series of sequential, overlapping, or total channel steps.	MIC-03-16-0 0007 MIC-03-16-0 0007 MIC-03-16-0 0007
~~CHANNEL OPERATIONAL TESTCOT) (application of test for digital equipment, PSMS)~~	~~A COT is a check of the PSMS software memory integrity to ensure there is no change to the internal PSMS software that would impact its functional operation or the continuous self test function.~~ ~~The PSMS is self-tested on a continuous basis from the digital side of all input modules to the digital side of all output modules. Self-testing also encompasses all data communications within a PSMS train, between PSMS trains and between the PSMS and PCMS. For the PSMS the self testing is described in Topical Report, "Safety I&C System Description and Design Process," MUAP-07004 Section 4.3 and Topical Report, "Safety System Digital Platform – MELTAC," MUAP-07005 Section 4.1.5. The software memory integrity test is described in Topical Report, "Safety I&C System Description and Design Process," MUAP-07004 Section 4.4.1 and Topical Report, "Safety System Digital Platform – MELTAC," MUAP-07005 Section 4.1.4.1.c.~~	MIC-03-16-0 0007
CORE ALTERATION	CORE ALTERATION shall be the movement of any fuel, sources, or reactivity control components, within the reactor vessel with the vessel head removed and fuel in the vessel. Suspension of CORE ALTERATIONS shall not preclude completion of movement of a component to a safe position.	
CORE OPERATING LIMITS REPORT (COLR)	The COLR is the unit-specific document that provides cycle-specific parameter limits. These cycle-specific parameter limits shall be determined for each cycle in accordance with Specification 5.6.3. Plant operation within these limits is addressed in individual Specifications.	

1.1 Definitions

DOSE EQUIVALENT I-131	DOSE EQUIVALENT I-131 shall be that concentration of I-131 (microcuries/gram) that alone would produce the same committed effective dose equivalent as the quantity and isotopic mixture of I-131, I-132, I-133, I-134, and I-135 actually present. The dose conversion factors used for this calculation shall be those listed in Table 2.1 of EPA Federal Guidance Report No. 11, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion," EPA-520/1-88-020, September 1988.
DOSE EQUIVALENT XE-133	DOSE EQUIVALENT XE-133 shall be that concentration of Xe-133 (microcuries per gram) that alone would produce the same effective dose equivalent as the quantity and isotopic mixture of noble gases (Kr-85m, Kr-85, Kr-87, Kr-88, Xe-133, and Xe-135) actually present. The dose conversion factors used for this calculation shall be those listed in Table III.1 of EPA Federal Guidance Report No. 12, "External Exposure to Radionuclides in Air, Water, and Soil," EPA 402-R-93-081, September 1993.
ENGINEERED SAFETY FEATURES (ESF) RESPONSE TIME	The ESF RESPONSE TIME shall be that time interval from when the monitored parameter exceeds its actuation setpoint at the channel sensor until the ESF equipment is capable of performing its safety function (i.e., the valves travel to their required positions, pump discharge pressures reach their required values, etc.). Times shall include Class 1E GTG starting and sequence loading delays, where applicable. The response time may be measured by means of any series of sequential, overlapping, or total steps so that the entire response time is measured. In lieu of measurement, response time may be verified for selected components provided that the components and methodology for verification have been previously reviewed and approved by the NRC. The ESF RESPONSE TIME includes post-test maintenance as necessary, based on manufacturer's recommendation, to maintain device reliability.

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1.1 Definitions

LEAKAGE	LEAKAGE shall be:

a. Identified LEAKAGE

    1. LEAKAGE, such as that from pump seals or valve packing (except reactor coolant pump (RCP) seal water injection or leakoff), that is captured and conducted to collection systems or a sump or collecting tank,

    2. LEAKAGE into the containment atmosphere from sources that are both specifically located and known either not to interfere with the operation of leakage detection systems or not to be pressure boundary LEAKAGE, or

    3. Reactor Coolant System (RCS) LEAKAGE through a steam generator to the Secondary System (primary to secondary LEAKAGE);

b. Unidentified LEAKAGE

All LEAKAGE (except RCP seal water injection or leakoff) that is not identified LEAKAGE, and

c. Pressure Boundary LEAKAGE

LEAKAGE (except primary to secondary LEAKAGE) through a nonisolable fault in an RCS component body, pipe wall, or vessel wall.

MEMORY INTEGRITY CHECK (MIC)

A MEMORY INTEGRITY CHECK (MIC) is a check of the PSMS software memory integrity to ensure there is no change to the internal PSMS software that would impact its functional operation, including digital Nominal Trip Setpoint values, Time Constants, Time Delays or the continuous automatic self-test function. The MIC overlaps with other surveillance requirements to adequately test the PSMS safety functions.

The PSMS is automatically self-tested on a continuous basis from the digital side of all input modules to the digital side of all output modules. Continuous automatic self-testing also encompasses all data communications within a PSMS train, between PSMS trains and between the PSMS and PCMS. For the PSMS the continuous automatic self-testing is described in "Safety I&C System Description and Design

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1.1 Definitions

Process, "MUAP-07004 Section 4.3 and "Safety System Digital Platform -MELTAC-, "MUAP-07005 Section 4.1.5. The software memory integrity test is described in "Safety I&C System Description and Design Process, "MUAP-07004 Section 4.4.1 and "Safety System Digital Platform -MELTAC-, "MUAP-07005 Section 4.1.4.1.c.

MODE	A MODE shall correspond to any one inclusive combination of core reactivity condition, power level, average reactor coolant temperature, and reactor vessel head closure bolt tensioning specified in Table 1.1-1 with fuel in the reactor vessel.
OPERABLE – OPERABILITY	A system, subsystem, train, component, or device shall be OPERABLE or have OPERABILITY when it is capable of performing its specified safety function(s) and when all necessary attendant instrumentation, controls, normal or emergency electrical power, cooling and seal water, lubrication, and other auxiliary equipment that are required for the system, subsystem, train, component, or device to perform its specified safety function(s) are also capable of performing their related support function(s).
PHYSICS TESTS	PHYSICS TESTS shall be those tests performed to measure the fundamental nuclear characteristics of the reactor core and related instrumentation. These tests are:

a.   Described in FSAR Chapter 14, Initial Test Program,

b.   Authorized under the provisions of 10 CFR 50.59, or

c.   Otherwise approved by the Nuclear Regulatory Commission.

PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR)	The PTLR is the unit specific document that provides the reactor vessel pressure and temperature limits, including heatup and cooldown rates and the low temperature overpressure protection arming temperature, for the current reactor vessel fluence period. These pressure and temperature limits shall be determined for each fluence period in accordance with Specification 5.6.4.
QUADRANT POWER TILT RATIO (QPTR)	QPTR shall be the ratio of the maximum upper excoredetector calibrated output to the average of the upper excore detector calibrated outputs, or the ratio of the maximum lower excore detector calibrated output to the average of the lower excore detector calibrated outputs, whichever is greater.

1.1 Definitions

RATED THERMAL POWER (RTP)	RTP shall be a total reactor core heat transfer rate to the reactor coolant of 4451 MWt.
REACTOR TRIP SYSTEM (RTS) RESPONSE TIME	The RTS RESPONSE TIME shall be that time interval from when the monitored parameter exceeds its RTS trip setpoint at the channel sensor until loss of stationary gripper coil voltage. The response time may be measured by means of any series of sequential, overlapping, or total steps so that the entire response time is measured. In lieu of measurement, response time may be verified for selected components provided that the components and methodology for verification have been previously reviewed and approved by the NRC. The RTS RESPONSE TIME includes post-test maintenance as necessary, based on manufacturer's recommendation, to maintain device reliability.

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SAFETY VDU TEST	A SAFETY VDU TEST is a check of the touch response and display OPERABILITY of the Safety VDU (S-VDU). Safety VDU touch screens are tested by manually touching screen targets and confirming correct safety VDU response. The SAFETY VDU TEST overlaps with the MIC for the Safety VDU processor, to ensure the S-VDU is OPERABLE. The SAFETY VDU TEST is explained in "Safety I&C System Description and Design Process," MUAP-07004 Section 4.4.1.

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SHUTDOWN MARGIN (SDM)	SDM shall be the instantaneous amount of reactivity by which the reactor is subcritical or would be subcritical from its present condition assuming:

a.   All rod cluster control assemblies (RCCAs) are fully inserted except for the single RCCA of highest reactivity worth, which is assumed to be fully withdrawn. However, with all RCCAs verified fully inserted by two independent means, it is not necessary to account for a stuck RCCA in the SDM calculation. With any RCCA not capable of being fully inserted, the reactivity worth of the RCCA must be accounted for in the determination of SDM, and

b.   In MODES 1 and 2, the fuel and moderator temperatures are changed to the nominal zero power design level.

1.1 Definitions

TRIP ACTUATING DEVICE
OPERATIONAL TEST (TADOT)

A TADOT shall consist of operating the trip actuating device and verifying the OPERABILITY of all devices in the channel required for trip actuating device OPERABILITY. ~~The TADOT shall include adjustment, as necessary, of the trip actuating device so that it actuates at the required setpoint within the necessary accuracy.~~ The TADOT may be performed by means of any series of sequential, overlapping, or total channel steps.

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There are two types of binary devices - those that have no drift potential, such as Manual Initiation switches and Actuation Output<u>s</u>, and those that have drift potential, such as <u>undervoltage (</u>UV<u>)</u> relays, valve position limit switches and RTB trip devices. The ~~operability~~<u>OPERABILITY</u> of binary devices that have drift potential is confirmed through CHANNEL CALIBRATION and/or RESPONSE TIME testing. <u>For some binary devices subject to drift potential, a TADOT may be specified in addition to these surveillance requirements.</u> The ~~operability~~<u>OPERABILITY</u> of <u>binary</u> devices that have no drift potential is confirmed<u> only</u> through TADOT.

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~~The~~<u>For devices with drift potential, the</u> CHANNEL CALIBRATION confirms the accuracy of the device's binary state change with regard to its trip setpoint requirement (i.e., the Allowable Value). The RESPONSE TIME test confirms the accuracy of the devices state change with regard to its trip timing requirement. The TADOT confirms only the state change ~~operability~~<u>OPERABILITY</u> (i.e., there is no setpoint or timing accuracy confirmation needed). The TADOT<u> also</u> includes ~~adjustments~~<u>maintenance</u> as necessary, based on manufacturer's recommendation, to maintain device reliability.

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For some binary devices with drift potential, a TADOT is specified in addition to the CHANNEL CALIBRATION and/or RESPONSE TIME test. The TADOT is specified on a more frequent basis than the CHANNEL CALIBRATION or RESPONSE TIME test, to confirm the state change ~~operability~~<u>OPERABILITY</u> of the devices, without checking its state change setpoint or timing accuracy. Checking the setpoint or timing accuracy more frequently than the CHANNEL CALIBRATION or RESPONSE TIME test interval is unnecessary, because the total channel uncertainty, including setpoint and/or timing drift between test intervals, is included in determination of the Nominal Setpoint, the Allowable Value and the response time requirement.

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SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY	
SR 3.1.9.1	Perform a̶ CHANNEL CALIBRATION on power range and intermediate range channels per SR 3.3.1.9 consistent with S̶R̶ ̶3̶.̶3̶.̶1̶.̶1̶0̶,̶ ̶a̶n̶d̶ Specification 5.5.21 Setpoint Control Program (SCP).	Prior to initiation of PHYSICS TESTS	MIC-03-16-0 007
SR 3.1.9.2	Verify the RCS lowest loop average temperature is ≥ 541°F.	In accordance with the Surveillance Frequency Control Program	
SR 3.1.9.3	Verify THERMAL POWER is $\leq$ 5% RTP.	In accordance with the Surveillance Frequency Control Program	
SR 3.1.9.4	Verify SDM is within the limits specified in the COLR.	In accordance with the Surveillance Frequency Control Program	

3.3   INSTRUMENTATION

3.3.1   Reactor Trip System (RTS) Instrumentation

LCO 3.3.1   The RTS instrumentation for each Function in Table 3.3.1-1 shall be
                    OPERABLE.

APPLICABILITY: According to Table 3.3.1-1.

ACTIONS

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

CONDITION	REQUIRED ACTION	COMPLETION TIME	
A. One or more Functions with one or more required channels or trains inoperable.	A.1 Enter the Condition referenced in Table 3.3.1-1 for the channel(s) or train(s).	Immediately	
B. One required Manual Reactor Trip ~~train~~Function inoperable.	B.1 Restore ~~three~~ train~~s~~ to OPERABLE status. OR B.2 Be in MODE 3.	72 hours 78 hours	MIC-03-16-0 0007 MIC-03-16-0 0007
C. One required Manual Reactor Trip ~~train~~Function inoperable.	C.1 Restore train to OPERABLE status. OR C.2.1 Initiate action to fully insert all rods. AND C.2.2 Place the Rod Control System in a condition incapable of rod withdrawal.	72 hours 72 hours 73 hours	MIC-03-16-0 0007

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME

E. One High Power Range Neutron Flux (~~h~~High ~~s~~Setpoint) channel inoperable.	-------------------NOTE-------------------
	
	 One channel may be bypassed for up to 12 hours for surveillance testing ~~and~~or setpoint adjustment, provided the other channels are OPERABLE or placed in the trip condition.
	
	 -- 	
	
	 E.1.1 Place channel in trip.
	
	     AND
	
	 E.1.2 Reduce THERMAL POWER to ≤ 75% RTP.
	
	 OR
	
	 E.2.1 Place channel in trip.
	
	     AND
	
	 E.2.2 --------------NOTE--------------
	
	     Only required to be performed when the Power Range Neutron Flux input to QPTR is inoperable.
	
	     ------------------------------------ 	
	
	     Perform SR 3.2.4.2.
	
	 OR
	
	 E.3 Be in MODE 3.
		
		 72 hours
		
		 78 hours
		
		 72 hours
		
		 Once per 12 hours
		
		 78 hours

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ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME	
F. One ~~required~~ channel inoperable.	--------------------NOTE------------------- ~~For High Power Range Neutron Flux channels only, o~~One channel may be bypassed for up to 12 hours for surveillance testing<u>, provided the other channels are OPERABLE or placed in the trip condition</u>. --- F.1 Place channel in trip. <u>OR</u> F.2 Be in MODE 3.	 72 hours 78 hours	MIC-03-16-0 0007 MIC-03-16-0 0007 MIC-03-16-0 0007
G. One High Intermediate Range Neutron Flux channel inoperable.	G.1 Reduce THERMAL POWER to < P-6. <u>OR</u> G.2 Increase THERMAL POWER to > P-10.	24 hours 24 hours	
H. Two High Intermediate Range Neutron Flux channels inoperable.	H.1 --------------NOTE-------------- Limited plant cooldown or boron dilution is allowed provided the change is accounted for in the calculated SDM. ------------------------------------- Suspend operations involving positive reactivity additions. <u>AND</u> H.2 Reduce THERMAL POWER to < P-6.	 Immediately 2 hours	

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME	
L. One required channel inoperable.	-------------------NOTE------------------- ~~Except for Pressurizer Pressure, Pressurizer Level, and SG Water Level, one~~One required channel may be bypassed for up to 12 hours for surveillance testing, provided the other required channels are OPERABLE or placed in the trip condition. --- L.1 Place channel in trip. OR L.2 Reduce THERMAL POWER to < P-7.	 72 hours 78 hours	MIC-03-16-0 0007 MIC-03-16-0 0007
M. One required train inoperable.	--------------------NOTE------------------ One ~~inoperable~~required train may be bypassed for up to 4 hours for surveillance testing provided the other ~~two~~required trains are OPERABLE. --- M.1 Restore train to OPERABLE status. OR M.2 Be in MODE 3.	 24 hours 30 hours	MIC-03-16-0 0007 MIC-03-16-0 0007
N. One required RTB train inoperable.	N.1 Restore train to OPERABLE status. OR N.2 Apply the requirements of 5.5.18.	24 hours 24 hours	

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME	
O. One or more channels inoperable.	O.1 Verify interlock is in required state for existing unit conditions. OR O.2 Be in MODE 3.	1 hour 7 hours	
P. One or more ~~trains inoperable or one or more required~~ channels inoperable.	P.1 Verify interlock is in required state for existing unit conditions. OR P.2 Be in MODE 2.	1 hour 7 hours	MIC-03-16-0 0007
Q. One trip mechanism inoperable for ~~one~~a required RTB.	Q.1 Restore inoperable trip mechanism to OPERABLE status. OR Q.2 Apply the requirements of Specification 5.5.18.	48 hours 48 hours	MIC-03-16-0 0007
R. One required train inoperable.	--------------------NOTE------------------ One ~~inoperable~~required train may be bypassed for up to 4 hours for surveillance testing. provided the other ~~two~~required trains are OPERABLE. -- R.1 Restore train to OPERABLE status. OR R.2 Apply the requirements of Specification 5.5.18.	 24 hours 24 hours	MIC-03-16-0 0007 MIC-03-16-0 0007

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME	
S. Required Action and associated Completion Time for Condition N, Q, or R not met.	S.1 Be in MODE 3.	6 hours	
T. One Main Turbine Stop Valve Position channel inoperable	--------------------NOTE------------------ One channel may be bypassed for up to 12 hours for surveillance testing. --- T.1 Place channel in trip. OR T.2 Reduce ~~thermal power~~THERMAL POWER to <~~ ~~P-7	 12 hours 18 hours	MIC-03-16-0 0007 MIC-03-16-0 0007
U. One required channel inoperable.	U.1 Place channel in trip. AND U.2 Restore channel to OPERABLE status.	1 hour 72 hours	MIC-03-16-0 0007
V. Required Action and associated Completion Time of Condition U not met.	V.1 Be in MODE 3.	6 hours	MIC-03-16-0 0007
W. One required channel inoperable.	W.1 Place channel in trip. AND W.2 Restore channel to OPERABLE status.	1 hour 72 hours	MIC-03-16-0 0007
X. Required Action and associated Completion Time of Condition W not met.	X.1 Reduce THERMAL POWER to < P-7.	6 hours	MIC-03-16-0 0007

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.3	----------------------------NOTE-------------------------- Not required to be performed until 24 hours after THERMAL POWER is $\geq$ 15% RTP. -- Compare results of the incore detector measurements to Nuclear Instrumentation System (NIS) AFD. Adjust NIS channel if absolute difference is $\geq$ 3%.	In accordance with the Surveillance Frequency Control Program
SR 3.3.1.4	Perform TADOT.	In accordance with the Surveillance Frequency Control Program
~~SR 3.3.1.5~~	~~Perform ACTUATION LOGIC TEST.~~	~~In accordance with the Surveillance Frequency Control Program~~

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SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.~~6~~5	-----------------------------NOTE------------------------- Not required to be performed until 24 hours after THERMAL POWER is $\geq$ 50% RTP. --- Calibrate excore channels to agree with incore detector measurements.	In accordance with the Surveillance Frequency Control Program
SR 3.3.1.~~7~~6	————————————NOTE———————————— ~~Not required to be performed for source range instrumentation prior to entering MODE 3 from MODE 2 until 4 hours after entry into MODE 3.~~ Perform ~~COT~~MIC consistent with Specification 5.5.21, Setpoint Control Program (SCP).	In accordance with the Surveillance Frequency Control Program

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SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY	
SR 3.3.1.~~8~~7 Perform CHANNEL CHECK.	Within 4 hours after reducing power below P-6 AND In accordance with the Surveillance Frequency Control Program	MIC-03-16-0 0007
SR 3.3.1.~~9~~8 ────────────────NOTE──────────────── ~~This Surveillance shall include verification that the~~ ~~time constants are adjusted to the prescribed~~ ~~values.~~ ───────────────────────────────── Perform ~~a~~ CHANNEL CALIBRATION ~~on each~~ ~~required channel~~ consistent with Specification 5.5.21, Setpoint Control Program (SCP).	In accordance with the Surveillance Frequency Control Program	MIC-03-16-0 0007
SR 3.3.1.~~10~~9 -----------------------------NOTE-------------------------- Neutron detectors are excluded from CHANNEL CALIBRATION. -- Perform ~~a~~ CHANNEL CALIBRATION ~~on each~~ ~~required channel~~ consistent with Specification 5.5.21, Setpoint Control Program (SCP).	In accordance with the Surveillance Frequency Control Program	MIC-03-16-0 0007 MIC-03-16-0 0007

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY	
SR 3.3.1.~~11~~10	Perform ~~a~~ CHANNEL CALIBRATION ~~on each required channel~~ consistent with Specification 5.5.21, Setpoint Control Program (SCP).	In accordance with the Surveillance Frequency Control Program	MIC-03-16-0 0007
SR 3.3.1.~~12~~11	──────────────NOTE────────────── ~~Verification of setpoint is not required.~~ Perform TADOT.	 Prior to exceeding the P-7 interlock whenever the unit has been in MODE 3, if not performed within the previous 31 days	MIC-03-16-0 0007
SR 3.3.1.~~13~~12	-----------------------------NOTE------------------------- Neutron detectors are excluded from response time testing. --- Verify RTS RESPONSE TIME is within limit~~s~~.	 In accordance with the Surveillance Frequency Control Program	MIC-03-16-0 0007 MIC-03-16-0 0007

Table 3.3.1-1 (page 1 of ~~9~~6)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	
1. Manual Reactor Trip Initiation	1,2	3 trains	B	SR 3.3.1.4	
	3[(a)], 4[(a)], 5[(a)]	3 trains	C	SR 3.3.1.4	
2. High Power Range Neutron Flux					
a. ~~h~~High ~~s~~Setpoint	1,2	4	E	SR 3.3.1.1 SR 3.3.1.2 SR 3.3.1.~~7~~6 SR 3.3.1.~~10~~9 SR 3.3.1.~~13~~12	MIC-03-16-0 0007 MIC-03-16-0 0007
b. ~~l~~Low ~~s~~Setpoint	1[(b)],2	4	F	SR 3.3.1.1 SR 3.3.1.~~7~~6 SR 3.3.1.~~10~~9 SR 3.3.1.~~13~~12	MIC-03-16-0 0007
3. High Power Range Neutron Flux Rate					
a. Positive Rate	1,2	4	F	SR 3.3.1.1 SR 3.3.1.~~7~~6 SR 3.3.1.~~10~~9 SR 3.3.1.~~13~~12	MIC-03-16-0 0007
b. Negative Rate	1,2	4	F	SR 3.3.1.1 SR 3.3.1.~~7~~6 SR 3.3.1.~~10~~9 SR 3.3.1.~~13~~12	MIC-03-16-0 0007
4. High Intermediate Range Neutron Flux	1[(b)], 2[(c)]	2	G,H	SR 3.3.1.1 SR 3.3.1.~~7~~6 SR 3.3.1.~~10~~9 SR 3.3.1.~~13~~12	MIC-03-16-0 0007

(a) With Rod Control System capable of rod withdrawal or one or more rods not fully inserted.

(b) Below the P-10 (Power Range Neutron Flux) interlocks.

(c) Above the P-6 (Intermediate Range Neutron Flux) interlocks.

Table 3.3.1-1 (page 2 of ~~9~~6)
Reactor Trip System Instrumentation

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FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS
5. High Source Range Neutron Flux	2[(d)]	2	I,J	SR 3.3.1.6 SR 3.3.1.7 SR 3.3.1.~~8~~9 SR 3.3.1.~~10~~12 ~~SR 3.3.1.13~~
	3[(a)], 4[(a)], 5[(a)]	2	J,K	SR 3.3.1.1 SR 3.3.1.~~7~~6 SR 3.3.1.~~10~~9 SR 3.3.1.~~13~~12
6. Overtemperature ΔT	1,2	3	~~F~~U,V	SR 3.3.1.1 SR 3.3.1.3 SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.~~7~~10 SR 3.3.1.~~11~~12 ~~SR 3.3.1.13~~

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(a) With Rod Control System capable of rod withdrawal or one or more rods not fully inserted.

(d) Below the P-6 (Intermediate Range Neutron Flux) interlocks.

~~(j) Refer to Note 1 after this table.~~

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Table 3.3.1-1 (page 3 of ~~9~~6)
Reactor Trip System Instrumentation

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FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	
7. Overpower ΔT	1,2	3	~~F~~U,V	SR 3.3.1.1 SR 3.3.1.3 SR 3.3.1.5 SR 3.3.1.6 SR 3.3.1.~~7~~10 SR 3.3.1.~~11~~12 ~~SR 3.3.1.13~~	MIC-03-16-0 0007 MIC-03-16-0 0007 MIC-03-16-0 0007
8. Pressurizer Pressure					
a. Low Pressurizer Pressure	1 (e)	3	~~L~~W,X	SR 3.3.1.1 SR 3.3.1.~~7~~6 SR 3.3.1.~~9~~8 SR 3.3.1.~~13~~12	MIC-03-16-0 0007
b. High Pressurizer Pressure	1,2	3	~~F~~U,V	SR 3.3.1.1 SR 3.3.1.~~7~~6 SR 3.3.1.~~9~~8 SR 3.3.1.~~13~~12	MIC-03-16-0 0007
9. High Pressurizer Water Level	1 (e)	3	~~L~~W,X	SR 3.3.1.1 SR 3.3.1.~~7~~6 SR 3.3.1.~~9~~8 SR 3.3.1.~~13~~12	MIC-03-16-0 0007
10. Low Reactor Coolant Flow	1 (e)	3 per loop	L	SR 3.3.1.1 SR 3.3.1.~~7~~6 SR 3.3.1.~~9~~8 SR 3.3.1.12	MIC-03-16-0 0007
11. Low Reactor Coolant Pump (RCP) Speed	1 (e)	3	L	SR 3.3.1.1 SR 3.3.1.~~7~~6 SR 3.3.1.~~9~~8 SR 3.3.1.~~13~~12	MIC-03-16-0 0007

(e) Above the P-7 (Low Power Reactor Trips Block) interlock.
~~(k)~~ ~~Refer to Note 2 after this table.~~

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Table 3.3.1-1 (page 4 of ~~9~~6)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	
12. Steam Generator (SG) Water Level					
a. Low	1,2	3 per SG	~~F~~U,V	SR 3.3.1.1 SR 3.3.1.~~7~~6 SR 3.3.1.~~9~~8 SR 3.3.1.~~13~~12	MIC-03-16-0 0007
b. High-High	1(e)	3 per SG	~~L~~W,X	SR 3.3.1.1 SR 3.3.1.~~7~~6 SR 3.3.1.~~9~~8 SR 3.3.1.~~13~~12	MIC-03-16-0 0007
13. Turbine Trip					
a. Turbine Emergency Trip Oil Pressure	1(e)	3	L	SR 3.3.1.~~4~~8 SR 3.3.1.~~7~~11 ~~SR 3.3.1.9~~ ~~SR 3.3.1.12~~	MIC-03-16-0 0007
b. Main Turbine Stop Valve Position	1(e)	1 per valve	T	SR 3.3.1.~~9~~8 SR 3.3.1.~~12~~11	MIC-03-16-0 0007

(e) Above the P-7 (Low Power Reactor Trips Block) interlock.

Table 3.3.1-1 (page 5 of ~~9~~6)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	
14. ECCS Actuation	1,2	3 trains	M	SR 3.3.1.~~5~~6	MIC-03-16-0 0007
15. Reactor Trip System Interlocks					
a. Intermediate Range Neutron Flux, P-6	2[(d)]	2	O	SR 3.3.1.~~7~~6 SR 3.3.1.~~10~~9	MIC-03-16-0 0007
b. Low Power Reactor Trips Block, P-7	1	1 per train	P	SR 3.3.1.~~5~~6	MIC-03-16-0 0007
c. Power Range Neutron Flux, P-10	1,2	4	O	SR 3.3.1.~~7~~6 SR 3.3.1.~~10~~9	MIC-03-16-0 0007
d. Turbine Inlet Pressure, P-13	1	3	P	SR 3.3.1.1 SR 3.3.1.~~7~~6 SR 3.3.1.~~9~~8	MIC-03-16-0 0007
16. Reactor Trip Breakers (RTBs)	1,2	3 trains[(f)]	N,S	SR 3.3.1.4 SR 3.3.1.~~13~~12	MIC-03-16-0 0007
	3[(a)], 4[(a)], 5[(a)]	3 trains[(f)]	D	SR 3.3.1.4 SR 3.3.1.~~13~~12	MIC-03-16-0 0007

(~~b~~a) With Rod Control System capable of rod withdrawal or one or more rods not fully inserted.
(d) Below the P-6 (Intermediate Range Neutron Flux) interlocks.
(~~i~~f) Two reactor trip breakers per train.

Table 3.3.1-1 (page 6 of ~~9~~6)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS
17. Reactor Trip Breaker Undervoltage and Shunt Trip Mechanisms	1,2	3 trains 1 each per RTB	Q,S	SR 3.3.1.4 SR 3.3.1.~~13~~12
	3^(~~b~~a), 4^(~~b~~a), 5^(~~b~~a)	3 trains 1 each per RTB	D	SR 3.3.1.4 SR 3.3.1.~~13~~12
18. Automatic Trip Logic	1,2	3 trains	R,S	SR 3.3.1.~~5~~6
	3^(~~b~~a), 4^(~~b~~a), 5^(~~b~~a)	3 trains	D	SR 3.3.1.~~5~~6

(~~b~~a) With Rod Control System capable of rod withdrawal or one or more rods not fully inserted.

Table 3.3.1-1 (page 7 of 9)
Reactor Trip System Instrumentation

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Note 1: Overtemperature ∆T

The Overtemperature ∆T Function is initiated based on setpoints derived for DNB protection or core exit boiling conditions.

$$\Delta T_{SP} = \textit{Lowselect}(\Delta T_{SP1}, \Delta T_{SP2})$$

$$\Delta T \frac{(1 + T_7 s)}{(1 + T_8 s)}\left(\frac{1}{1 + T_9 s}\right) \geq \Delta T_{SP}$$

Where: T_7=[*]sec T_8=[*]sec T_9=[*]sec

1.DNB Protection

$$\Delta T_{SP1} = \Delta T_0\left(K_1 - K_2\frac{(1 + T_2 s)}{(1 + T_3 s)}(T_{avg} - T_{avg0}) + K_3(P - P_0) - f_1(\Delta I)\right)$$

Where: ∆T is measured RCS ∆T,°F.
ΔT_0 is indicated RCS ∆T at RTP, °F.

s is the Laplace transform operator, $\sec^{-1}$.
T_{avg} is the measured RCS average temperature,°F.
T_{avg0} is the nominal T_{avg} at RTP, ≤ [*]°F.

P is the measured pressurizer pressure, psig
P_0 is the nominal RCS operating pressure, ≥ [*] psig

K_1 ≤ [*] K_2 ≥ [*]/ F K_3 ≥ [*]/psig
T_2 ≥ [*] sec T_3 ≤ [*] sec

$f_1(\Delta I)$ = [*] {[*] - ($q_t - q_b$)}when $q_t - q_b$ ≤ [*]% RTP
        0% of RTP when [*]% RTP < $q_t - q_b$ ≤ [*]% RTP
        [*] {($q_t - q_b$) - [*]}when $q_t - q_b$ > [*]% RTP

Where q_t and q_b are percent RTP in the upper and lower halves of the core, respectively, and $q_t + q_b$ is the total THERMAL POWER in percent RTP.

*These values denoted with [*] are specified in the COLR.

Table 3.3.1-1 (page 8 of 9)
Reactor Trip System Instrumentation

Note 1: Overtemperature ΔT (continued)

2. Core Exit Boiling Limit

$$\Delta T_{SP2} = \Delta T_0\left(K_4 - K_5\frac{(1 + T_4 s)}{(1 + T_5 s)}(T_{avg} - T_{avg0}) + K_6(P - P_0)\right)$$

Where: ΔT is measured RCS ΔT, °F.

ΔT_0 is indicated RCS ΔT at RTP, °F.

s is the Laplace transform operator, sec^{-1}.

T_{avg} is the measured RCS average temperature, °F.

T_{avg0} is the nominal T_{avg} at RTP, ≤ [*]°F.

P is the measured pressurizer pressure, psig

P_0 is the nominal RCS operating pressure, ≥ [*] psig

K_4 ≤ [*] K_5 ≥ [*]/°F K_6 ≥ [*]/psig

T_4 ≥ [*] sec T_5 ≤ [*] sec

*These values denoted with [*] are specified in the COLR.

Table 3.3.1-1 (page 9 of 9)
Reactor Trip System Instrumentation

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Note 2: Overpower ΔT

$$\Delta T \frac{(1+T_{13}s)}{(1+T_{14}s)}\left(\frac{1}{1+T_{15}s}\right) \geq \Delta T_0\left(-K_8\frac{T_6s}{1+T_6s}T_{avg}-K_9\left(T_{avg}-T_{avg0}\right)-f_2(\Delta I)\right)$$

Where: ΔT is measured RCS ΔT,°F.

ΔT_0 is indicated RCS ΔT at RTP,°F.

s is the Laplace transform operator, sec^{-1}.

T_{avg} is the measured RCS average temperature,°F.

T_{avg0} is the nominal T_{avg} at RTP, ≤ [*]°F.

K_7 ≤ [*] K_8 ≥ [*]/°F for increasing T_{avg} K_9 ≥ [*]/°F when T_{avg} > T_{avg0}
          [*]/°F for decreasing T_{avg} [*]/°F when T_{avg} ≤ T_{avg0}

T_6 ≥ [*] sec T_{13} ≥ [*] sec T_{14} ≤ [*] sec
T_{15} ≤ [*] sec

$f_2(\Delta I)$ = [*]

*These values denoted with [*] are specified in the COLR.

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME	
C. One ~~required~~ train inoperable.	--------------------NOTE------------------ One ~~required~~ train may be bypassed for up to 4 hours for surveillance testing. provided the other ~~required~~ train(s) ~~is~~are OPERABLE. -- C.1　　Restore train to OPERABLE status. OR C.2.1　Be in MODE 3. 　　　AND C.2.2　Be in MODE 5.	 24 hours 30 hours 60 hours	MIC-03-16-0 0007 MIC-03-16-0 0007
D. One required channel inoperable.	------------------NOTE-------------------- One required channel may be bypassed for up to 12 hours for surveillance testing, provided the other required channels are OPERABLE or placed in the trip condition. -- D.1　　Place channel in trip. OR D.2.1　Be in MODE 3. 　　　AND D.2.2　Be in MODE 4.	 72 hours 78 hours 84 hours	MIC-03-16-0 0007 MIC-03-16-0 0007

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME	
E. One required Containment Pressure channel inoperable.	--------------------NOTE------------------ One required channel may be bypassed for up to 12 hours for surveillance testing, provided the other required channels are OPERABLE ---		MIC-03-16-0 0007
	E.1 ~~Restore required number of OPERABLE channels.~~ Restore channel to OPERABLE status.	72 hours	
	OR		
	E.2.1 Be in MODE 3.	78 hours	
	AND		
	E.2.2 Be in MODE 4.	84 hours	
F. One ~~required~~ channel or required train inoperable.	------------------NOTE-------------------- One Loss of Offsite Power channel may be bypassed for up to 4 hours for surveillance testing, provided the other channels are OPERABLE or placed in the trip condition. ---		MIC-03-16-0 0007
	F.1 Restore channel or train to OPERABLE status.	72 hours	
	OR		
	F.2.1 Be in MODE 3.	78 hours	
	AND		
	F.2.2 Be in MODE 4.	84 hours	

ACTIONS (continued)

G. One ~~required~~ train inoperable.	--------------------NOTE------------------ One ~~inoperable~~ train may be bypassed for up to 4 hours for surveillance testing. provided the other train~~(s)~~ is~~(are)~~ OPERABLE. ---		MIC-03-16-0 0007 MIC-03-16-0 0007
	G.1 Restore train to OPERABLE status.	24 hours	
	OR		
	G.2.1 Be in MODE 3.	30 hours	
	AND		
	G.2.2 Be in MODE 4.	36 hours	

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME	
H. One ~~channel for trip of all~~required Main Feedwater Pumps trips channel inoperable.	H.1	Restore channel to OPERABLE status.	48 hours	MIC-03-16-0 0007
	OR			
	H.2	Be in MODE 3.	54 hours	
I. One or more required Pressurizer Pressure, P-11 channels inoperable.	I.1	Verify interlock is in required state for existing unit condition.	1 hour	MIC-03-16-0 0007
	OR			
	I.2.1	Be in MODE 3.	7 hours	
	AND			
	I.2.2	Be in MODE 4.	13 hours	
J. One required Emergency Feedwater Actuation train inoperable.	--------------------NOTE------------------- One ~~inoperable~~required train may be bypassed for up to 4 hours for surveillance testing, provided the other ~~train(s) is~~(required trains are~~)~~ OPERABLE. ---			MIC-03-16-0 0007 MIC-03-16-0 0007
			72 hours	
	J.1	Restore train to OPERABLE status.		
	OR			
			72 hours	
	J.2	Apply the requirements of Specification 5.5.18.		

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME	
K. One required Containment High ~~Range~~ Area Radiation ~~monitoring~~ channel inoperable.	K.1 Restore channel to OPERABLE status. OR ~~K.2.1~~ ~~Be in MODE 3.~~ ~~AND~~ ~~K.2.2~~ ~~Be in MODE 5.~~	72 hours ~~78 hours~~ ~~108 hours~~	MIC-03-16-0 0007 MIC-03-16-0 0007
L. One or more ~~Actuation Logic and Actuation Output~~Containment Purge Isolation trains inoperable. OR Two or more required Containment High Range Area Radiation ~~Monitoring~~ channels inoperable. OR Required Action and associated Completion Time of Condition K not met.	L.1 Enter applicable Conditions and Required Actions of LCO 3.6.3, "Containment Isolation Valves," for containment purge and exhaust isolation valves made inoperable by isolation instrumentation.	Immediately	MIC-03-16-0 0007 MIC-03-16-0 0007 MIC-03-16-0 0007

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME	
M. One ~~or more Functions with one~~required channel ~~or train~~ inoperable.	M.1	~~Place one train of the affected subsystem(s) in the emergency mode, depending on the inoperable train.~~Place channel in trip.	~~7 days~~1 hour	MIC-03-16-00007
		────────── NOTE ────────── ~~Inoperable train A or D affects both subsytem MCREFS and subsystem MCRATCS, while inoperable train B or C affects only subsystem MCRATCS.~~ ────────────────────────		
		AND		
	M.2	Restore channel to OPERABLE status.	72 hours	
N. Required Action and associated Completion Time of Condition M not met.	N.1 AND N.2	Be in MODE 3. Be in MODE 4.	6 hours 12 hours	MIC-03-16-00007

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME	
~~N~~O. ~~One or more Functions with two channels or two trains inoperable.~~ One S-VDU train inoperable.	~~N.1.1~~ ~~Place the affected subsystem(s) in the emergency mode.~~	~~Immediately~~	MIC-03-16-0 0007
	~~AND~~		
	~~N.1.2~~ ~~Enter applicable Conditions and Required Actions for the affected subsystem(s) made inoperable by inoperable actuation instrumentation, depending on inoperable trains.~~	~~Immediately~~	
	~~OR~~		
	~~N.2~~ ~~Place all trains of the affected subsystem(s) in emergency mode.~~	~~Immediately~~	
	--------------------~~Note~~-------------------- ~~Inoperable train A or D affects both subsystem MCREFS and subsytem MCRATCS, while inoperable train B or C affects only subsystem MCRATCS.~~		
	--------------------NOTE-------------------- One train may be bypassed for up to 4 hours for surveillance testing, provided the other trains are OPERABLE. --		
	O.1 Restore train to OPERABLE status.	72 hours	
	OR		
	O.2 Enter applicable Conditions and Required Actions for the ESF components made inoperable by the inoperable S-VDU train.	72 hours	

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME	
~~O~~P. ~~Required Action and associated Completion Time for Condition M or N not met in MODE 1, 2, 3, or 4.~~One COM-2 train inoperable.	~~O.1 Be in MODE 3.~~ ~~AND~~ ~~O.2 Be in MODE 5.~~ --------------------NOTE-------------------- One train may be bypassed for up to 4 hours for surveillance testing, provided the other trains are OPERABLE. --- P.1 Restore train to OPERABLE status. OR P.2 Enter applicable Conditions and Required Actions for the ESF components made inoperable by the inoperable COM-2 train.	 ~~6~~12 hours ~~36~~12 hours	MIC-03-16-0 0007
~~P. Required Action and associated Completion Time for Condition M or N not met during movement of irradiated fuel assemblies.~~	~~P.1 Suspend movement of irradiated fuel assemblies.~~	~~Immediately~~	MIC-03-16-0 0007

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME	
Q. One required train inoperable.	--------------------NOTE------------------ One required train may be bypassed for up to 4 hours for surveillance testing, provided the other required train(s) is(are) OPERABLE. --		MIC-03-16-0 0007

	Q.1 Restore train to OPERABLE status.
	
	OR
	
	Q.2
	
	  --------------NOTE--------------
	  This Required Action is not applicable in MODE 4.
	  ------------------------------------- 	
	
	  Apply the requirements of Specification 5.5.18.
		24 hours
		
		24 hours	

R. Required Action and associated Completion Time for Condition Q not met.	R.1 Be in MODE 3. AND R.2 Be in MODE 5.	6 hours 36 hours	
S. One required train inoperable.	--------------------NOTE------------------ One inoperable train may be bypassed for up to 4 hours for surveillance testing, provided the other train(s) is(are) OPERABLE. -- S.1 Restore train to OPERABLE status. OR S.2 Apply the requirements of Specification 5.5.18.	 24 hours 24 hours	MIC-03-16-0 0007 MIC-03-16-0 0007

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME	
T. Required Action and associated Completion Time for Condition J or S not met.	T.1	Be in MODE 3.	6 hours	
		AND		
	T.2	Be in MODE 4.	12 hours	
U. One or more MCR Outside Air Intake Radiation Functions with one channel inoperable.	U.1	Place one MCREFS train and two MCRATCS trains in the emergency mode.	7 days	MIC-03-16-0 0007
V. One or more MCR Outside Air Intake Radiation Functions with two channels inoperable.	V.1	Place one MCREFS train and two MCRATCS trains in the emergency mode.	Immediately	MIC-03-16-0 0007
		AND		
	V.2.1	Restore one channel to OPERABLE status.	7 days	
		OR		
	V.2.2	Place two MCREFS trains and three MCRATCS trains in the emergency mode.	7 days	
W. One or more Functions with one train, A or D, inoperable.	--------------------NOTE-------------------- This condition is only applicable to Train A or D. For inoperable Train B or C there is no action required. ---			MIC-03-16-0 0007
	W.1	Place the affected train of MCREFS in the emergency mode.	7 days	

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME	

X. One or more Functions with two trains, A and D, inoperable.	--------------------NOTE------------------
	This condition is only applicable to Train A and D. Other inoperable two-train combinations are addressed in Condition Y.
	-- 	
	
	X.1 Place one MCREFS train in the emergency mode.
	
	AND
	
	X.2.1 Restore one MCREFS train to OPERABLE status (i.e., one train in the emergency mode and one train OPERABLE).
	
	     OR
	
	X.2.2 Place two MCREFS trains in the emergency mode.
	
	AND
	
	X.3.1 Restore one affected MCRATCS train to OPERABLE status (i.e., three trains OPERABLE).
	
	     OR
	
	X.3.2 Place one affected MCRATCS train in the emergency mode (i.e., one train in the emergency mode and two trains OPERABLE).
		
		Immediately
		
		7 days
		
		7 days
		
		7 days
		
		7 days
			MIC-03-16-0 0007

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME	
Y. One or more Functions with two trains, except A and D, inoperable.	--------------------NOTE------------------ Inoperable Train A or D affects MCREFS and MCRATCS. Inoperable Train B or C affects MCRATCS. -- Y.1 Restore one affected train to OPERABLE status for the affected subsystem(s). OR Y.2 Place one affected train in the emergency mode for the affected subsystem(s).	 Immediately 7 days	MIC-03-16-0 0007
Z. Required Action and associated Completion Time for Condition U, V, W, X or Y not met in MODE 1, 2, 3, or 4.	Z.1 Be in MODE 3. AND Z.2 Be in MODE 5.	6 hours 36 hours	MIC-03-16-0 0007
AA. Required Action and associated Completion Time for Condition U, V, W, X or Y not met during movement of irradiated fuel assemblies.	AA.1 Suspend movement of irradiated fuel assemblies.	Immediately	MIC-03-16-0 0007
BB. One required Reactor Trip, P-4 train inoperable.	BB.1 Restore train to OPERABLE status. OR BB.2.1 Be in MODE 3. AND BB.2.2 Be in MODE 4.	48 hours 54 hours 60 hours	MIC-03-16-0 0007

SURVEILLANCE REQUIREMENTS

---NOTE---
Refer to Table 3.3.2-1 to determine which SRs apply for each ESFAS Function.

SURVEILLANCE		FREQUENCY	
SR 3.3.2.1	Perform CHANNEL CHECK.	In accordance with the Surveillance Frequency Control Program	
SR 3.3.2.2	Perform ~~ACTUATION LOGIC TEST~~MIC consistent with Specification 5.5.21, Setpoint Control Program (SCP).	In accordance with the Surveillance Frequency Control Program	MIC-03-16-0 0007
~~SR 3.3.2.3~~	~~Perform COT.~~	~~In accordance with the Surveillance Frequency Control Program~~	MIC-03-16-0 0007

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY	
SR 3.3.2.~~4~~3 Perform TADOT for ~~a~~Actuation ~~o~~Outputs.	In accordance with the Surveillance Frequency Control Program	MIC-03-16-0 0007
SR 3.3.2.~~5~~4 ──────────── NOTE ──────────── ~~Verification of relay setpoints not required.~~ ──────────────────────── Perform TADOT.	 In accordance with the Surveillance Frequency Control Program	MIC-03-16-0 0007
SR 3.3.2.~~6~~5 ──────────── NOTE ──────────── ~~Verification of setpoint not required for manual initiation functions.~~ ──────────────────────── Perform TADOT.	 In accordance with the Surveillance Frequency Control Program	MIC-03-16-0 0007

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY	
SR 3.3.2.~~7~~6	———————————— NOTE ———————————— ~~This Surveillance shall include verification that the time constants are adjusted to the prescribed values.~~ Perform ~~a~~ CHANNEL CALIBRATION ~~on each required channel~~ consistent with Specification 5.5.21, Setpoint Control Program (SCP).	In accordance with the Surveillance Frequency Control Program	MIC-03-16-0 0007
SR 3.3.2.~~8~~7	-----------------------------NOTE--------------------------- Not required to be performed for the turbine driven EFW pumps until 24 hours after SG pressure is $\geq$ 1000 psig. --- Verify ESF~~AS~~ RESPONSE TIME~~S~~ ~~are~~is within limit.	In accordance with the Surveillance Frequency Control Program	MIC-03-16-0 0007 MIC-03-16-0 0007
SR 3.3.2.~~9~~8	———————————— NOTE ———————————— ~~Verification of setpoint not required.~~ Perform TADOT.	Once per reactor trip breaker cycle	MIC-03-16-0 0007
SR 3.3.2.9	Perform SAFETY VDU TEST.	In accordance with the Surveillance Frequency Control Program	MIC-03-16-0 0007

Table 3.3.2-1 (page 1 of 11)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	
1. ECCS Actuation					
a. Manual Initiation	1,2,3,4	3 trains	B	SR 3.3.2.~~6~~5	MIC-03-16-0 0007
b. Actuation Logic and Actuation Outputs	1,2,3,4	3 trains	Q,R	SR 3.3.2.2 SR 3.3.2.~~4~~3	MIC-03-16-0 0007
c. High Containment Pressure	1,2,3	3	D	SR 3.3.2.1 SR 3.3.2.~~3~~2 SR 3.3.2.6 SR 3.3.2.7 ~~SR 3.3.2.8~~	MIC-03-16-0 0007 MIC-03-16-0 0007
d. Low Pressurizer Pressure	1,2,3(a)	3	~~D~~M,N	SR 3.3.2.1 SR 3.3.2.~~3~~2 SR 3.3.2.6 SR 3.3.2.7 ~~SR 3.3.2.8~~	MIC-03-16-0 0007 MIC-03-16-0 0007
e. Low Main Steam Line Pressure	1,2,3(a)	3 per steam line	~~D~~M,N	SR 3.3.2.1 SR 3.3.2.~~3~~2 SR 3.3.2.6 SR 3.3.2.7 ~~SR 3.3.2.8~~	MIC-03-16-0 0007 MIC-03-16-0 0007

(a) Above the P-11 (Pressurizer Pressure) interlock.

Table 3.3.2-1 (page 2 of 11)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	
2. Containment Spray					
a. Manual Initiation	1,2,3,4	2 switches per train for ~~3~~4 trains	B	SR 3.3.2.~~6~~5	MIC-03-16-0 0007
b. Actuation Logic and Actuation Outputs	1,2,3,4	3 trains	Q,R	SR 3.3.2.2 SR 3.3.2.~~4~~3	MIC-03-16-0 0007
c. High-3 Containment Pressure	1,2,3	3	E	SR 3.3.2.1 SR 3.3.2.~~3~~2 SR 3.3.2.6 SR 3.3.2.7 ~~SR 3.3.2.8~~	MIC-03-16-0 0007 MIC-03-16-0 0007

Table 3.3.2-1 (page 3 of 11)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	
3. Containment Isolation					
a. Phase A Isolation					
(1) Manual Initiation	1,2,3,4	Trains A and D	B	SR 3.3.2.~~6~~5	MIC-03-16-0 0007
(2) Actuation Logic and Actuation Outputs	1,2,3,4	Trains A and D	C	SR 3.3.2.2 SR 3.3.2.~~4~~3	MIC-03-16-0 0007
(3) ECCS Actuation	Refer to Function 1 (ECCS Actuation) for all ~~initiation functions and~~ requirements.				MIC-03-16-0 0007
b. Phase B Isolation					
(1) Containment Spray - Manual Initiation	Refer to Function 2.a (Containment Spray - Manual Initiation) for all ~~initiation functions and~~ requirements.				MIC-03-16-0 0007
(2) Actuation Logic and Actuation Outputs	1,2,3,4	4 trains	C	SR 3.3.2.2 SR 3.3.2.~~4~~3	MIC-03-16-0 0007
(3) High-3 Containment Pressure	Refer to Function 2.c (Containment Spray~~) for all~~ - High-3 Containment Pressure) for all requirements.				MIC-03-16-0 0007

Table 3.3.2-1 (page 4 of 11)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	
4. Main Steam Line Isolation					
a. Manual Initiation	1,2 (h),3 (h)	Trains A and D	F	SR 3.3.2.65	MIC-03-16-0 0007
b. Actuation Logic and Actuation Outputs	1,2 (h),3 (h)	Trains A and D	S,T	SR 3.3.2.2 SR 3.3.2.43	MIC-03-16-0 0007
c. High-High Containment Pressure	1, 2 (h), 3 (h)	3	D	SR 3.3.2.1 SR 3.3.2.32 SR 3.3.2.6 SR 3.3.2.7 SR 3.3.2.8	MIC-03-16-0 0007 MIC-03-16-0 0007
d. Main Steam Line Pressure					
(1) Low Main Steam Line Pressure	1, 2 (h), 3 (a) (h)	3 per steam line	DM,N	SR 3.3.2.1 SR 3.3.2.32 SR 3.3.2.6 SR 3.3.2.7 SR 3.3.2.8	MIC-03-16-0 0007 MIC-03-16-0 0007
(2) High Main Steam Line Pressure Negative Rate	3 (f) (hb)	3 per steam line	DM,N	SR 3.3.2.1 SR 3.3.2.32 SR 3.3.2.6 SR 3.3.2.7 SR 3.3.2.8	MIC-03-16-0 0007 MIC-03-16-0 0007

(a) Above the P-11 (Pressurizer Pressure) interlock.

(fb) Below the P-11 (Pressurizer Pressure) interlock.

(h) Except when all MSIVs are closed.

MIC-03-16-0 0007

Table 3.3.2-1 (page 5 of 11)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	
5. Main Feedwater Isolation					
~~5A. Main Feedwater Regulation Valve Closure~~					MIC-03-16-0 0007
a. Manual Initiation	1,2,3	Trains A and D	F	SR 3.3.2.5	MIC-03-16-0 0007
~~a~~b. ~~Low T$_{avg}$~~Actuation Logic and Actuation Outputs	1,2~~(i)~~,3~~(i)~~	~~3~~Trains A and D	~~D~~S,T	SR 3.3.2.~~1~~2 SR 3.3.2.3 ~~SR 3.3.2.7~~ ~~SR 3.3.2.8~~	MIC-03-16-0 0007
~~Coincident with Reactor Trip, P-4~~		~~Refer to Function 11.a for all P-4 requirements.~~			MIC-03-16-0 0007
~~5B. Main Feedwater Isolation~~					MIC-03-16-0 0007
c. High-High SG Water Level	1,2,3$^{(c)}$	3 per SG	M,N	SR 3.3.2.1 SR 3.3.2.2 SR 3.3.2.6 SR 3.3.2.7	MIC-03-16-0 0007
d. ECCS Actuation	Refer to Function 1 (ECCS Actuation) for all requirements.				MIC-03-16-0 0007
~~a~~e. ~~Manual Initiation~~Low T$_{avg}$$^{(d)}$	1,2~~(i)~~,3~~(i)~~	~~Trains A and D~~3	~~F~~M,N	SR 3.3.2.1 SR 3.3.2.2 SR 3.3.2.6 SR 3.3.2.7	MIC-03-16-0 0007
~~b. Actuation Logic and Actuation Outputs~~	~~1,2 (i), 3(i)~~	~~Trains A and D~~	~~S,T~~	~~SR 3.3.2.2~~ ~~SR 3.3.2.4~~	MIC-03-16-0 0007
~~c. High-High SG Water Level~~	~~1,2 (i),3(a) (i)~~	~~3 per SG~~	~~D~~	~~SR 3.3.2.1~~ ~~SR 3.3.2.3~~ ~~SR 3.3.2.7~~ ~~SR 3.3.2.8~~	MIC-03-16-0 0007
~~d. ECCS Actuation~~Coincident with Reactor Trip, P-4		~~Refer to Function 1 (ECCS Actuation) for all initiation functions and requirements.~~Refer to Function 11.a (ESFAS Interlocks - Reactor Trip, P-4) for all requirements.			MIC-03-16-0 0007

~~(a) Above the P-11 (Pressurizer Pressure) interlock.~~

~~(i) Except when all MFIVs, MFRVs, MFBRVs, and SGWFCVs are closed.~~

~~(j) Except when all MFRVs are closed.~~

(c) The sub-function for trip of all MWF pumps, and closure of the MFIVs and SGWFCVs may be manually bypassed in MODE 3 below the P-11 (Pressurizer Pressure) interlock.

(d) Low T$_{avg}$ coincident with Reactor Trip, P-4 only closes MFW Regulation valves.

MIC-03-16-0 0007

Table 3.3.2-1 (page 6 of 11)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS
6. Emergency Feedwater Actuation				
a. Manual Initiation	1,2,3	3 trains	F	SR 3.3.2.~~6~~5
b. Actuation Logic and Actuation Outputs	1,2,3	3 trains	J,T	SR 3.3.2.2 SR 3.3.2.~~4~~3
c. Low SG Water Level	1,2,3	3 per SG	~~D~~M,N	SR 3.3.2.1 SR 3.3.2.~~3~~2 SR 3.3.2.6 SR 3.3.2.7 ~~SR 3.3.2.8~~
d. ECCS Actuation	Refer to Function 1 (ECCS Actuation) for all ~~initiation functions and~~ requirements.			
e. LOOP Signal	1,2,3	3 per bus for each EFW train	F	SR 3.3.2.~~5~~4 SR 3.3.2.6 SR 3.3.2.7 ~~SR 3.3.2.8~~
f. Trip of all Main Feedwater Pumps	1,2	1 per pump	H	SR 3.3.2.~~6~~5 SR 3.3.2.~~8~~7

~~(I)   Nominal Trip Setpoint~~

MIC-03-16-0 0007 (×9)

Table 3.3.2-1 (page 7 of 11)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	
7. Emergency Feedwater Isolation					
a. Manual Initiation	1,2,3	2 trains per SG	F	SR 3.3.2.~~6~~5	MIC-03-16-0 0007
b. Actuation Logic and Actuation Outputs	1,2,3	2 trains per SG	G	SR 3.3.2.2 SR 3.3.2.~~4~~3	MIC-03-16-0 0007
c. High SG Water Level	1,2,3 (a)	3 per SG	~~D~~M,N	SR 3.3.2.1 SR 3.3.2.~~3~~2 SR 3.3.2.6 SR 3.3.2.7 ~~SR 3.3.2.8~~	MIC-03-16-0 0007 MIC-03-16-0 0007
Coincident with Reactor Trip, P-4		Refer to Function 11.a (ESFAS Interlocks - Reactor Trip, P-4) for all ~~P-4~~ requirements.			MIC-03-16-0 0007
and No Low Main Steam Line Pressure		Refer to Function ~~-~~ 7.d (Emergency Feedwater Isolation - Low Main Steam Line Pressure) for all ~~initiation functions and~~ requirements.			MIC-03-16-0 0007
d. Low Main Steam Line Pressure	1,2,3 (a)	3 per SG	~~D~~M,N	SR 3.3.2.1 SR 3.3.2.~~3~~2 SR 3.3.2.6 SR 3.3.2.7 ~~SR 3.3.2.8~~	MIC-03-16-0 0007 MIC-03-16-0 0007
8. CVCS Isolation					
a. Manual Initiation	1,2,3	Trains A and D	F	SR 3.3.2.~~6~~5	MIC-03-16-0 0007
b. Actuation Logic and Actuation Outputs	1,2,3	Trains A and D	G	SR 3.3.2.2 SR 3.3.2.~~4~~3	MIC-03-16-0 0007
c. High Pressurizer Water Level	1,2,3 (a)	3	~~D~~M,N	SR 3.3.2.1 SR 3.3.2.~~3~~2 SR 3.3.2.6 SR 3.3.2.7 ~~SR 3.3.2.8~~	MIC-03-16-0 0007 MIC-03-16-0 0007

(a) Above the P-11 (Pressurizer Pressure) interlock.

Table 3.3.2-1 (page 8 of 11)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	
9. Turbine Trip					
a. Actuation Logic and Actuation Outputs	1,2,3	~~4 trains~~Trains A and D	G	SR 3.3.2.2 SR 3.3.2.~~4~~3	MIC-03-16-0 0007
b. Reactor Trip, P-4	Refer to Function 11.a (ESFAS Interlocks - Reactor Trip, P-4) for all ~~P-4~~ requirements.				MIC-03-16-0 0007
c. High-High SG Water Level	1,2 ~~(i)~~,3 ~~(i)~~	3 per SG	~~D~~M,N	SR 3.3.2.1 SR 3.3.2.~~3~~2 SR 3.3.2.6 SR 3.3.2.7 ~~SR 3.3.2.8~~	MIC-03-16-0 0007 MIC-03-16-0 0007
10. Reactor Coolant Pump Trip					
a. ECCS Actuation	Refer to Function 1 (ECCS Actuation) for all ~~initiation functions and~~ requirements.				MIC-03-16-0 0007
Coincident with Reactor Trip, P-4	Refer to Function 11.a (ESFAS Interlocks - Reactor Trip, P-4) for all ~~P-4~~ requirements.				MIC-03-16-0 0007
11. ESFAS Interlocks					
a. Reactor Trip, P-4	1,2,3	3 trains	~~F~~BB	SR 3.3.2.~~9~~8	MIC-03-16-0 0007
b. Pressurizer Pressure, P-11	1,2,3	3	I	SR 3.3.2.1 SR 3.3.2.~~3~~2 SR 3.3.2.~~7~~6	MIC-03-16-0 0007

~~(i) Except when all MFIVs, MFRVs, MFBRVs, and SGWFCVs are closed.~~   MIC-03-16-0 0007

Table 3.3.2-1 (page 9 of 11)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	
12.Containment Purge Isolation					
a. Containment Isolation Phase A - Manual Initiation	Refer to Function 3.a.(1) (Containment Isolation - Phase A Isolation - Manual Initiation) for all ~~initiation functions and~~ requirements.				MIC-03-16-0 0007
b. Containment Spray - Manual Initiation	Refer to Function 2.a~~.~~ (Containment Spray - Manual Initiation) for all ~~initiation functions and~~ requirements.				MIC-03-16-0 0007
c. Actuation Logic and Actuation Outputs	1,2,3,4	Trains A and D	L	SR 3.3.2.2 SR 3.3.2.~~4~~3	MIC-03-16-0 0007
d. ECCS Actuation	Refer to Function 1 (ECCS Actuation) for all ~~initiation functions and~~ requirements.				MIC-03-16-0 0007
e. Containment High Range Area Radiation	1,2,3,4	3	K, L	SR 3.3.2.1 SR 3.3.2.~~3~~2 SR 3.3.2.6 SR 3.3.2.7 ~~SR 3.3.2.8~~	MIC-03-16-0 0007 MIC-03-16-0 0007

Table 3.3.2-1 (page 10 of 11)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	
13. Main Control Room (MCR) Isolation					
a. Manual Initiation	1,2,3,4,(~~*~~e)	3 trains including A and D(~~m~~f)	~~M, N, O, P~~W, X, Y, Z, AA	SR 3.3.2.~~6~~5	MIC-03-16-0 0007
b. Actuation Logic and Actuation Output	1,2,3,4,(~~*~~e)	3 trains including A and D(~~m~~f)	~~M, N, O, P~~W, X, Y, Z, AA	SR 3.3.2.2 SR 3.3.2.~~4~~3	MIC-03-16-0 0007
c. MCR Outside Air Intake Radiation					
(1) MCR Outside Air Intake Gas Radiation	1,2,3,4,(~~*~~e)	2	~~M, N, O, P~~U, V, Z, AA	SR 3.3.2.1 SR 3.3.2.~~3~~2 SR 3.3.2.6 SR 3.3.2.7 ~~SR 3.3.2.8~~	MIC-03-16-0 0007 MIC-03-16-0 0007
(2) MCR Outside Air Intake Particulate Radiation	1,2,3,4,(~~*~~e)	2	~~M, N, O, P~~U, V, Z, AA	SR 3.3.2.1 SR 3.3.2.~~3~~2 SR 3.3.2.6 SR 3.3.2.7 ~~SR 3.3.2.8~~	MIC-03-16-0 0007 MIC-03-16-0 0007
(3) MCR Outside Air Intake Iodine Radiation	1,2,3,4,(~~*~~e)	2	~~M, N, O, P~~U, V, Z, AA	SR 3.3.2.1 SR 3.3.2.~~3~~2 SR 3.3.2.6 SR 3.3.2.7 ~~SR 3.3.2.8~~	MIC-03-16-0 0007 MIC-03-16-0 0007
d. ECCS Actuation			Refer to ~~LCO 3.3.2, "ESFAS Instrumentation,"~~ Function 1~~,~~ (ECCS Actuation) for all ~~initiation functions and~~ requirements.		MIC-03-16-0 0007

(~~k~~e) During movement of ~~-~~irradiated fuel assemblies.

(~~m~~f) Two trains of MCREFS are required to be operable (trains A and D); three trains of MCRATS are required to be operable (three out of four trains A, B, C, D).

MIC-03-16-0 0007

Table 3.3.2-1 (page 11 of 11)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	
14. Block Turbine Bypass and Cooldown Valves					
a. Manual Initiation	1,2 ~~(h)~~,3 ~~(h)~~	Trains A and D	F	SR 3.3.2.~~6~~5	MIC-03-16-0 0007
b. Actuation Logic and Actuation Outputs	1,2 ~~(h)~~,3 ~~(h)~~	Trains A and D	S,T	SR 3.3.2.2 SR 3.3.2.~~4~~3	MIC-03-16-0 0007
c. Low-Low T_{avg} Signal	1,2 ~~(h)~~,3 ~~(h)~~	3	~~D~~M,N	SR 3.3.2.1 SR 3.3.2.~~3~~2 SR 3.3.2.6 SR 3.3.2.7 ~~SR 3.3.2.8~~	MIC-03-16-0 0007
					MIC-03-16-0 0007
15. Manual Control of ESF Components					MIC-03-16-0 0007
a. Safety VDU	1, 2, 3, 4, 5, 6	4 trains	O	SR 3.3.2.2 SR 3.3.2.9	MIC-03-16-0 0007
b. COM-2	1, 2, 3, 4, 5, 6	4 trains	P	SR 3.3.2.2	MIC-03-16-0 0007
c. Actuation Logic and Actuation Outputs	Refer to LCO 3.4 through 3.7 for all requirements applicable to the controlled ESF components.			SR 3.3.2.2 SR 3.3.2.3	MIC-03-16-0 0007

~~(h) Except when all MSIVs are closed.~~

MIC-03-16-0 0007

3.3 INSTRUMENTATION

3.3.3   Post Accident Monitoring (PAM) Instrumentation

LCO 3.3.3   The PAM ~~i~~Instrumentation ~~for each~~ Function in Table 3.3.3-1, and for all four trains of the PAM Display Function, shall be OPERABLE. | MIC-03-16-0 0007

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

---NOTE---

Separate Condition entry is allowed for each Function.

CONDITION	REQUIRED ACTION	COMPLETION TIME	
A. One or more PAM Instrumentation Functions with one required channel inoperable. OR One train of the PAM Display Function inoperable.	A.1 Restore ~~required~~ channel or train to OPERABLE status.	30 days	MIC-03-16-0 0007 MIC-03-16-0 0007
B. Required Action and associated Completion Time of Condition A not met.	B.1 ~~─────── NOTE ───────~~ ~~1. For RCS Hot and Cold Leg Temperatures, this Condition is applicable only if at least one channel (Hot or Cold) is operable in each loop. Otherwise, go to Condition C.~~ ~~2. For SG Water Level and EFW flow, this condition is applicable only if at least one channel (Level or flow) is operable in each loop. Otherwise, go to Condition C.~~ ──────────────── Initiate action in accordance with Specification 5.6.5.	Immediately	MIC-03-16-0 0007

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. One or more PAM Instrumentation Functions with two required channels inoperable. OR Two trains of the PAM Display Function inoperable.	C.1 ──────────NOTE────────── 1. For RCS Hot and Cold Leg Temperatures, this Condition is applicable only when both channels in the same loop are inoperable. 2. For SG Water Level and EFW flow, this condition is applicable only when both channels in the same loop are inoperable. ─────────────────────── Restore one train or one required channel to OPERABLE status. OR C.2 --------------NOTE------------- This alternate action may be used only when the Emergency Feedwater Pit Level is inoperable. ------------------------------------ Apply the requirements of Specification 5.5.18.	 7 days 7 days

MIC-03-16-0 0007

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME	
D. Required Action and associated Completion Time of Condition C not met.	D.1	~~Enter the Condition referenced~~Be in ~~Table~~MODE 3.~~3.3 1 for the channel.~~	~~Immediately~~6 hours	MIC-03-16-0 0007
	AND			
	D.2	Be in MODE 4.	12 hours	
~~E. As by Required Action D.1 and referenced in Table 3.3.3 1.~~	~~E.1~~	~~Be in MODE 3.~~	~~6 hours~~	MIC-03-16-0 0007
	~~AND~~			
	~~E.2~~	~~Be in MODE 4.~~	~~12 hours~~	
~~F. As by Required Action D.1 and referenced in Table 3.3.3 1.~~	~~F.1~~	~~Initiate action in accordance with Specification 5.6.5.~~	~~Immediately~~	MIC-03-16-0 0007

SURVEILLANCE REQUIREMENTS

---NOTE---
SR 3.3.3.1 and SR 3.3.3.2 apply to each PAM ~~i~~Instrumentation Function in Table 3.3.3-1. MIC-03-16-0 0007

SURVEILLANCE	FREQUENCY	
SR 3.3.3.1 Perform CHANNEL CHECK ~~for each required instrumentation channel that is normally energized~~.	In accordance with the Surveillance Frequency Control Program	MIC-03-16-0 0007
SR 3.3.3.2 --------------------------------NOTE------------------------- Neutron detectors are excluded from CHANNEL CALIBRATION. --- Perform CHANNEL CALIBRATION.	In accordance with the Surveillance Frequency Control Program	
<u>SR 3.3.3.3</u> <u>Perform MIC for the PAM Instrumentation.</u>	<u>In accordance with the Surveillance Frequency Control Program</u>	MIC-03-16-0 0007
<u>SR 3.3.3.4</u> <u>Perform SAFETY VDU TEST for all four trains of the PAM Display Function.</u>	<u>In accordance with the Surveillance Frequency Control Program</u>	MIC-03-16-0 0007

Table 3.3.3-1 (page 1 of 1)
Post Accident Monitoring Instrumentation

FUNCTION	REQUIRED CHANNELS	~~CONDITION REFERENCED FROM REQUIRED ACTION D.1~~	MIC-03-16-0 0007
1. Wide Range Neutron Flux	2	~~E~~	
2. Reactor Coolant System (RCS) Hot Leg Temperature (Wide Range)	~~1 per loop~~ $^{(d)}$3	~~E~~	
3. RCS Cold Leg Temperature (Wide Range)	~~1 per loop~~$^{(d)}$3	~~E~~	
4. RCS Pressure (Wide Range)	2	~~E~~	
5. Reactor Vessel Water Level	2$^{(d)}$	~~F~~	
6. Containment Pressure	2	~~E~~	
7. Containment Isolation Valve Position	2 per penetration flow path$^{(a)(b)}$	~~E~~	
8. Containment High Range Area Radiation	2	~~F~~	
9. Pressurizer Water Level	2	~~E~~	
10. Steam Generator Water Level (Wide Range)	1 per ~~steam generator~~$^{(d)}$SG	~~E~~	
11. Steam Generator Water Level (Narrow Range)	2 per ~~steam generator~~SG	~~E~~	
12. Core Exit Temperature - Quadrant 1	~~2~~4$^{(c)}$	~~E~~	
13. Core Exit Temperature - Quadrant 2	~~2~~4$^{(c)}$	~~E~~	
14. Core Exit Temperature - Quadrant 3	~~2~~4$^{(c)}$	~~E~~	
15. Core Exit Temperature - Quadrant 4	~~2~~4$^{(c)}$	~~E~~	
16. Emergency Feedwater Flow	1 per SG$^{(d)}$	~~E~~	
17. Degrees of Subcooling	2	~~E~~	
18. Main Steam Line Pressure	2 per ~~steam generator~~SG	~~E~~	
19. Emergency Feedwater Pit Level	2	~~E~~	
20. Refueling Water Storage Pit Level (Wide Range)	2	~~E~~	
21. Refueling Water Storage Pit Level (Narrow Range)	2	~~E~~	

(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 channel is required for penetration flow paths with only one installed control room indication channel.

(c) ~~A channel consists of two core exit thermocouples.~~ Two thermocouple channels are required from each of two trains. For each train, one thermocouple channel is required near the center of the core and one thermocouple channel is required near the core perimeter.

(d) ~~RCS hot leg temperature wide range and RCS cold leg temperature wide range of the same loop are pair PAM functions. Similarly, SG water level wide range and an emergency feedwater flow of the same steam generator are pair PAM functions. Either parameter forming a pair can fulfill all PAM Requirements. Therefore, only 1 per loop/SG of either parameter of the pair is required.~~ A channel consists of three sections with two sensors per section. A channel is OPERABLE if at least one sensor is OPERABLE in all three sections.

MIC-03-16-0 0007

3.3 INSTRUMENTATION

3.3.4 Remote Shutdown Console (RSC)

LCO 3.3.4   The RSC shall be OPERABLE.

APPLICABILITY: MODES 1, 2 and 3.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME	
A. ~~RSC~~One required channel or train inoperable~~.~~ for the Display and Control Function. OR One train inoperable for the Transfer of Control Function.	A.1 Restore channel or train to OPERABLE status.	30 days	MIC-03-16-0 0007
B. Required Action and associated Completion Time of Condition A not met.	B.1 Be in MODE 3. AND B.2 Be in MODE 4.	6 hours 12 hours	MIC-03-16-0 0007

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY	
SR 3.3.4.1	Perform TADOT for ~~each~~ Transfer Switches.	In accordance with the Surveillance Frequency Control Program	MIC-03-16-0 0007
SR 3.3.4.2	Perform ~~ACTUATION LOGIC~~SAFETY VDU TEST for ~~each PSMS train~~all four trains of the RSC Display Function.	In accordance with the Surveillance Frequency Control Program	MIC-03-16-0 0007
SR 3.3.4.3	Perform ~~Safety VDU Test~~CHANNEL CHECK for each ~~train of the PSMS~~RSC Instrumentation Function.	In accordance with the Surveillance Frequency Control Program	MIC-03-16-0 0007
SR 3.3.4.4	----------------------------NOTE---------------------------- Neutron detectors are excluded from CHANNEL CALIBRATION. -- Perform CHANNEL CALIBRATION for each RSC Instrumentation Function.	In accordance with the Surveillance Frequency Control Program	MIC-03-16-0 0007
SR 3.3.4.5	Perform MIC for the RSC.	In accordance with the Surveillance Frequency Control Program	MIC-03-16-0 0007
SR 3.3.4.6	Perform TADOT for Actuation Outputs of each RCS Control Function.	In accordance with the Surveillance Frequency Control Program	MIC-03-16-0 0007

3.3   INSTRUMENTATION

3.3.5   Loss of Power (LOP) Class 1E Gas Turbine Generator (GTG) Start Instrumentation

LCO 3.3.5   The following Loss of Power (LOP) Class 1E Gas Turbine Generator (GTG) Start Instrumentation shall be OPERABLE. | MIC-03-16-0 0007

| | a. | Three channels per required bus of the loss of voltage Function and three channels per required bus of the degraded voltage Function ~~shall be OPERABLE~~. and | MIC-03-16-0 0007 |

| | b. | One train per required bus of the LOP Actuation Function. |

APPLICABILITY: MODES 1, 2, 3, and 4,
                        When associated Class 1E GTG is required to be OPERABLE by
                        LCO 3.8.2, "AC Sources - Shutdown."

ACTIONS

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

CONDITION	REQUIRED ACTION	COMPLETION TIME	
A. One or more Functions with one ~~or more~~ channel~~s~~ per required bus inoperable.	A.1 --------------NOTE-------------- ~~The inoperable~~One channel may be bypassed for up to 4 hours for surveillance testing ~~of~~. provided the other channel~~s~~. on the same bus are operable or placed in the trip condition. ------------------------------------- Place channel in trip.	 6 hours	MIC-03-16-0 0007 MIC-03-16-0 0007
B. One or more Functions with two or more channels per required bus inoperable.	B.1 Restore all but one channel per required bus to OPERABLE status.	1 hour	MIC-03-16-0 0007

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME	
C. One train of the LOP Actuation Function per required bus inoperable. OR Required Action and associated Completion Time of Conditions A or B not met.	C.1 Enter applicable Condition(s) and Required Action(s) for the associated Class 1E GTG made inoperable by LOP Class 1E GTG ~~s~~Start ~~i~~Instrumentation.	Immediately	MIC-03-16-0 0007 MIC-03-16-0 0007

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY	
SR 3.3.5.1	Perform ~~CHANNEL CHECK~~TADOT for LOP undervoltage relays.	In accordance with the Surveillance Frequency Control Program	MIC-03-16-0 0007
SR 3.3.5.2	Perform ~~TADOT~~CHANNEL CALIBRATION for the following LOP undervoltage relays consistent with Specification 5.5.21, Setpoint Control Program (SCP). a. Loss of voltage b. Degraded voltage	In accordance with the Surveillance Frequency Control Program	MIC-03-16-0 0007
SR 3.3.5.3	Perform ~~CHANNEL CALIBRATION~~MIC for LOP ~~undervoltage relays with Specification 5.5.21, Setpoint Control Program (SCP), with following time delay:~~ Class 1E GTG Start Instrumentation. ~~a. Loss of voltage with a time delay of ≤ 2 second~~ ~~b. Degraded voltage with a time delay of ≤ 10 seconds.~~	In accordance with the Surveillance Frequency Control Program	MIC-03-16-0 0007

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY	
SR 3.3.5.4	~~Perform ACTUATION LOGIC TEST.~~ Perform TADOT for GTG control outputs.	In accordance with the Surveillance Frequency Control Program	MIC-03-16-0 0007
~~SR 3.3.5.5~~	~~Perform TADOT for Class 1E GTG start Actuation Outputs.~~	~~In accordance with the Surveillance Frequency Control Program~~	MIC-03-16-0 0007

3.3 INSTRUMENTATION

3.3.6 Diverse Actuation System (DAS) Instrumentation

LCO 3.3.6   DAS for each function in Table 3.3.6-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.6-1.

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

CONDITION	REQUIRED ACTION	COMPLETION TIME	
A. One or more Functions, with one or more subsystems or required ~~DAS Functions~~channels inoperable.	--------------------NOTES------------------ 1. The Actuation Logic of one subsystem, or one required channel may be bypassed for up to 4 hours for surveillance testing, provided the Actuation Logic in the other subsystems or the other required channels are OPERABLE. 2. The Actuation Outputs of two subsystems may be bypassed for up to 4 hours for surveillance testing of the Actuation Outputs from the other subsystems, or surveillance testing of the Rod Drive Motor-Generator Set Trip Devices. --- A.1 Restore ~~required Function~~subsystem or channel to OPERABLE status. ~~OR~~ ~~A.2.1 Be in MODE 3.~~ ~~AND~~ ~~A.2.2 Be in MODE 4.~~	 30 days ~~Within the following 6 hours~~ ~~Within the following 12 hours~~	MIC-03-16-0 0007

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME	
B. Required Action and associated Completion Time of Condition A not met.	B.1 Be in MODE 3. AND B.2 Be in MODE 4.	6 hours 12 hours	MIC-03-16-0 0007

SURVEILLANCE REQUIREMENTS

--NOTE-- MIC-03-16-0
Refer to Table 3.3.6-1 to determine which SRs apply for each DAS Function. 0007

	SURVEILLANCE	FREQUENCY	
SR 3.3.6.1	Perform CHANNEL CHECK ~~for each required channel~~.	In accordance with the Surveillance Frequency Control Program	MIC-03-16-0 0007
SR 3.3.6.2	Perform COT ~~analog~~ consistent with Specification 5.5.21, Setpoint Control Program (SCP).	In accordance with the Surveillance Frequency Control Program	MIC-03-16-0 0007
SR 3.3.6.3	--------------------------------NOTE-------------------------- The CHANNEL CALIBRATION conducted for the PSMS in LCO 3.3.1 or 3.3.2 may be credited for DAS. --- Perform ~~a~~ CHANNEL CALIBRATION ~~on each required channel~~ consistent with Specification 5.5.21, Setpoint Control Program (SCP).	In accordance with the Surveillance Frequency Control Program	MIC-03-16-0 0007
SR 3.3.6.4	Perform ACTUATION LOGIC TEST.	In accordance with the Surveillance Frequency Control Program	

Table 3.3.6-1 (page 1 of 2)
Diverse Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	
1. Reactor Trip/ Turbine Trip/ MFW Isolation					
a. Manual Initiation	1,2,3[(a)]	1[(b)]	A.B	SR 3.3.6.5 ~~SR 3.3.6.6~~	MIC-03-16-0 0007
b. ~~Automatic~~ Actuation Logic and Actuation Outputs	1,2,3[(a)]	~~2~~4 subsystems	A.B	SR 3.3.6.4 SR 3.3.6.5	MIC-03-16-0 0007
c. Low Pressurizer Pressure	1,2,3[(a)]	~~2~~3[(c)]	A.B	SR 3.3.6.1 SR 3.3.6.2 SR 3.3.6.3	MIC-03-16-0 0007
d. High Pressurizer Pressure	1,2,3[(a)]	~~2~~3[(c)]	A.B	SR 3.3.6.1 SR 3.3.6.2 SR 3.3.6.3	MIC-03-16-0 0007
e. Low Steam Generator Water Level	1,2,3[(a)]	1[(c)] per SG for any ~~2~~3 SGs	A.B	SR 3.3.6.1 SR 3.3.6.2 SR 3.3.6.3	MIC-03-16-0 0007
f. Rod Drive Motor-Generator Set Trip Device	1,2,3[(a)]	2 subsystems (1 for each MG-Set)	A.B	SR 3.3.6.6	MIC-03-16-0 0007
2. EFWS Actuation					
a. Manual Initiation	1,2,3[(a)]	1[(b)]	A.B	SR 3.3.6.5	MIC-03-16-0 0007
b. ~~Automatic~~ Actuation Logic and Actuation Outputs	1,2,3[(a)]	~~2~~4 subsystems	A.B	SR 3.3.6.5	MIC-03-16-0 0007
c. Low Steam Generator Water Level	Refer to Function 1.e (Reactor Trip/ Turbine Trip/ MFW Isolation - Low Steam Generator Water Level) for all ~~Low Steam Generator Water Level~~ requirements.				MIC-03-16-0 0007

(a) With the Pressurizer Pressure > P-11

(b) Manual ~~i~~Initiation and Manual Control ~~f~~Functions require operation of 2 switches on the DHP:~~.~~ (1) ~~t~~The Permissive Switch for DAS HSI, which is common to all Manual Initiation and Manual Control Functions, and (2) the ~~m~~Manual ~~i~~Initiation or Manual Control switch ~~on the DHP.~~ which is unique for each Function. Therefore, a channel consists of both switches and their respective interfaces to two of the four DAAC subsystems.   MIC-03-16-0 0007

(c) Required channels for each of the four DAAC subsystems must be OPERABLE.

Table 3.3.6-1 (page 2 of 2)
Diverse Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	
3. ECCS Actuation					
a. Manual Initiation	1,2,3(a)	1(b)	A,B	SR 3.3.6.5	MIC-03-16-0 0007
b. Actuation Logic and Actuation Outputs	1,2,3(a)	4 subsystems	A,B	SR 3.3.6.4 SR 3.3.6.5	MIC-03-16-0 0007
c. Low-Low Pressurizer Pressure	1,2,3(a)	3(c)	A,B	SR 3.3.6.1 SR 3.3.6.2 SR 3.3.6.3	MIC-03-16-0 0007
4. Containment Isolation					
a. Manual Initiation	1,2,3(a)	1(b)	A,B	SR 3.3.6.5	MIC-03-16-0 0007
5. EFW Isolation Valves					
a. Manual Control	1,2,3(a)	1(b) for each SG	A,B	SR 3.3.6.5	MIC-03-16-0 0007
6. Pressurizer Safety Depressurization Valves					
a. Manual Control	1,2,3(a)	1(b)	A,B	SR 3.3.6.5	MIC-03-16-0 0007
b. Actuation Logic and Actuation Outputs	1,2,3(a)	4 subsystems	A,B	SR 3.3.6.4 SR 3.3.6.5	MIC-03-16-0 0007
7. Main Steam Depressurization Valves					
a. Manual Control	1,2,3(a)	1(b) for each SG	A,B	SR 3.3.6.5	MIC-03-16-0 0007
b. Actuation Logic and Actuation Outputs	1,2,3(a)	4 subsystems	A,B	SR 3.3.6.4 SR 3.3.6.5	MIC-03-16-0 0007
8. Main Steam Line Isolation					MIC-03-16-0 0007
a. Manual Control	1,2,3(a)	1(b)	A,B	SR 3.3.6.5	MIC-03-16-0 0007
b. Actuation Logic and Actuation Outputs	1,2,3(a)	4 subsystems	A,B	SR 3.3.6.4 SR 3.3.6.5	MIC-03-16-0 0007

(a) With the Pressurizer Pressure > P-11

(b) ~~One channel is~~Manual Initiation and Manual Control Functions require operation of 2 switches on the DHP: (1) ~~t~~The Permissive Switch for DAS HSI, which is common to all Manual Initiation~~/~~ and Manual Control functions, and (2) the Manual Initiation or Manual Control switch, which is unique for each Function. Therefore, a channel consists of both switches and their respective interfaces to two of the four DAAC subsystems.

(c) Required channels for each of the four DAAC subsystems must be OPERABLE.

MIC-03-16-0 0007

3.4   REACTOR COOLANT SYSTEM (RCS)

3.4.6   RCS Loops - MODE 4

LCO 3.4.6   Two RCS loops shall be OPERABLE and one RCS loop shall be in operation.

OR

Three Residual Heat Removal (RHR) loops shall be OPERABLE and two RHR loops shall be in operation and all sources of unborated water shall be isolated.

DCD_15.4.6-6

---NOTES--

1.   All reactor coolant pumps (RCPs) and CS/RHR pumps may be removed from operation for ≤ 1 hour per 8 hour period provided:

   a.   No operations are permitted that would cause introduction of coolant into the RCS with boron concentration less than required to meet the SDM of LCO 3.1.1; and

   b.   Core outlet temperature is maintained at least 10°F below saturation temperature.

2.   No RCP shall be started with any RCS cold leg temperature ≤ the Low Temperature Overpressure Protection (LTOP) arming temperature specified in the PTLR unless the secondary side water temperature of each steam generator (SG) is ≤ 50°F above each of the RCS cold leg temperatures.

APPLICABILITY: MODE 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One required loop inoperable.	A.1 Initiate action to restore a second loop to OPERABLE status. AND	Immediately

ACTIONS (continued)

CONDITION		REQUIRED ACTION	COMPLETION TIME
	A.2	--------------NOTE-------------- Only required if two RHR loops are OPERABLE. ------------------------------------- Be in MODE 5.	 24 hours
B. Two or more required loops inoperable. OR Required loop(s) not in operation.	B.1 AND B.2	Suspend operations that would cause introduction of coolant into the RCS with boron concentration less than required to meet SDM of LCO 3.1.1. Initiate action to restore one loop to OPERABLE status and operation.	Immediately Immediately
C. -----------NOTE----------- Separate Condition entry is allowed for each unborated water source isolation valve. ---------------------------- -----------NOTE----------- Required Action C.2 must be completed whenever Condition C is entered. ---------------------------- One or more valves not secured in closed position.	C.1 AND C.2	Initiate actions to secure valve in closed position except during planned dilution or makeup. Following a planned dilution or makeup, isolate all sources of unborated water by initiaing action to secure the valves closed within 15 minutes. Perform SR 3.1.1.1 (SDM verification)	Immediately 4 hours

DCD_15.4.6-6

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.6.1	Verify required RHR or RCS loops are in operation. If no RCS loops are in operation, perform SR 3.4.6.4.	In accordance with the Surveillance Frequency Control Program
SR 3.4.6.2	Verify SG secondary side water levels are ≥ 13% for required RCS loops.	In accordance with the Surveillance Frequency Control Program
SR 3.4.6.3	--------------------------------NOTE-------------------------- Not required to be performed until 24 hours after a required pump is not in operation. --- Verify correct breaker alignment and indicated power are available to each required pump.	In accordance with the Surveillance Frequency Control Program
SR 3.4.6.4	-----------------------------NOTE------------------------ Not required to be performed unless no RCPs are in operation. --- Verify each valve that isolates unborated water sources is secured in the closed position.	In accordance with the Surveillance Frequency Control Program

DCD_15.4.6-6

DCD_15.4.6-6

3.4   REACTOR COOLANT SYSTEM (RCS)

3.4.7   RCS Loops - MODE 5, Loops Filled

LCO 3.4.7   Two residual heat removal (CS/RHR) loops shall be OPERABLE and in operation, and all sources of unborated water shall be isolated and either: | DCD_15.4.6-6

a.   One additional RHR loop shall be OPERABLE or

b.   The secondary side water level of at least two steam generators (SGs) shall be ≥ 13%.

---NOTES---
The CS/RHR pumps of the loops in operation may be removed from operation for ≤ 1 hour per 8 hour period provided:

a.   No operations are permitted that would cause introduction of coolant into the RCS with boron concentration less than required to meet the SDM of LCO 3.1.1; and

b.   Core outlet temperature is maintained at least 10°F below saturation temperature.

1.   One required RHR loop may be inoperable for up to 2 hours for surveillance testing provided that the other RHR loops are OPERABLE and in operation.

2.   No reactor coolant pump shall be started with one or more RCS cold leg temperatures ≤ the Low Temperature Overpressure Protection (LTOP) arming temperature specified in the PTLR unless the secondary side water temperature of each SG is ≤ 50°F above each of the RCS cold leg temperatures.

3.   All RHR loops may be removed from operation during planned heatup to MODE 4 when at least one RCS loop is in operation. The requirement for isolation of the unborated water sources is removed as soon as one RCP is in operation. | DCD_15.4.6-6

APPLICABILITY: MODE 5 with RCS Loops Filled.

ACTIONS (continued)

CONDITION		REQUIRED ACTION		COMPLETION TIME	
C.	----------NOTE---------- Separate Condition entry is allowed for each unborated water source isolation valve. ---------------------------- ----------NOTE---------- Required Action C.2 must be completed whenever Condition C is entered. ----------------------------	C.1	Initiate actions to secure valve in closed position except during planned dilution or makeup. Following a planned dilution or makeup, isolate all source of unborated water by initiaing action to secure the valves closed within 15 minutes. AND	Immediately	DCD_15.4.6-6
	One or more valves not secured in closed position.	C.2	Perform SR 3.1.1.1 (SDM verification)	4 hours	

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.4.7.1	Verify required RHR loops are in operation.	In accordance with the Surveillance Frequency Control Program
SR 3.4.7.2	Verify SG secondary side water level is ≥ 13% in required SGs.	In accordance with the Surveillance Frequency Control Program
SR 3.4.7.3	--------------------------------NOTE------------------------- Not required to be performed until 24 hours after a required pump is not in operation. -- Verify correct breaker alignment and indicated power are available to each required CS/RHR pump.	In accordance with the Surveillance Frequency Control Program
SR 3.4.7.4	--------------------------------NOTE------------------------- Not required to be performed unless no RCPs in operation. -- Verify each valve that isolates unborated water sources is secured in the closed position.	In accordance with the Surveillance Frequency Control Program

DCD_15.4.6-6

3.4   REACTOR COOLANT SYSTEM (RCS)

3.4.8   RCS Loops - MODE 5, Loops Not Filled

LCO 3.4.8   Three residual heat removal (RHR) loops shall be OPERABLE and two
                    RHR loops shall be in operation, and low-pressure letdown line isolation
                    valve shall be OPERABLE and all sources of unborated water shall be   DCD_15.4.6-
                    isolated.   6
                    --NOTES--

                    1.   One CS/RHR pump may be removed from operation for
                           ≤ 15 minutes when switching from one loop to another provided:

                           a.   The core outlet temperature is maintained > 10°F below
                                  saturation temperature,

                           b.   No operations are permitted that would cause introduction
                                  of coolant into the RCS with boron concentration less than
                                  required to meet the SDM of LCO 3.1.1; and

                           c.   No draining operations to further reduce the RCS water
                                  volume are permitted.

                    2.   One required RHR loop may be inoperable for ≤ 2 hours for
                           surveillance testing provided that the other two RHR loops are
                           OPERABLE and in operation.

APPLICABILITY: MODE 5 with RCS loops not filled.

ACTIONS

CONDITION		REQUIRED ACTION	COMPLETION TIME
A. One required RHR loop inoperable.	A.1	Initiate action to restore RHR loop to OPERABLE status.	Immediately
B. One low-pressure letdown isolation valve inoperable.	B.1	Initiate action to restore low-pressure letdown line isolation valve to OPERABLE status.	Immediately

ACTIONS (continued)

CONDITION		REQUIRED ACTION		COMPLETION TIME
C. Less than two required RHR loops OPERABLE. OR Less than two Required RHR loops in operation.	C.1	Suspend operations that would cause introduction of coolant into the RCS with boron concentration less than required to meet SDM of LCO 3.1.1. AND		Immediately
	C.2	Initiate action to restore two RHR loops to OPERABLE status and operation.		Immediately
D. ----------NOTE---------- Separate Condition entry is allowed for each unborated water source isolation valve. ----------------------------- ----------NOTE---------- Required Action D.2 must be completed whenever Condition D is entered. ----------------------------- One or more valves not secured in closed position.	D.1	Initiate actions to secure valve in closed position except during planned dilution or makeup. Following a planned dilution or makeup, isolate all sources of unborated water by initiaing action to secure the valves closed within 15 minutes. AND		Immediately
	D.2	Perform SR 3.1.1.1 (SDM verification)		4 hours

DCD_15.4.6-6

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.8.1	Verify required RHR loops are in operation.	In accordance with the Surveillance Frequency Control Program
SR 3.4.8.2	-------------------------------NOTE------------------------- Not required to be performed until 24 hours after a required pump is not in operation. --- Verify correct breaker alignment and indicated power are available to each required CS/RHR pump.	In accordance with the Surveillance Frequency Control Program
SR 3.4.8.3	Perform a complete cycle of each low-pressure letdown line isolation valve.	In accordance with the Surveillance Frequency Control Program
SR 3.4.8.4	-------------------------------NOTE------------------------ Not required to be performed unless no RCPs are in operation. --- Verify each valve that isolates unborated water sources is secured in the closed position.	In accordance with the Surveillance Frequency Control Program

DCD_15.4.6-6

3.4   REACTOR COOLANT SYSTEM (RCS)

3.4.9   Pressurizer

LCO 3.4.9The pressurizer shall be OPERABLE with:

a.   <u>Pressurizer water level ≤ 60% (MODE 1)</u>   DCD_16-298
     Pressurizer water level ≤ 92% <u>(MODES 2 and 3)</u> and

b.   Three groups of pressurizer heaters OPERABLE with the capacity
     of each group ≥ 120 kW and capable of being powered from an
     emergency power supply.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. Pressurizer water level not within limit.	A.1	Be in MODE 3.	6 hours
	AND		
	A.2	Fully insert all rods.	6 hours
	AND		
	A.3	Place Rod Control System in a condition incapable of rod withdrawal.	6 hours
	AND		
	A.4	Be in MODE 4.	12 hours
B. One required group of pressurizer heaters inoperable.	B.1	Restore required group of pressurizer heaters to OPERABLE status.	72 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time of Condition B not met.	C.1 Be in MODE 3. AND C.2 Be in MODE 4.	6 hours 12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY	
SR 3.4.9.1 Verify pressurizer water level is ≤ 60% in MODE 1, or ≤ 92% in MODES 2 and 3.	In accordance with the Surveillance Frequency Control Program	DCD_16-298
SR 3.4.9.2 Verify capacity of each required group of pressurizer heaters is ≥ 120 kW.	In accordance with the Surveillance Frequency Control Program	

3.4   REACTOR COOLANT SYSTEM (RCS)

3.4.12 Low Temperature Overpressure Protection (LTOP) System

LCO 3.4.12   An LTOP System shall be OPERABLE with a maximum of two Safety
                     Injection (SI) pumps and one charging pump capable of injecting into the
                     RCS and the accumulators isolated and one of the following pressure
                     relief capabilities:

                     a.   Two residual heat removal (RHR) suction relief valves with
                             setpoints specified in the PTLR ≥ 456 psig and ≤ 484 psig, or   DCD_05.03.
                                                                                                    02-9

                     b.   The RCS depressurized and an RCS vent of ≥ 4.7 square inches.

                     --NOTES---
                     1.   Two charging pumps may be made capable of injecting for ≤ 1 hour
                             for pump swap operations.

                     2.   Accumulator may be unisolated when accumulator pressure is less
                             than the maximum RCS pressure for the existing RCS cold leg
                             temperature allowed by the P/T limit curves provided in the PTLR.

APPLICABILITY: MODE 4 when any RCS cold leg temperature is ≤ LTOP arming
                     temperature specified in the PTLR,
                     MODE 5,
                     MODE 6 when the reactor vessel head is on.

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
Verify leakage from each RCS PIV is equivalent to ≤ 0.5 gpm per nominal inch of valve size up to a maximum of 5 gpm at an RCS pressure ≥ 2215 psig and ≤ 2255 psig.	In accordance with the Inservice Testing Program, and Surveillance Frequency Control Program AND Prior to entering MODE 2 whenever the unit has been in MODE 5 for 7 days or more, if leakage testing has not been performed in the previous 9 months AND Within 24 hours following valve actuation due to automatic or manual action or flow through the valve
SR 3.4.14.2 --------------------------------NOTE------------------------- Not required to be met when the RHR System suction valve interlock is disabled in accordance with SR 3.4.12.7. -- Verify RHR System suction valve interlock prevents the valves from being opened with a simulated or actual RCS pressure signal ≥ 425 psig.	In accordance with the Surveillance Frequency Control Program

MAP-16-401

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.4.1	----------------------------NOTE-------------------------- Only required to be performed when containment air temperature is < 32°F or > 120°F. --- Verify RWSP borated water temperature is ≥ 32°F and ≤ 120°F.	In accordance with the Surveillance Frequency Control Program
SR 3.5.4.2	Verify RWSP borated water volume is ≥ ~~583,340 gallons~~76,600 ft³ (573,000 gallons).	In accordance with the Surveillance Frequency Control Program
SR 3.5.4.3	Verify RWSP boron concentration is ≥ 4000 ppm and ≤ 4200 ppm.	In accordance with the Surveillance Frequency Control Program
SR 3.5.4.4	Verify isotopic concentration of B-10 in the RWSP is ≥ 19.9% (atom percent).	In accordance with the Surveillance Frequency Control Program

DCD_06.02.02-64

Table 3.7.1-2 (page 1 of 1)
Main Steam Safety Valve Lift Settings

VALVE NUMBER				LIFT SETTING (psig ± 1%)
STEAM GENERATOR				
#1	#2	#3	#4	
~~MS-V509A~~ MSS-SRV-509A	~~MS-V509B~~ MSS-SRV-509B	~~MS-V509C~~ MSS-SRV-509C	~~MS-V509D~~ MSS-SRV-509D	1185
~~MS-V510A~~ MSS-SRV-510A	~~MS-V510B~~ MSS-SRV-510B	~~MS-V510C~~ MSS-SRV-510C	~~MS-V510D~~ MSS-SRV-510D	1215
~~MS-V511A~~ MSS-SRV-511A	~~MS-V511B~~ MSS-SRV-511B	~~MS-V511C~~ MSS-SRV-511C	~~MS-V511D~~ MSS-SRV-511D	1244
~~MS-V512A~~ MSS-SRV-512A	~~MS-V512B~~ MSS-SRV-512B	~~MS-V512C~~ MSS-SRV-512C	~~MS-V512D~~ MSS-SRV-512D	1244
~~MS-V513A~~ MSS-SRV-513A	~~MS-V513B~~ MSS-SRV-513B	~~MS-V513C~~ MSS-SRV-513C	~~MS-V513D~~ MSS-SRV-513D	1244
~~MS-V514A~~ MSS-SRV-514A	~~MS-V514B~~ MSS-SRV-514B	~~MS-V514C~~ MSS-SRV-514C	~~MS-V514D~~ MSS-SRV-514D	1244

MAP-16-402

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY	
SR 3.7.7.1	------------------------------NOTE------------------------ Isolation of CCW flow to individual components does not render the CCW System inoperable. --- Verify each CCW manual, power operated, and automatic valve in the flow path servicing safety related equipment, that is not locked, sealed, or otherwise secured in position, is in the correct position.	In accordance with the Surveillance Frequency Control Program	
SR 3.7.7.2	Verify train leakage for each CCW train is less than 3 gallons per hour.	In accordance with the Surveillance Frequency Control Program	DCD_09.02. 02-49
SR 3.7.7.3	Verify total subsystem leakage for CCW valving used to isolate non-safety piping is less than 25 gallons per 7 days.	In accordance with the Surveillance Frequency Control Program	DCD_09.02. 02-49
SR 3.7.7.~~2~~4	Verify each CCW automatic valve in the flow path that is not locked, sealed, or otherwise secured in position, actuates to the correct position on an actual or simulated actuation signal.	In accordance with the Surveillance Frequency Control Program	DCD_09.02. 02-49
SR 3.7.7.~~3~~5	Verify each CCW pump starts automatically on an actual or simulated actuation signal.	In accordance with the Surveillance Frequency Control Program	DCD_09.02. 02-49

3.7 PLANT SYSTEMS

3.7.9   Ultimate Heat Sink (UHS)

LCO 3.7.9   Three UHS cooling towers shall be OPERABLE including their associated
                     fans and three OPERABLE transfer pumps.

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

ACTIONS

CONDITION		REQUIRED ACTION	COMPLETION TIME
A. One required cooling tower with associated cooling tower fans inoperable.	A.1	Restore three cooling towers with associated fans to OPERABLE status.	72 hours
	OR		
	A.2	-------------NOTES------------- This Required Action is not applicable in MODE 4. ------------------------------------	
		Apply the requirements of Specification 5.5.18.	72 hours
B. One or more required UHS basins with water temperature not within limits.	B.1	Verify that water temperature of the UHS is ≤ ~~95~~93°F averaged over the previous 24 hour period.	~~o~~Once per hour
C. One or more required UHS basins with water level not within limits.	C.1	Restore water level(s) to within limits.	72 hours
D. One or more required UHS transfer pump(s) inoperable.	D.1	Restore the transfer pump(s) to OPERABLE status.	7 days
	OR		
	D.2.1	Implement an alternate method of basin transfer.	7 days
		AND	
	D.2.2	Restore the transfer pump(s) to OPERABLE status.	31 days

MAP-16-403

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. Required Action and associated Completion Time of Condition A, B, C, or D not met. OR UHS inoperable for reasons other than Condition A, B, C, or D.	E.1 Be in MODE 3. AND E.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY	
SR 3.7.9.1	Verify each required UHS basin water ~~level~~inventory is ≥ 2,800,000 gallons.	In accordance with the Surveillance Frequency Control Program	MAP-16-403
SR 3.7.9.2	Verify water temperature of UHS is ≤ 93°F.	In accordance with the Surveillance Frequency Control Program	
SR 3.7.9.3	Operate each cooling tower fan for ≥ 15 minutes.	In accordance with the Surveillance Frequency Control Program	
SR 3.7.9.4	Verify each cooling tower fan starts automatically on an actual or simulated actuation signal.	In accordance with the Surveillance Frequency Control Program	
SR 3.7.9.5	Verify each UHS transfer pump starts on manual actuation.	In accordance with the Inservice Testing Program	

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.7.11.1	Operate each Annulus Emergency Exhaust System train for ≥ 15 minutes.	In accordance with the Surveillance Frequency Control Program
SR 3.7.11.2	Perform required Annulus Emergency Exhaust System filter testing in accordance with the Ventilation Filter Testing Program (VFTP).	In accordance with the VFTP
SR 3.7.11.3	Verify each Annulus Emergency Exhaust System train actuates on an actual or simulated actuation signal.	In accordance with the Surveillance Frequency Control Program
SR 3.7.11.4	Verify the associated room can be maintained at a pressure ≤ -0.25 inches water gauge relative to ~~atmospheric pressure~~surrounding areas using one Annulus Emergency Exhaust System train during the accident condition at a flow rate of ≤ 5600 cfm within 240 seconds after a start signal.	In accordance with the Surveillance Frequency Control Program

DCD_14.03.07-55

5.5 Programs and Manuals

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5.5.4   Radioactive Effluent Controls Program (continued)

i.   Limitations on the annual and quarterly doses to a member of the public from iodine-131, iodine-133, tritium, and all radionuclides in particulate form with half lives > 8 days in gaseous effluents released from each unit to areas beyond the site boundary, conforming to 10 CFR 50, Appendix I, and

j.   Limitations on the annual dose or dose commitment to any member of the public, beyond the site boundary, due to releases of radioactivity and to radiation from uranium fuel cycle sources, conforming to 40 CFR 190.

        The provisions of SR 3.0.2 and SR 3.0.3 are applicable to the Radioactive Effluent Controls Program surveillance frequency.

5.5.5   Component Cyclic or Transient Limit

This program provides controls to track the FSAR ~~Chapter 3~~Subsection 3.9.1, cyclic and transient occurrences to ensure that components are maintained within the design limits. | MIC-03-16-0 0005

5.5.6   Prestressed Concrete Containment Tendon Surveillance Program

This program provides controls for monitoring any tendon degradation in prestressed concrete containments, including effectiveness of its corrosion protection medium, to ensure containment structural integrity. The program shall include baseline measurements prior to initial operations. The Tendon Surveillance Program, inspection frequencies, and acceptance criteria shall be in accordance with Section XI, Subsection IWL of the ASME Boiler and Pressure Vessel Code and applicable addenda as required by 10 CFR 50.55a, except where an alternative, exemption, or relief has been authorized by the NRC.

The provisions of SR 3.0.3 are applicable to the Tendon Surveillance Program inspection frequencies.

5.5.7   Reactor Coolant Pump Flywheel Inspection Program

This program shall provide for the inspection of each reactor coolant pump flywheel per the recommendations of Regulatory Position C.4.b of Regulatory Guide 1.14, Revision 1, August 1975.

In lieu of Position C.4.b(1) and C.4.b(2), a qualified in-place UT examination over the volume from the inner bore of the flywheel to the circle one-half of the outer radius or a surface examination (MT and/or PT) of exposed surfaces of the removed flywheels may be conducted at 20 year intervals.

5.5 Programs and Manuals

5.5.11 Ventilation Filter Testing Program (VFTP)

A program shall be established to implement the following required testing of Engineered Safety Feature (ESF) filter ventilation systems at the frequencies specified in accordance with Regulatory Guide 1.52, Revision 3, ASME N510-1989, and AG-1.

a. Demonstrate for each of the ESF systems that an inplace test of the high efficiency particulate air (HEPA) filters shows a penetration and system bypass < 0.05% when tested in accordance with Regulatory Guide 1.52, Revision 3, and ASME N510-1989 at the system flowrate specified below ± 10%.

ESF Ventilation System	Flowrate
Main Control Room Emergency Filtration System (MCREFS)	3600 cfm
Annulus Emergency Exhaust System (AEES)	5600 cfm

b. Demonstrate for each of the ESF systems that an inplace test of the charcoal adsorber shows a penetration and system bypass < 0.05% when tested in accordance with Regulatory Guide 1.52, Revision 3, and ASME N510-1989 at the system flowrate specified below ± 10%.

ESF Ventilation System	Flowrate
MCREFS	3600 cfm

c. Demonstrate for each of the ESF systems that a laboratory test of a sample of the charcoal adsorber, when obtained as described in Regulatory Guide 1.52, Revision 3, shows the methyl iodide penetration less than the value specified below when tested in accordance with ASTM D3803-1989 at a temperature of 30°C (86°F) and the relative humidity specified below.

ESF Ventilation System	Penetration	RH	Face Velocity	
MCREFS	2.5%	70%	2400 fpm	DCD_16-136

5.5 Programs and Manuals

5.5.14 Technical Specifications (TS) Bases Control Program

This program provides a means for processing changes to the Bases of these Technical Specifications.

a.   Changes to the Bases of the TS shall be made under appropriate administrative controls and reviews.

b.   Licensees may make changes to Bases without prior NRC approval provided the changes do not require ~~either~~any of the following: DCD_16-303

1.   A change in the plant specific TS incorporated in the combined license;~~ or~~

2.   ~~A change to the updated FSAR or Bases that requires NRC approval pursuant to 10 CFR 50.59.~~A change to or a departure from Tier 1 or Tier 2* information in the FSAR pursuant to 10 CFR 52.98(c)(1);

3.   A change to or a departure from Tier 2 information in the FSAR pursuant to 10 CFR 52.98(c)(1) that requires prior NRC approval;

4.   A change to site-specific information in the FSAR pursuant to 10 CFR 52.98(c)(2) that requires prior NRC approval; or

5.   Any other change to the Bases that requires prior NRC approval.

c.   The Bases Control Program shall contain provisions to ensure that the Bases are maintained consistent with the FSAR as updated.   DCD_16-303

d.   Proposed changes that meet the criteria of Specification 5.5.14b above shall be reviewed and approved by the NRC prior to implementation. Changes to the Bases implemented without prior NRC approval shall be provided to the NRC on a frequency consistent with 10 CFR 50.71(e).

5.5.15 Safety Function Determination Program (SFDP)

This program ensures loss of safety function is detected and appropriate actions taken. Upon entry into LCO 3.0.6, an evaluation shall be made to determine if loss of safety function exists. Additionally, other appropriate actions may be taken as a result of the support system inoperability and corresponding exception to entering supported system Condition and Required Actions. This program implements the requirements of LCO 3.0.6. The SFDP shall contain the following:

a.   Provisions for cross-train checks to ensure a loss of the capability to perform the safety function assumed in the accident analysis does not go undetected,

b.   Provisions for ensuring the plant is maintained in a safe condition if a loss of function condition exists,

5.5 Programs and Manuals

5.5.20 <u>Control Room Envelope Habitability Program</u> (continued)

e. The quantitative limits on unfiltered air inleakage into the CRE. These limits shall be stated in a manner to allow direct comparison to the unfiltered air inleakage measured by the testing described in paragraph c. The unfiltered air inleakage limit for radiological challenges is the inleakage flow rate assumed in the licensing basis analyses of DBA consequences. Unfiltered air inleakage limits for hazardous chemicals must ensure that exposure of CRE occupants to these hazards will be within the assumptions in the licensing basis.

f. The provisions of SR 3.0.2 are applicable to the Frequencies for assessing CRE habitability, determining CRE unfiltered inleakage, and measuring CRE pressure and assessing the CRE boundary as required by paragraphs c and d, respectively.

5.5.21 <u>Setpoint Control Program (SCP)</u>

a. The Setpoint Control Program (SCP) implements the regulatory requirement of 10 CFR 50.36 (c)(1)(ii) (A) that technical specifications will include items in the category of limiting safety system settings (LSSS), which are settings for automatic protective devices related to those variables having significant safety functions. MIC-03-16-0 0007

b. The Nominal Trip Setpoint (NTSP), Allowable Value (AV), Performance Test Acceptance Criteria (PTAC), and Calibration Tolerance (CT) for each Technical Specification required automatic protection instrumentation function (i.e., reactor trip, ESFAS actuation and permissive interlocks) shall be calculated in conformance with the instrumentation setpoint methodology previously reviewed and approved by the NRC in [Title, Revision No., dated Month dd, yyyy, (MLxxxxxxxxx)], and the conditions stated in the associated NRC safety evaluation, [Letter to MHI from NRC, Title, dated Month, dd, yyyy, (MLxxxxxxxxx)]. MIC-03-16-0 0007

c. For each Technical Specification required automatic protection instrumentation function implemented with a <s>digital bistable function</s>conventional analog bistable, performance of a <s>CHANNEL CALIBRATION</s>COT surveillance shall include the following: MIC-03-16-0 0007

1. <s>If all as-found calibration setting values are inside the two-sided limits of (calibration setting ± pre-defined test acceptance criteria band (PTAC)), then the channel is fully operable.</s>The as-found value of the instrument channel trip setting shall be compared with the previous as-left value of the specified NTSP. MIC-03-16-0 0007

  i. <s>If any as-found calibration setting value is outside the two-sided limits of (calibration setting ± PTAC), but inside the limits of ± AV, then the channel is operable but degraded, and corrective action is required to restore the channel to within specifications.</s>If the

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as-found value of the instrument channel trip setting differs from the previous as-left value or the specified NTSP by more than the PTAC, but less than the specified AV, then the instrument channel shall be evaluated to verify that it is functioning in accordance with its design basis before declaring the surveillance requirement met and returning the instrument channel to service. This condition shall be dispositioned by the plant's corrective action program.

MIC-03-16-00007

ii.   ~~If any as found calibration setting value is outside the two-sided limits of ± AV, then the channel is inoperable, and corrective action is required, including those actions required by 10 CFR 50.36 when automatic protective devices do not function as required.~~If the as-found value of the instrument channel trip setting differs from the specified NTSP by more than the specified AV, then the surveillance requirement is not met and the instrument channel shall be immediately declared inoperable.

~~The Calibration Tolerance (CT) limits are applied to the calibration setting. The instrument channel calibration settings shall be set or confirmed to be within the specified CT around the five calibration settings (0, 25, 50, 75 and 100 percent) at the completion of each CHANNEL CALIBRATION surveillance. CT is a two sided limit controlled by plant procedures, and is typically Sensor Calibration Accuracy (SCA), Rack Calibration Accuracy (RCA), or a combination of both.~~

d.   ~~For each Technical Specification required automatic protection instrumentation function implemented with a binary sensor connected to a digital channel or an analog bistable function, performance of a CHANNEL CALIBRATION surveillance (binary sensors connected to digital channels) or a COT analog surveillance (analog bistables) shall include the following:~~

1.   ~~If the as found trip setting differs from the specified NTSP by less than the PTAC, then the channel is fully operable.~~

2.   ~~If the as found trip setting differs from the specified NTSP by more than the PTAC, but less than the specified AV, then the channel is operable but degraded, and corrective action is required to restore the channel to within specifications.~~

3.   ~~If the as found trip setting is differs from the specified NTSP by more than the specified AV, then the channel is inoperable, and corrective action is required, including those actions required by 10 CFR 50.36 when automatic protective devices do not function as required.~~

~~The CT limits are applied to NTSP.~~

2.   The instrument channel trip setting shall be set or confirmed to be within the specified CT around the NTSP at the completion of each COT ~~analog~~ surveillance; otherwise the surveillance. ~~CT is a two-sided limit controlled by plant procedures, and is typically a function of SCA, RCA or a~~

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combination of both. requirement is not met and the instrument channel shall be immediately declared inoperable.

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d. For each Technical Specification required automatic protection instrumentation function implemented with a binary sensor (e.g., pressure switches, UV relays)a conventional analog bistable, the difference between the instrument channel trip settings as-found value and either the previous as-left trip setting value or the specified NTSP shall be trended and evaluated to verify that the instrument channel is functioning in accordance with its design basis.

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e. For each Technical Specification required automatic protection instrumentation function implemented with a digital bistable functionbinary sensor (e.g., pressure switches, UV relays), a performance of a CHANNEL CALIBRATION surveillance shall include the following:

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1. The as-found value of the instrument channel state change shall be compared with the previous as-left value or the specified NTSP.

i. If the as-found value of the instrument channel state change differs from the previous as-left value or the specified NTSP by more than the PTAC, but less than the specified AV, then the instrument channel shall be evaluated to verify that it is functioning in accordance with its design basis before declaring the surveillance requirement met and returning the instrument channel to service. This condition shall be dispositioned by the plant's corrective action program.

ii. If the as-found value of the instrument channel state change differs from the specified NTSP by more than the specified AV, then the surveillance requirement is not met and the instrument channel shall be immediately declared inoperable.

2. The instrument channel state change shall be set or confirmed to be within the specified CT around the NTSP at the completion of each CHANNEL CALIBRATION surveillance; otherwise, the surveillance requirement is not met and the instrument channel shall be immediately declared inoperable.

f. For each Technical Specification required automatic protection instrumentation function implemented with a binary sensor, the difference between the instrument channel calibration setting (0, 25, 50, 75 and 100 percent)state change as-found and either the previous as-left values or the specified NTSP shall be trended and evaluated to verify that the instrument channel is functioning in accordance with its design basis.

g. For each Technical Specification required automatic protection instrumentation function implemented with an analog bistable function,sensor (e.g., pressure transmitter), performance of a CHANNEL CALIBRATION surveillance shall include the following:

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1.   The as-found value of the instrument channel calibration setting shall be compared with the previous as-left value or the specified calibration setting at five calibration settings corresponding to 0%, 25%, 50%, 75% and 100% of the instrument range.

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   i.   If any as-found calibration setting value is outside the two-sided limits of "previous as-left value ± PTAC" or "calibration setting ± PTAC," but inside the specified limits of ± AV, then the instrument channel shall be evaluated to verify that it is functioning in accordance with its design basis before declaring the surveillance requirement met and returning the instrument channel to service. This condition shall be dispositioned by the plant's corrective action program.

   ii.   If any as-found calibration setting value is outside of the two-sided limits of ± AV, then the surveillance requirement is not met and the instrument channel shall be immediately declared inoperable.

2.   The instrument channel calibration settings shall be set or confirmed to be within the specified CT around the five calibration settings (0%, 25%, 50%, 75%, and 100%) at the completion of each CHANNEL CALIBRATION surveillance; otherwise, the surveillance requirement is not met and the instrument channel shall be immediately declared inoperable.

h.   For each Technical Specification required automatic protection instrumentation function implemented with an analog sensor, the difference between the instrument channel ~~trip~~calibration setting (0%, 25%, 50%, 75% and 100%) as-found value and either the previous as-left ~~trip setting~~ value or the specified ~~NTSP~~calibration setting shall be trended and evaluated to verify that the instrument channel is functioning in accordance with its design basis.

i.   The SCP shall establish a document containing the current values of the specified NTSP, AV, PTAC, and CT for each Technical Specification required automatic protection instrumentation function, and references to the calculation documentation. Changes to this document shall be governed by the regulatory requirements of 10 CFR 50.59. In addition, changes to the specified NTSP, AV, PTAC, and CT values shall be governed by the approved setpoint methodology. This document, including any midcycle revisions or supplements, shall be provided upon issuance for each reload cycle to the NRC.

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j.   For each Technical Specification required automatic protection instrumentation function implemented with a digital bistable, the Nominal Trip Setpoint value shall be confirmed during the software MEMORY INTEGRITY CHECK (MIC).

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5.5.22 Technical Requirements Manual (TRM)

The TRM contains selected requirements which do not meet the criteria for inclusion in the Technical Specification but are important to the operation of Comanche Peak Units 3 and 4.

5.6 Reporting Requirements

5.6.4   Reactor Coolant System (RCS) PRESSURE AND TEMPERATURE LIMITS REPORT
        (PTLR)

   a.   RCS pressure and temperature limits for heat up, cooldown, low temperature
           operation, criticality, and hydrostatic testing, LTOP arming, as well as heatup and   MIC-03-16-0
           cooldown rates shall be established and documented in the PTLR for the   0005
           following:

           3.4.3, "RCS Pressure and Temperature (P/T) Limits"
           3.4.12, "Low Temperature Overpressure Protection System"

   b.   The analytical methods used to determine the RCS pressure and temperature
           limits shall be those previously reviewed and approved by the NRC, specifically
           those described in the MUAP-09016, "Pressure and Temperature Limits Report"

   c.   The PTLR shall be provided to the NRC upon issuance for each reactor vessel
           fluence period and for any revision or supplement thereto.

5.6.5   Post Accident Monitoring Report

        When a report is required by Condition B of LCO 3.3.3, "Post Accident Monitoring (PAM)
        Instrumentation," a report shall be submitted within the following 14 days. The report
        shall outline the preplanned alternate method of monitoring, the cause of the inoperability,
        and the plans and schedule for restoring the instrumentation channels of the Function to
        OPERABLE status.

5.6.6   Tendon Surveillance Report

        Any abnormal degradation of the containment structure detected during the tests required
        by the Prestressed Concrete Containment Tendon Surveillance Program shall be
        reported to the NRC within 30 days. The report shall include a description of the tendon
        condition, the condition of the concrete (especially at tendon anchorages), the inspection
        procedures, the tolerances on cracking, and the corrective action taken.

Bases

Bases – Tracking Report Revision List

Change ID No.	Section	TS Rev 2 Page*	Reason for change	Change Summary	Rev . of T/R
MIC-03-16-00007	B 3.1.9	B 3.1.9-7	Consistency with DCD changes identified by MIC-03-16-00007.	Revised the sections listed in Section column based on the MHI/NRC DCD Technical Specifications meeting on 1/17/2012.	0
	B 3.3.1	B 3.3.1-1 through B 3.3.1-51 [B 3.3.1-1 through B 3.3.1-67]			
	B 3.3.2	B 3.3.2-1 through B 3.3.2-60 [B 3.3.2-1 through B 3.3.2-94]			
	B 3.3.3	B 3.3.3-1 through B 3.3.3-12 [B 3.3.3-1 through B 3.3.3-18]			
	B 3.3.4	B 3.3.4-1 through B 3.3.4-4 [B 3.3.4-1 through B 3.3.4-9]			
	Table B 3.3.4-1 (Sheets 1,2)(New Table)	B 3.3.4-4 [B 3.3.4-10 B 3.3.4-11]			
	Table B 3.3.4-2 (Sheets 1,2,3)(new Table)	B 3.3.4-4 [B3.3.4-12 through B 3.3.4-14]			
	B.3.3.5	B 3.3.5-1 through B 3.3.5-7 [B3.3.5-1 through B 3.3.5-11]			
	B.3.3.6	B 3.3.6-1 through B 3.3.6-12 [B3.3.6-1			

Change ID No.	Section	TS Rev 2 Page*	Reason for change	Change Summary	Rev. of T/R
		through B 3.3.6-19]			
DCD_16-304	B 3.1.4 B 3.1.6 B 3.2.3 B 3.4.1 B 3.4.16 B 3.5.1 B 3.7.15	B 3.1.4-8 B 3.1.6-5 B 3.2.3-6 B 3.4.1-3 [B 3.4.1-3 B 3.4.1-4] B 3.4.16-5 B 3.5.1-8 B 3.7.15-2	Reflect Response to DCD RAI No. 816	Clarified the basis of the surveillance requirements.	0
CTS-01463	B 3.2.1	B 3.2.1-10	Correction	Deleted unnecessary return.	0
CTS-01471	B 3.4.3	B 3.4.3-3	Editorial	Numbered the last paragraph as "c" in consistency with DCD.	0
DCD_15.4.6-6	B 3.4.6 B 3.4.7 B 3.4.8	B 3.4.6-1 B 3.4.6-3 through B 3.4.6-5 [B 3.4.6-1 through B 3.4.6-7] B 3.4.7-1 through B 3.4.7-5 [B 3.4.7-1 through B 3.4.7-7] B 3.4.8-1 through B 3.4.8-4 [B 3.4.8-1 through B 3.4.8-5 and B 3.4.8-7]	Reflect Response to DCD RAI No.682	Added new sentences and revised each item in consistency with DCD.	0
CTS-01472	B3.4.6	B 3.4.6-3	Editorial	Added "(" to LCO 3.9.5.	0

Change ID No.	Section	TS Rev 2 Page*	Reason for change	Change Summary	Rev. of T/R
CTS-01473	B 3.4.8	B 3.4.8-3 [B 3.4.8-4]	Editorial	Inserted space between "to" and "criticality" in second sentence of C.1 and C.2.	0
MAP-16-404	B3.4.8	B 3.4.8-4 [B 3.4.8-6]	Consistency with DCD	Inserted "every 12 hours" after "This SR requires verification" in the first sentence of SR 3.4.8.1.	0
DCD_16-298	B 3.4.9	B 3.4.9-1 through B 3.4.9-4 [B 3.4.9-5] [B 3.4.9-6]	Reflect Response to DCD RAI No.399	Added new sentences and revised each item in consistency with DCD.	0
MIC-03-16-00004	B 3.4.12	B 3.4.12-4	Correction	Corrected reference numbers from 5 to 6 and 6 to 7.	0
MAP-16-405	B 3.4.12	B 3.4.12-5	Consistency with DCD	Deleted third sentence in the first paragraph in consistency with DCD.	0
CTS-01474	B 3.4.14	B 3.4.14-6	Editorial	Inserted space between "of" and "900" in the first sentence of SR 3.4.14.2.	0
MAP-16-406	B 3.5.1	B 3.5.1-4	Consistency with DCD	Revised 19.9 atom percent to 10.9 atom percent in consistency with DCD.	0
MAP-16-407	B 3.5.2	B 3.5.2-7	Consistency with DCD	Deleted following from SR 3.5.2.4: "Testing Program of the ASME Code. The ASME Code provides the"	0
CTS-01475	B 3.6.3	B 3.6.3-5	Editorial	Combined 1st and 2nd paragraph.	0
MAP-16-408	B 3.6.3	B 3.6.3-12	Consistency with DCD	Deleted "(from 184 days)" in consistency with DCD.	0
CTS-01476	B 3.7.5	B 3.7.5-3	Editorial	Split 3rd paragraph in LCO into 3 paragraphs.	0
DCD_09.02.02-84	B 3.7.7	B 3.7.7-1	Response to DCD RAI No. 774	Added description about CCWS capability to support all operating modes, including accident conditions.	0

Change ID No.	Section	TS Rev 2 Page*	Reason for change	Change Summary	Rev. of T/R
DCD_09.02.02-49	B 3.7.7	B 3.7.7-4 [B 3.7.7-5] [B 3.7.7-6]	Reflect Response to DCD RAI No.571	Added surveillance requirement and associated Bases to verify system leakage in consistent with DCD.	0
CTS-01477	B 3.7.7	B 3.7.7-3	Editorial	Combined 2nd paragraph and 3rd paragraph in SR 3.7.7.1.	0
CTS-01478	B 3.7.9	B 3.7.9-1	Correction	Corrected description to include LOOP scenario in consistency with DCD.	0
CTS-01478	B 3.7.9	B 3.7.9-2	Correction	Corrected to relocate description of LOOP scenario in consistency with DCD.	0
CTS-01478	B 3.7.9	B 3.7.9-3	Correction	Corrected description of UHS basin temperature as 93°F in consistency with DCD.	0
MAP-16-409	B 3.7.9	B 3.7.9-5	Consistency with DCD	Replaced "Design Basis Accident" with "design basis LOCA or safe shutdown with LOOP" in consistency with DCD.	0
MAP-16-409	B 3.7.9	B 3.7.9-6	Consistency with DCD and correction	Revised SR 3.7.9.5 description. Deleted "–" between "normal" and "operating" and replaced "ESWS" with "UHS" in 2nd sentence of 1st paragraph of SR 3.7.9.7 for correction.	0
MAP-16-410	B 3.7.10	B 3.7.10-3	Consistency with DCD and correction	Inserted "or isolation mode, as required" at the end of second sentence and corrected wording from "moded" to "mode".	0
MAP-16-411	B 3.7.11	B 3.7.11-2	Consistency with DCD	Inserted "SAFETY" between "design basis is" and "established by" in the first sentence in consistency with DCD.	0
CTS-01480	B 3.7.13	B 3.7.13-1	Editorial	Deleted extra period in the last sentence of the BACKGROUND section.	0
MAP-16-412	B 3.9.2	B 3.9.2-3	Consistency with DCD	Inserted following sentences between second sentence and third sentence: "The boron concentration is checked every 72 hours during MODE 6 under SR 3.9.1.1. This Surveillance demonstrates that the valves are closed through a system walkdown." in consistency with DCD.	0

Change ID No.	Section	TS Rev 2 Page*	Reason for change	Change Summary	Rev. of T/R
MIC-03-16-00008	B 3.9.4	B 3.9.4-4	Correction (Incorporated changes applied to the DCD Chapter 16)	Revised "ALTERNATIONS" to "ALTERATIONS"	0
CTS-01464	B 3.9.8	B 3.9.8-1	Correction	Revised "Chapter 15" to "FSAR Chapter 15".	0

*Page numbers for the attached marked-up pages may differ from the revision 1 page numbers due to text additions and deletions. When the page numbers for the attached pages do differ, the page number for the attached page is shown in brackets.

BASES

ACTIONS (continued)

increasing the RCS boron concentration to provide negative reactivity, as described in the Bases for LCO 3.1.1. The required Completion Time of 1 hour for initiating boration is reasonable, based on the time required for potential xenon redistribution, the low probability of an accident occurring, and the steps required to complete the action. This allows the operator sufficient time to align the required valves and start the boric acid pumps. Boration will continue until the required SDM is restored.

D.2

If more than one rod is found to be misaligned or becomes misaligned because of bank movement, the unit conditions fall outside of the accident analysis assumptions. Since automatic bank sequencing would continue to cause misalignment, the unit must be brought to a MODE or Condition in which the LCO requirements are not applicable. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours.

The allowed Completion Time is reasonable, based on operating experience, for reaching MODE 3 from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE
REQUIREMENTS

SR 3.1.4.1

Verification that individual rod positions are within alignment limits provides a history that allows the operator to detect a rod that is beginning to deviate from its expected position. | DCD_16-304

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.1.4.2

Verifying each control rod is OPERABLE would require that each rod be tripped. However, in MODES 1 and 2 with $K_{eff} \geq 1.0$, tripping each control rod would result in radial or axial power tilts, or oscillations. Exercising each individual control rod provides increased confidence that all rods continue to be OPERABLE without exceeding the alignment limit, even if they are not regularly tripped. Moving each control rod by 10 steps will not cause radial or axial power tilts, or oscillations, to occur.

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.1.6.1

This Surveillance is required to ensure that the reactor does not achieve criticality with the control banks below their insertion limits.

The estimated critical position (ECP) depends upon a number of factors, one of which is xenon concentration. If the ECP was calculated long before criticality, xenon concentration could change to make the ECP substantially in error. Conversely, determining the ECP immediately before criticality could be an unnecessary burden. There are a number of unit parameters requiring operator attention at that point. Performing the ECP calculation within 4 hours prior to criticality avoids a large error from changes in xenon concentration, but allows the operator some flexibility to schedule the ECP calculation with other startup activities.

SR 3.1.6.2

Verification of the control bank insertion limits are periodically performed to detect control banks that may be approaching the insertion limits.   DCD_16-304

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.1.6.3

When control banks are maintained within their insertion limits as checked by SR 3.1.6.2 above, it is unlikely that their sequence and overlap will not be in accordance with requirements provided in the COLR. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

REFERENCES

1. 10 CFR 50, Appendix A, GDC 10, GDC 26, GDC 28.

2. 10 CFR 50.46.

3. FSAR Section 15.1, 15.4 and Subsection 15.0.0.2.

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.1.9.1

The power range and intermediate range neutron detectors must be
verified to be OPERABLE in MODE 2 by LCO 3.3.1, "Reactor Trip System
(RTS) Instrumentation." A CHANNEL CALIBRATION is performed on each
power range and intermediate range channel per SR 3.3.1.9, consistent
with Specification 5.5.21, Setpoint Control Program (SCP), prior to initiation
of the PHYSICS TESTS. This will ensure that the RTS is properly aligned
to provide the required degree of core protection during the performance of
the PHYSICS TESTS.

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SR 3.1.9.2

Verification that the RCS lowest loop T_{avg} is ≥ 541°F will ensure that the
unit is not operating in a condition that could invalidate the safety analyses.
The Surveillance Frequency is based on operating experience, equipment
reliability, and plant risk and is controlled under the Surveillance Frequency
Control Program.

SR 3.1.9.3

Verification that the THERMAL POWER is ≤ 5% RTP will ensure that the
plant is not operating in a condition that could invalidate the safety
analyses. The Surveillance Frequency is based on operating experience,
equipment reliability, and plant risk and is controlled under the Surveillance
Frequency Control Program.

SR 3.1.9.4

The SDM is verified by performing a reactivity balance calculation,
considering the following reactivity effects:

a.   RCS boron concentration,

b.   Control bank position,

c.   RCS average temperature,

BASES

SURVEILLANCE REQUIREMENTS (continued)

Performing the Surveillance in MODE 1 prior to exceeding 75% RTP ensures that the $F_Q(Z)$ limit is met when RTP is achieved, because peaking factors are generally decreased as power level is increased.

$F_Q(Z)$ is verified at power levels ≥ 10% RTP above the THERMAL POWER of its last verification, 12 hours after achieving equilibrium conditions to ensure that $F_Q(Z)$ is within its limit at higher power levels.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

REFERENCES

1.   10 CFR 50.46, 1974.

2.   FSAR Subsection 15.0.0.1.2

3.   10 CFR 50, Appendix A, GDC 26.

4.   WCAP-7308-L-P-A, "Evaluation of Nuclear Hot Channel Factor Uncertainties," June 1988.

5.   WCAP-10216-P-A, Rev. 1A, "Relaxation of Constant Axial Offset Control (and) F_Q Surveillance Technical Specification," February 1994.

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6.   ~~February 1994.~~

BASES

ACTIONS (continued)

Condition C is modified by a Note that requires that Required Actions C.1 and C.2 must be completed whenever this Condition is entered.

D.1

If Required Action C.1 is not completed within its required Completion Time of 30 minutes, the axial xenon distribution starts to become significantly skewed with the THERMAL POWER ≥ 50% RTP. In this situation, the assumption that a cumulative penalty deviation time of 1 hour or less during the previous 24 hours while the AFD is outside its target band is acceptable at < 50% RTP, is no longer valid.

Reducing the power level to < 15% RTP within the Completion Time of 9 hours and complying with LCO penalty deviation time requirements for subsequent increases in THERMAL POWER ensure that acceptable xenon conditions are restored.

This Required Action must also be implemented either if the cumulative penalty deviation time is > 1 hour during the previous 24 hours, or the AFD is not within the target band and not within the acceptable operation limits.

SURVEILLANCE REQUIREMENTS

SR 3.2.3.1

This Surveillance verifies that the AFD as indicated by the NIS excore channels is within the target band. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

The AFD should be monitored and logged more frequently in periods of operation for which the power level or control bank positions are changing to allow corrective measures when the AFD is more likely to move outside the target band.

SR 3.2.3.2

This Surveillance requires that the target flux difference is updated.   DCD_16-304

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

B 3.3 INSTRUMENTATION

B 3.3.1 Reactor Trip System (RTS) Instrumentation

BASES

BACKGROUND

The RTS initiates a unit shutdown, based on the values of selected unit parameters, to protect against violating the core fuel design limits and Reactor Coolant System (RCS) pressure boundary during anticipated operational occurrences (AOOs) and to assist the Engineered Safety Features (ESF) Systems in mitigating accidents.

The protection and monitoring systems have been designed to assure safe operation of the reactor. This is achieved by specifying limiting safety system settings (LSSS) in terms of parameters directly monitored by the RTS, as well as specifying LCOs on other reactor system parameters and equipment performance.

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

The Nominal Trip Setpoint, recorded and maintained in a document established by the Setpoint Control Program (SCP), is a predetermined setting for a protective device chosen to ensure automatic actuation prior to the process variable reaching the ~~Analytic~~Analytical Limit and thus ensuring that the SL would not be exceeded. As such, the Nominal Trip Setpoint accounts for uncertainties in setting the device (e.g., calibration), uncertainties in how the device might actually perform (e.g., repeatability), changes in the point of action of the device over time (e.g., drift during surveillance intervals), and any other factors which may influence its actual performance (e.g., harsh accident environments). In this manner, the Nominal Trip Setpoint plays an important role in ensuring that SLs are not exceeded. As such, the Nominal Trip Setpoint meets the definition of an LSSS (Ref. 1) and is used to meet the requirement that they be contained in the Technical Specifications. This is an acceptable approach for digital systems because the digital setpoints do not drift as in analog systems. The Nominal Trip Setpoint is applicable to automatic protection instrumentation functions for Reactor Trip, ESF Actuation Systems (ESFAS) actuation and permissive interlocks.

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BASES

BACKGROUND (continued)

Technical Specifications contain ~~measured accuracy values~~Allowable Values related to the OPERABILITY of equipment required for safe operation of the facility.~~ ~~ The ~~measured accuracy value~~Allowable Value accommodates expected drift in the analog components of the channel that would have been specifically accounted for in the setpoint methodology for calculating the Nominal Trip Setpoint and thus the automatic protective action would still have ensured that the SL would not be exceeded with the "as found" settings of the protective device. Therefore, the device would still be OPERABLE since it would have performed its safety function and the only corrective action required would be to recalibrate the device to account for further drift during the next surveillance interval.

However, there is also some point beyond which the device would have not been able to perform its function due, for example, to greater than expected drift. This value needs to be specified in the Technical Specifications in order to define OPERABILITY of the devices and is designated as the Allowable Value.

The Allowable Value, recorded and maintained in a document established by the Setpoint Control Program (SCP)~~ demonstrates~~, is considered a limiting value such that a channel is OPERABLE if the ~~measured accuracy is~~ as-found value does not~~ to~~ exceed the Allowable Value during CHANNEL CALIBRATION.~~ (protection functions implemented with digital bistable functions) or COT (protection functions implemented with~~ The Allowable Value is applicable to automatic protection instrumentation functions for Reactor Trip, ESFAS actuation and permissive interlocks.

For analog ~~bistable functions). The~~measurements, the CHANNEL CALIBRATION verifies the ~~instrument~~channel accuracy at five calibration settings corresponding to 0%, 25%, 50%, 75% and 100% of the instrument range. For binary measurements, the CHANNEL CALIBRATION verifies the accuracy of the channel's state change at the required setpoint. As such, the Allowable Value accounts for the expected instrument loop uncertainties, such as drift, during the surveillance interval. In this manner, the actual setting of the device will still meet the LSSS definition and ensure that a SL is not exceeded at any given point of time as long as the device has not drifted beyond that expected during the surveillance interval.

Note that, although the channel is "OPERABLE" under these circumstances, the channel ~~should~~shall be left adjusted to a value within the established channel ~~c~~Calibration ~~t~~Tolerance (CT) band, in accordance with uncertainty assumptions stated in the referenced setpoint methodology (as-left criteria), and confirmed to be operating within the statistical allowances of the uncertainty terms assigned. The Calibration Tolerance, recorded and maintained in a document established by the SCP, is applicable to automatic protection instrumentation functions for Reactor

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BASES

BACKGROUND (continued)

Trip, ESFAS actuation and permissive interlocks.   MIC-03-16-0
                                                                   0007

If the ~~actual accuracy~~as-found value of the device is found to have
exceeded the Allowable Value, or the as-left value of the device cannot be
adjusted to a value within the Calibration Tolerance, the device would be
considered inoperable from a technical specification perspective. This
requires corrective action including those actions required by 10 CFR 50.36
when automatic protective devices do not function as required.

In the Protection and Safety Monitoring System (PSMS), setpoints   MIC-03-16-0
associated with analog measurements are stored as digital values that   0007
have no potential for variation due to time, environmental drift or component
aging. For analog measurements, the only factors that can result in
variation in the trip Functions reside in the uncertainties that are pertinent to
the analog portion of the system. Therefore, for analog measurements in
the PSMS, it is appropriate for the Allowable Value to be expressed in terms
of values that are measured during periodic testing of the analog portion of
the system (i.e., CHANNEL CALIBRATION).

For PSMS analog measurements, the as-found and as-left values are
measured from sensor to digital Visual Display Unit (VDU) readout during
CHANNEL CALIBRATION. The US-APWR enhances human performance
by establishing a standard CHANNEL CALIBRATION method for all analog
measurements, whereby the as-found and as-left values read at the VDU
are measured at the same five calibration settings, regardless of the PSMS
trip setpoint(s).

Since the PSMS trip logic and setpoints for analog measurements are
stored as digital values with no drift potential, and those digital values are
confirmed through the MEMORY INTEGRITY CHECK (MIC), the only
untested area required to confirm channel operability pertains to the
accuracy of the analog input signal. When the analog input accuracy is
confirmed, by reading the digital values of the five point CHANNEL
CALIBRATION settings on any VDU driven by the same digital value used
in the controller that executes the trip Functions, the operability of the
complete channel is confirmed, including the accuracy of all trip setpoints
associated with that channel.

BASES

BACKGROUND (continued)

In the PSMS, setpoints associated with binary measurements are stored within the binary device itself. These setpoints have potential for variation due to time, environmental drift or component aging. However, these sensors are interfaced to the digital portion of the PSMS, which has no potential for variation due to time, environmental drift or component aging. For binary measurements, the only factors that can result in variation in the trip Functions reside in the uncertainties that are pertinent to the binary sensor itself. Therefore, for binary measurements in the PSMS, it is appropriate for the Allowable Value to be expressed in terms of values that are measured during periodic testing of the binary device (i.e., CHANNEL CALIBRATION).

For PSMS binary measurements, the as-found and as-left state change values are measured from sensor to VDU readout during CHANNEL CALIBRATION. The US-APWR enhances human performance by establishing a standard CHANNEL CALIBRATION method for all binary measurements, whereby the as-found and as-left values read at the VDU are measured at the channel's required state change.

Since the PSMS trip logic for binary sensors is stored as digital values with no drift potential, and those digital values are confirmed through the MIC, the only untested area required to confirm channel operability pertains to the accuracy of the binary input signal. When the binary input accuracy is confirmed, by reading the channel's state change on any VDU driven by the same digital value used in the controller that executes the trip Functions, the operability of the complete channel is confirmed, including the accuracy of the trip setpoint associated with that channel.

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

1.   The Departure from Nucleate Boiling Ratio (DNBR) shall be maintained above the Safety Limit (SL) value to prevent departure from nucleate boiling (DNB),

2.   Fuel centerline melt shall not occur, and

3.   The RCS pressure SL of 2733.5 psig shall not be exceeded.

Operation within the SLs of Specification 2.0, "Safety Limits (SLs)," also maintains the above values and assures that offsite dose will be within the 10 CFR 50 and 10 CFR 100 criteria during AOOs.

BASES

BACKGROUND (continued)

Accidents are events that are analyzed even though they are not expected to occur during the unit life. The acceptable limit during accidents is that offsite dose shall be maintained within an acceptable fraction of 10 CFR 100 limits. Different accident categories are allowed a different fraction of these limits, based on probability of occurrence. Meeting the acceptable dose limit for an accident category is considered having acceptable consequences for that event.

The RTS instrumentation is segmented into four distinct but interconnected modules as illustrated in FSAR Chapter 7 (Ref. 2), and as identified below:

1.   Field transmitters, process sensors or field contacts: provide a measurable electronic signal based upon the physical characteristics of the parameter being measured,

2.   The RPS, including Nuclear Instrumentation System (NIS): provides signal conditioning, analog to digital conversion, digital bistables for setpoint comparison, process algorithm actuation, compatible electrical signal output to the Reactor Trip Breakers (RTBs), and digital output to control board/control room/miscellaneous VDUs, and   MIC-03-16-0 0007

3.   Reactor trip breakers (RTBs): provide the means to interrupt power to the control rod drive mechanisms (CRDMs) and allows the rod cluster control assemblies (RCCAs), or "rods," to fall into the core and shut down the reactor.   MIC-03-16-0 0007

4.   Manual Reactor Trip switches: provide the Manual Reactor Trip Initiation in the control room.   MIC-03-16-0 0007

BASES

BACKGROUND (continued)

Field Transmitters or Sensors

To meet the design demands for redundancy and reliability, more than one, and often as many as four, field transmitters or sensors are used to measure unit parameters. To account for the calibration tolerances and instrument drift, which are assumed to occur between calibrations, statistical allowances are provided in the Nominal Trip Setpoint and Allowable Values. The OPERABILITY of each transmitter or sensor is determined by either "as-found" calibration data evaluated during the CHANNEL CALIBRATION orand by qualitative assessment of field transmitter or sensor as related to the channel behavior observed during performance of the CHANNEL CHECK.

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Protection and Safety Monitoring System

Generally, four channels of process control equipment are used for the signal processing of unit parameters measured by the field instruments. Four channels provides the capability for unlimited bypass of one channel while maintaining single failure criteria, therefore generally allowing a requirement for only three channels to be OPERABLE. The process control equipment provides signal conditioning, analog to digital conversion, comparable digital output signals for VDUs located on the main control board, and comparison of measured input signals with setpoints established by safety analyses. These setpoints are defined in FSAR Chapter 7 (Ref. 2). If the measured value of a unit parameter exceeds the predetermined setpoint, ana digital output from a digital bistable is processed for decision evaluation. Channel separation is maintained throughout the PSMS. Some unit parameters provide input only to the PSMS, while others are used by the PSMS and are retransmitted to the Plant Control and Monitoring System (PCMS) for use in one or more control systems.

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Generally, if a parameter is used only for input to the protection circuits, three channels with a two-out-of-three logic are sufficient to provide the required reliability and redundancy. If one channel fails in a direction that would not result in a partial Function trip, the Function is still OPERABLE with a two-out-of-two logic. If one channel fails, such that a partial Function trip occurs, a trip will not occur and the Function is still OPERABLE with a one-out-of-two logic.

BASES

BACKGROUND (continued)

Generally, if a parameter is used for input to the protection circuits and a control function, three channels with a two-out-of-three logic are also sufficient to provide the required reliability and redundancy. ~~The~~When three or more channels are OPERABLE, the Signal Selection Algorithm (SSA) within the PCMS ensures the control systems can withstand an input failure to the control system without causing erroneous control system operation, which would otherwise require the protection function actuation. Since the input failure does not cause an erroneous control system action that challenges the protection function, the input failure is considered a single failure in the RTS and the RTS remains capable of providing its protective function with the remaining two ~~operable~~OPERABLE channels. Again, a single failure will neither cause nor prevent the protection function actuation. These requirements are described in IEEE-603-1991 (Ref. 4). The actual number of channels required for each unit parameter is specified in Reference 2. When there are less than three OPERABLE channels, the SSA cannot prevent erroneous control system operation due to an input failure. This is reflected in the LCO Completion Times for shared channels, when there are only three required channels.

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The RTB trains are arranged in a two- -out- -of- -four configuration. Therefore, three logic trains are required to ensure no single random failure of a logic train will disable the RTS. The logic trains are designed such that testing required while the reactor is at power may be accomplished without causing trip. Provisions allow removing logic trains from service during maintenance.

Allowable Values and RTS Setpoints

The Nominal Trip Setpoints used in the digital bistables or binary sensors are based on the Analytical Limits defined in the accident analysis and the channel uncertainty. The selection of these Nominal Trip Setpoints is such that adequate protection is provided when all sensor and processing ~~t~~Time ~~d~~Delays are taken into account.

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To allow for calibration tolerances, instrumentation uncertainties, instrument drift, and severe environment errors for those RTS channels that must function in harsh environments as defined by 10 CFR 50.49 (Ref. 5), the Nominal Trip Setpoints ~~recorded~~ and ~~maintained in a document established by the SCP in the accompanying LCO~~Allowable Values are conservative ~~with respect~~ to protect the Analytical Limits. The methodology identified in the SCP, used to calculate the Allowable Values and Nominal Trip Setpoints, incorporates all of the known uncertainties applicable to each channel (Ref. ~~2~~12). The magnitudes of these uncertainties are factored into the determination of each Nominal Trip Setpoint and ~~corresponding~~ Allowable Value.

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BASES

BACKGROUND (continued)

The Nominal Trip Setpoint entered into the digital bistable or binary sensor is more conservative than that specified by the Analytical Limit (LSSS) to account. The Nominal Trip Setpoint accounts for measurement errors detectable by the CHANNEL CALIBRATION. and other unmeasurable errors (such as the effects of anticipated environmental conditions), which are both considered in the Allowable Value for CHANNEL CALIBRATION. The Allowable Value serves as the Technical Specification OPERABILITY limit for the purpose of the CHANNEL CALIBRATION. One example of such a change in measurement error is drift during the surveillance interval. If the measured accuracyas-found value does not exceed the Allowable Value, the channel is considered OPERABLE.

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The Nominal Trip Setpoint (i.e., LSSS) is the value at which the digital bistable or binary sensor is set. The Nominal Trip Setpoint value ensures the LSSS and the safety analysis limits are met for the surveillance interval selected when a channel is adjusted based on the stated channel uncertainties. Any channel is considered to be properly adjusted when the "as-left" accuracy value is within the established Calibration Tolerance (CT) band, in accordance with the methods and assumptions inof the SCP. The Nominal Trip Setpoint value (i.e., expressed as a value without inequalities) is used for digital bistables, is confirmed during the purposes of COTMIC. The Nominal Trip Setpoint value (i.e., expressed as a value with inequalities) for binary sensors is confirmed during the CHANNEL CALIBRATION.

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Nominal Trip Setpoints and Allowable Values, consistent with the requirements of the Allowable ValueSCP, ensure that SLs are not violated during AOOs (and that the consequences of Postulated Accidents (PAs) will be acceptable, providingprovided the unit is operated from within the LCOs at the onset of the AOO or PA and the equipment functions as designed).

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DigitalWithin the PSMS controllers, Nominal Trip Setpoints and Time Constants are digital settings maintained in non-volatile software memory within each Reactor Protection System (RPS) train. Digital settings have no potential for variation due to time, environmental drift or component aging; therefore, these digital settings have no surveillance tolerance. Each train of the process control equipment isPSMS controller has continuous automatic self tested continuously on line to verifytesting, which verifies that the digital Nominal Trip Setpoint and Time Constant settings are correct. Nominal Trip Setpoints and Time Constants are also verified periodically through a diverse software memory integrity test, which maythe MIC which must be conducted with the RTS trainaffected PSMS controller out of service. A designated instrument channel is taken out of service for periodic calibrationCHANNEL CALIBRATION. SRs for the channels and trains are specified in the SRs section.

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BASES

BACKGROUND (continued)

NOTE: The Allowable Value ~~recorded and maintained in a document established by the SCP~~ is the maximum deviation ~~at the calibration setpoints~~ that can be measured during CHANNEL CALIBRATION, whereby the channel is considered OPERABLE. This value ~~is~~includes the deviations that are included in the calculations that determined the ~~TRIP SETPOINT recorded and maintained in a document established by the SCP~~Nominal Trip Setpoint. The "expected as-found value" shall be as specified in the plant-specific setpoint analysis. The expected as-found value reflects the expected normal drift of actual plant equipment, so that a degraded device can be identified before the Allowable Value limit is reached. The expected as-found value is also referred to as the Performance Test Acceptance Criteria (PTAC). The PTAC, recorded and maintained in a document established by the SCP, is applicable to automatic protection instrumentation functions for Reactor Trip, ESFAS actuation and permissive interlocks.

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Reactor Trip Breakers

The RTBs are in the electrical power supply line from the control rod drive motor generator set power supply to the CRDMs. Opening of the RTBs interrupts power to the CRDMs, which allows the shutdown rods and control rods to fall into the core by gravity. There are eight RTBs, two from each of four RTB trains, arranged in a two-out-of-four configuration.

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During normal operation the output from the RPS is a voltage signal that energizes the undervoltage coils in the RTBs. When protective action is required, the RPS output voltage signal is removed, the undervoltage coils are de-energized, the breaker trip lever is actuated by the de-energized undervoltage coil, and the RTBs are tripped open. This allows the shutdown rods and control rods to fall into the core. In addition to the de-energization of the undervoltage coils, each breaker is also equipped with a shunt trip device that is energized to trip the breaker open upon receipt of a ~~r~~Reactor ~~t~~Trip signal from the RPS. Either the undervoltage coil or the shunt trip mechanism is sufficient by itself, thus providing a diverse trip mechanism.

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The decision logic matrix Functions are described in the functional diagrams included in Reference 2. In addition to the ~~r~~Reactor ~~t~~Trip or ESF, these diagrams also describe the various "permissive interlocks" that are associated with unit conditions. Each train has built in continuous automatic self-testing that automatically tests the decision logic Functions while the unit is at power. When any one or two trains are taken out of service for testing, the other two trains are capable of providing unit monitoring and protection until the testing has been completed.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY	The RTS ~~f~~Functions to maintain the SLs during all AOOs and mitigates the consequences of PAs in all MODES in which the Rod Control System is capable of rod withdrawal or one or more rods are not fully inserted.

Each of the analyzed accidents and transients can be detected by one or more RTS Functions. The accident analysis described in Reference 3 and 9 takes credit for most RTS ~~trip~~ Functions. RTS ~~trip~~ Functions not specifically credited in the accident analysis are qualitatively credited in the safety analysis and the NRC staff approved licensing basis for the unit. These RTS ~~trip~~ Functions may provide protection for conditions that do not require dynamic transient analysis to demonstrate Function performance. They may also serve as backups to RTS ~~trip~~ Functions that were credited in the accident analysis.

The LCO requires all instrumentation performing an RTS Function, listed in Table 3.3.1-1 in the accompanying LCO, to be OPERABLE. A channel is OPERABLE provided the "as-found" value, measured during surveillance testing, does not exceed its associated Allowable Value~~. For digital functions~~ and provided the "as-left" value is within the specified calibration tolerance at the completion of each CHANNEL CALIBRATION. For analog measurements, Allowable Values are defined in terms pertinent to the five channel calibration settings~~. For analog functions~~ 0%, 25%, 50%, 75% and 100%. For binary measurements there is one Allowable Value~~s are~~ defined in terms pertinent to the state change at the Nominal Trip Setpoint. A Nominal Trip Setpoint ~~may be~~is set more conservative than the ~~Limiting Trip Setpoint as necessary in response~~Allowable Value to ~~plant conditions~~account for channel uncertainties. Failure of any instrument renders the affected channel(s) inoperable and reduces the reliability of the affected Functions.

The LCO generally requires OPERABILITY of three or two channels in each instrumentation Function, three trains of Manual Reactor Trip ~~in each logic Function~~Initiation, and three trains in each Automatic Trip Logic Function. Three OPERABLE instrumentation channels in a two-out-of-three configuration are required when one RTS channel is also used as a control system input. ~~The~~When there are three or more OPERABLE channels, the SSA within the control system prevents the possibility of ~~the~~a shared channel failing in such a manner that it creates a transient that requires RTS action. The input failure is considered a single failure in the RTS and RTS remains capable of providing its protective function with the remaining two ~~operable~~OPERABLE channels. The SSA ensures there is no potential for control system and protection system interaction that could simultaneously create a need for RTS trip and disable one RTS channel. When there are less than three OPERABLE channels, the SSA cannot prevent erroneous control system operation due to an input failure. This is reflected in the LCO Completion Times for shared channels, when there are only three required channels.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The two-out-of-three configuration allows one channel to be tripped during maintenance or testing without causing a ~~r~~Reactor ~~t~~Trip. Specific exceptions to the above general philosophy exist and are discussed below.

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~~In all cases where the LCO states "Restore channel or train to OPERABLE status", this means restore the required number of channels or trains to OPERABLE status. Therefore, restoration of an alternate channel or train, other than the failed channel or train, is also acceptable~~Due to redundant components within the PSMS, such as controllers, communication links and power supplies, an inoperable component may or may not result in an inoperable channel/train. Where an inoperable component results in an inoperable required channel/train, LCOs are entered. For inoperable components that do not result in inoperable channels/trains, LCOs are not entered.

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Reactor Trip System Functions

The safety analyses and OPERABILITY requirements applicable to each RTS Function are discussed below:

1.   Manual Reactor Trip ~~i~~Initiation

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The Manual Reactor Trip ~~i~~Initiation ensures that the control room operator can initiate a ~~r~~Reactor ~~t~~Trip at any time by using any two-out-of-four hardwired reactor trip switches in the control room. A Manual Reactor Trip ~~i~~Initiation accomplishes the same results as any one of the automatic trip Functions. It is used by the reactor operator to shut down the reactor whenever any parameter is rapidly trending toward its Nominal Trip Setpoint.

The LCO requires three Manual Reactor Trip ~~trains~~Functions to be OPERABLE. Each train is controlled by a manual reactor trip switch. Each train activates two ~~r~~Reactor ~~t~~Trip ~~b~~Breakers in its respective train. Three independent trains are required to be OPERABLE so that no single random failure will disable the Manual Reactor Trip ~~i~~Initiation Function.

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In MODE 1 or 2, ~~m~~Manual ~~i~~Initiation of a ~~r~~Reactor ~~t~~Trip must be OPERABLE. These are the MODES in which the shutdown rods and/or control rods are partially or fully withdrawn from the core. In MODE 3, 4, or 5, the ~~m~~Manual ~~i~~Initiation Function must also be OPERABLE if one or more shutdown rods or control rods are withdrawn or the Rod Control System is capable of withdrawing the shutdown rods or the control rods. In this condition, inadvertent control rod withdrawal is possible. In MODE 3, 4, or 5, ~~m~~Manual

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Initiation of a Reactor Trip does not have to be OPERABLE if the Rod Control System is not capable of withdrawing the shutdown rods or control rods and if all rods are fully inserted. If the rods cannot be withdrawn from the core, or all of the rods are inserted, there is no need to be able to trip the reactor. In MODE 6, neither the shutdown rods nor the control rods are permitted to be withdrawn and the CRDMs are disconnected from the control rods and shutdown rods. Therefore, the Manual Initiation Function is not required. | MIC-03-16-0 0007

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2.   High Power Range Neutron Flux

The NIS power range detectors are located external to the reactor vessel and measure neutrons leaking from the core. Four channels are required because each channel measures neutron flux in one quadrant of the core. Anomalies occurring in one core quadrant can be seen by the neutron flux detector in that quadrant and by the neutron detectors in the two adjacent quadrants, but may not be detected by the detector in the opposite quadrant. Therefore, to ensure event detection and accommodate a single failure, neutron flux detectors must be OPERABLE in all four quadrants. | MIC-03-16-0 0007

The NIS power range detectors also provide control inputs to the Rod Control System and the Steam Generator (SG) Water Level Control System. The interface from the safety channels in the PSMS to the PCMS is through the Signal SelectorSelection Algorithm (SSA). TheWhen there are three or more OPERABLE NIS power range channels, the SSA ensures an input failure to the control system does not result in erroneous control system action that would require the protection function actuation. Therefore, fourWhen there are less than three OPERABLE NIS power range channels are sufficient, an additional channel is not required. Therefore, the actuation logic must be able to withstandSSA cannot prevent erroneous control system operation due to an input failure to the control system, which may then require the protection function actuation, and a single failure in the other channels providing the protection function actuation. This is reflected in the LCO Completion Times for shared NIS power range channels. | MIC-03-16-0 0007

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Note that this Function also provides a signal to prevent automatic and manual rod withdrawal prior to initiating a Reactor Trip. Limiting further rod withdrawal may terminate the transient and eliminate the need to trip the reactor. | MIC-03-16-0 0007

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

a. High Setpoint

    The High Power Range Neutron Flux (High Setpoint) trip
    Function ensures that protection is provided, from all power
    levels, against a positive reactivity excursion leading to DNB
    during power operations. These can be caused by rod
    withdrawal or reductions in RCS temperature.

    The LCO requires all four of the High Power Range Neutron
    Flux (High Setpoint) channels to be OPERABLE.

    In MODE 1 or 2, when a positive reactivity excursion could
    occur, the High Power Range Neutron Flux (High
    Setpoint) trip must be OPERABLE. This Function will
    terminate the reactivity excursion and shut down the reactor
    prior to reaching a power level that could damage the fuel.
    In MODE 3, 4, 5, or 6, the NIS power range detectors cannot
    detect neutron levels in this range. In these MODES, the
    High Power Range Neutron Flux (High Setpoint) does not
    have to be OPERABLE because the reactor is shut down
    and reactivity excursions into the power range are extremely
    unlikely. Other RTS Functions and administrative controls
    provide protection against reactivity additions when in
    MODE 3, 4, 5, or 6.

b. Low Setpoint

    The LCO requirement for the High Power Range Neutron
    Flux (Low Setpoint) trip Function ensures that protection is
    provided against a positive reactivity excursion from low
    power or subcritical conditions.

    The LCO requires all four of the High Power Range Neutron
    Flux (Low Setpoint) channels to be OPERABLE.

    In MODE 1, below the Power Range Neutron Flux (P-10
    setpoint), and in MODE 2, the High Power Range Neutron
    Flux (Low Setpoint) trip must be OPERABLE. This
    Function may be manually blocked by the operator when
    two-out-of-four power range channels are greater than
    approximately 10% RTP (P-10 setpoint). This Function is
    automatically unblocked when three out of four power range
    channels are below the P-10 setpoint. Above the P-10
    setpoint, positive reactivity additions are mitigated by the
    High Power Range Neutron Flux (High Setpoint) trip
    Function.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

In MODE 3, 4, 5, or 6, the High Power Range Neutron Flux (~~l~~Low ~~s~~Setpoint) trip Function does not have to be OPERABLE because the reactor is shut down and the NIS power range detectors cannot detect neutron levels in this range. Other RTS~~ trip~~ Functions and administrative controls provide protection against positive reactivity additions or power excursions in MODE 3, 4, 5, or 6.

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3. High Power Range Neutron Flux Rate

The High Power Range Neutron Flux Rate trips use the same channels as discussed for Function 2 above. Four channels are required because each channel measures neutron flux in one quadrant of the core. Anomalies occurring in one core quadrant can be seen by the neutron flux detector in that quadrant and by the neutron detectors in the two adjacent quadrants, but not by the detector in the opposite quadrant. Therefore, to ensure event detection and accommodate a single failure, neutron flux detectors must be OPERABLE in all four quadrants.

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a. Positive Rate

The High Power Range Neutron Flux Positive Rate trip Function ensures that protection is provided against rapid increases in neutron flux that are characteristic of an RCCA drive rod housing rupture and the accompanying ejection of the RCCA. This Function compliments the High Power Range Neutron Flux (~~h~~High and ~~l~~Low ~~s~~Setpoint) trip Functions to ensure that the criteria are met for a rod ejection from the power range.

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The LCO requires all four of the High Power Range Neutron Flux Positive Rate channels to be OPERABLE.

In MODE 1 or 2, when there is a potential to add a large amount of positive reactivity from a rod ejection accident (REA), the High Power Range Neutron Flux Positive Rate trip must be OPERABLE. In MODE 3, 4, 5, or 6, the High Power Range Neutron Flux Positive Rate trip Function does not have to be OPERABLE because other RTS~~ trip~~ Functions and administrative controls will provide protection against positive reactivity additions. Also, since only the shutdown banks may be withdrawn in MODE 3, 4, or 5, the remaining complement of control bank worth ensures a sufficient degree of SDM in the event of an REA. In

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

MODE 6, no rods are withdrawn and the SDM is increased during refueling operations. The reactor vessel head is also removed or the closure bolts are detensioned preventing any pressure buildup. In addition, the NIS power range detectors cannot detect neutron levels present in this ~~mode~~MODE.

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This Function has a dynamic transfer function. The Time Constants for this Function are recorded and maintained in a document established by the Setpoint Control Program (SCP).

b.   Negative Rate

The High Power Range Neutron Flux Negative Rate trip Function ensures that protection is provided for multiple rod drop accidents. At high power levels, a multiple rod drop accident could cause local flux peaking that would result in an unconservative local DNBR. DNBR is defined as the ratio of the heat flux required to cause a DNB at a particular location in the core to the local heat flux. The DNBR is indicative of the margin to DNB. No credit is taken for the operation of this Function for those rod drop accidents in which the local DNBRs will be greater than the limit.

The LCO requires all four High Power Range Neutron Flux Negative Rate channels to be OPERABLE.

In MODE 1 or 2, when there is potential for a multiple rod drop accident to occur, the High Power Range Neutron Flux Rate trip must be OPERABLE. In MODE 3, 4, 5, or 6, the High Power Range Neutron Flux Negative Rate trip Function does not have to be OPERABLE because the core is not critical and DNB is not a concern. Also, since only the shutdown banks may be withdrawn in MODE 3, 4, or 5, the remaining complement of control bank worth ensures a sufficient degree of SDM in the event of an REA. In MODE 6, no rods are withdrawn and the required SDM is increased during refueling operations. In addition, the NIS power range detectors cannot detect neutron levels present in this MODE.

This Function has a dynamic transfer function. The Time Constants for this Function are recorded and maintained in a document established by the Setpoint Control Program (SCP).

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

4.   High Intermediate Range Neutron Flux

The High Intermediate Range Neutron Flux trip Function ensures
that protection is provided against an uncontrolled RCCA bank rod
withdrawal accident from a subcritical condition during startup. This
trip Function provides redundant protection to the High Power
Range Neutron Flux (~~l~~Low ~~s~~Setpoint) trip Function. The NIS
intermediate range detectors are located external to the reactor
vessel and measure neutrons leaking from the core. The NIS
intermediate range detectors do not provide any input to control
systems. Note that this Function also provides a signal to prevent
automatic and manual rod withdrawal prior to initiating a ~~r~~Reactor
~~t~~Trip. Limiting further rod withdrawal may terminate the transient
and eliminate the need to trip the reactor.

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The LCO requires two channels of High Intermediate Range
Neutron Flux to be OPERABLE. Two OPERABLE channels are
sufficient to ensure no single random failure will disable this trip
Function.

Because this trip Function is important only during startup, there is
generally no need to disable channels for testing while the Function
is required to be OPERABLE. Therefore, a third channel is
unnecessary.

In MODE 1 below the P-10 setpoint, and in MODE 2 above the P-6
setpoint, when there is a potential for an uncontrolled RCCA bank
rod withdrawal accident during reactor startup, the Intermediate
Range Neutron Flux trip must be OPERABLE. Above the P-10
setpoint, the High Power Range Neutron Flux (~~h~~High ~~s~~Setpoint) trip
and the High Power Range Neutron Flux Positive Rate trip provide
core protection for a rod withdrawal accident. In MODE 2 below the
P-6 setpoint, the High Source Range Neutron Flux trip provides the
core protection for reactivity accidents. In MODE 3, 4, or 5, the
High Intermediate Range Neutron Flux trip does not have to be
OPERABLE because the control rods must be fully inserted and
only the shutdown rods may be withdrawn. The reactor cannot be
started up in this condition. The core also has the required SDM to
mitigate the consequences of a positive reactivity addition accident.
In MODE 6, all rods are fully inserted and the core has a required
increased SDM. Also, the NIS intermediate range detectors cannot
detect neutron levels present in this MODE.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

5.   High Source Range Neutron Flux

The LCO requirement for the High Source Range Neutron Flux trip Function ensures that protection is provided against an uncontrolled RCCA bank rod withdrawal accident from a subcritical condition during startup. This trip Function provides redundant protection to the High Power Range Neutron Flux (Low Setpoint) trip Function. In MODES 3, 4, and 5, administrative controls also prevent the uncontrolled withdrawal of rods. The NIS source range detectors are located external to the reactor vessel and measure neutrons leaking from the core. The NIS source range detectors do not provide any inputs to control systems. The source range trip is the only RTS automatic protection function required in MODES 3, 4, and 5 when rods are capable of withdrawal or one or more rods are not fully inserted. Therefore, the functional capability at the specified Nominal Trip Setpoint is assumed to be available.

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The High Source Range Neutron Flux Function provides protection for control rod withdrawal from subcritical, boron dilution and control rod ejection events.

In MODE 2 when below the P-6 setpoint and in MODES 3, 4, and 5 when there is a potential for an uncontrolled RCCA bank rod withdrawal accident, the High Source Range Neutron Flux trip must be OPERABLE. Two OPERABLE channels are sufficient to ensure no single random failure will disable this trip Function. Above the P-6 setpoint, the High Intermediate Range Neutron Flux trip and the High Power Range Neutron Flux (Low Setpoint) trip will provide core protection for reactivity accidents. Above the P-6 setpoint, the High Source Range Neutron Flux trip may be manually bypassed which will also de-energize the NIS source range detectors. Above the P-10 setpoint, the High Source Range Neutron Flux trip is automatically bypassed and the NIS source range detectors are automatically de-energized.

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In MODES 3, 4, and 5 with all rods fully inserted and the Rod Control System not capable of rod withdrawal, and in MODE 6, the outputs of the Function to RTS logic are not required OPERABLE.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

6.   Overtemperature ΔT

The Overtemperature ΔT trip Function is initiated based on setpoints derived for DNB protection or core exit conditions. This trip Function also limits the range over which the Overpower ΔT trip Function must provide protection. The inputs to the Overtemperature ΔT trip include all pressure, coolant temperature, axial power distribution, and reactor power as indicated by loop ΔT assuming full reactor coolant flow. Protection from violating the DNBR limit or core exit boiling is assured for those transients that are slow with respect to delays from the core to the measurement system. The Function monitors both variation in power and flow since a decrease in flow has the same effect on ΔT as a power increase. The ~~r~~Reactor ~~t~~Trip occurs if ~~indicated~~measured loop ΔT exceeds the lower setpoint of the DNB protection limit setpoint and the core exit boiling limit setpoint. The Overtemperature ΔT trip Function uses each loop's ΔT as a measure of reactor power and is compared with a setpoint that is automatically varied with the following parameters: | MIC-03-16-0
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-    reactor coolant average temperature - the Nominal Trip Setpoint is varied to correct for changes in coolant density and specific heat capacity with changes in coolant temperature, | MIC-03-16-0
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-    ~~p~~Pressurizer ~~p~~Pressure - the Nominal Trip Setpoint is varied to correct for changes in system pressure, and | MIC-03-16-0
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-    axial power distribution - f(ΔI), the Nominal Trip Setpoint is varied to account for imbalances in the axial power distribution as detected by the NIS upper and lower power range detectors. If axial peaks are greater than the design limit, as indicated by the difference between the upper and lower NIS power range detectors, the Nominal Trip Setpoint is reduced in accordance with ~~Note~~ FSAR Section 7.2.1 ~~of~~ ~~Table 3~~.4.3.1 ~~1~~ (Ref. 2). | MIC-03-16-0
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Dynamic compensation is included for system piping delays from the core to the temperature measurement system.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The Overtemperature ΔT trip Function is calculated for each loop as described in ~~Note~~ FSAR Section 7.2.1 ~~of Table 3~~ .4.3.1 ~~1~~ (Ref. 2). Trip occurs if Overtemperature ΔT is indicated in two loops. The pressure and temperature signals are used for other control functions. The interface from the safety channels in the PSMS to the PCMS is through the SSA. When three or more temperature and pressure channels are OPERABLE, ~~T~~the SSA ensures an input failure to the control system does not result in erroneous control system action that would require the protection function actuation. Therefore the protection function requires only two additional channels to provide the protection function actuation (i.e. three channels total). When there are less than three OPERABLE temperature and pressure channels, the SSA cannot prevent erroneous control system operation due to an input failure. This is reflected in the LCO Completion Times for temperature and pressure channels, since there are only three required channels.

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Note that this Function also provides a signal to generate a turbine runback prior to reaching the Nominal Trip Setpoint. A turbine runback will reduce turbine power and reactor power. A reduction in power will normally alleviate the Overtemperature ΔT condition and may prevent a ~~r~~Reactor ~~t~~Trip.

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The LCO requires three channels of the Overtemperature ΔT trip Function to be OPERABLE. Note that the Overtemperature ΔT Function receives input from channels shared with other RTS Functions. Failures that affect multiple Functions require entry into the Conditions applicable to all affected Functions.

In MODE 1 or 2, the Overtemperature ΔT trip must be OPERABLE to prevent DNB. In MODE 3, 4, 5, or 6, this trip Function does not have to be OPERABLE because the reactor is not operating and there is insufficient heat production to be concerned about DNB.

The cycle dependent variables for this Function are specified in the COLR.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

7.   Overpower ∆T

The Overpower ∆T trip Function ensures that protection is provided to ensure the integrity of the fuel (i.e., no fuel pellet melting and less than 1% cladding strain) under all possible overpower conditions. This trip Function also limits the required range of the Overtemperature ∆T trip Function and provides a backup to the High Power Range Neutron Flux (~~h~~High ~~s~~Setpoint) trip. The Overpower ∆T trip Function ensures that the allowable heat generation rate (kW/ft) of the fuel is not exceeded. It uses the ∆T of each loop as a measure of reactor power with a setpoint that is automatically varied with the following parameters:

-    reactor coolant average temperature - the <u>Nominal</u> Trip Setpoint is varied to correct for changes in coolant density and specific heat capacity with changes in coolant temperature, and

-    rate of change of reactor coolant average temperature - including dynamic compensation for the delays between the core and the temperature measurement system.

The Overpower ∆T trip Function is calculated for each loop as per ~~Note~~ <u>FSAR Section 7.</u>2 ~~of Table~~ <u>1.4.</u>3.~~3.1 1~~<u>2 (Ref. 2)</u>. Trip occurs if Overpower ∆T is indicated in two loops. The temperature signals are also used for other control functions. The interface from the safety channels in the PSMS to the PCMS is through the SSA. <u>When three or more temperature channels are OPERABLE,</u> ~~T~~<u>t</u>he SSA ensures an input failure to the control system does not result in erroneous control system action that would require the protection function actuation. Therefore, the protection function requires only two additional channels to provide the protection function actuation (i.e., three channels total). <u>When there are less than three OPERABLE temperature channels, the SSA cannot prevent erroneous control system operation due to an input failure. This is reflected in the LCO Completion Times for temperature channels, since there are only three required channels.</u>

Note that this Function also provides a signal to generate a turbine runback prior to reaching the Allowable Value. A turbine runback will reduce turbine power and reactor power. A reduction in power will normally alleviate the Overpower ∆T condition and may prevent a ~~r~~<u>R</u>eactor ~~t~~<u>T</u>rip.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The LCO requires three channels of the Overpower ∆T trip Function to be OPERABLE. Note that the Overpower ∆T trip Function receives input from channels shared with other RTS Functions. Failures that affect multiple Functions require entry into the Conditions applicable to all affected Functions.

In MODE 1 or 2, the Overpower ∆T trip Function must be OPERABLE. These are the only times that enough heat is generated in the fuel to be concerned about the heat generation rates and overheating of the fuel. In MODE 3, 4, 5, or 6, this trip Function does not have to be OPERABLE because the reactor is not operating and there is insufficient heat production to be concerned about fuel overheating and fuel damage.

The cycle dependent variables for this Function are specified in the COLR.

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8.   Pressurizer Pressure

The same sensors provide inputs to the High and Low Pressurizer Pressure trips and the Overtemperature ∆T trip. The Pressurizer Pressure channels are also used to provide control inputs to the Pressurizer Pressure Control System. The interface from the safety channels in the PSMS to the PCMS is through the SSA. When three or more Pressurizer Pressure channels are OPERABLE, the SSA ensures an input failure to the control system does not result in erroneous control system action that would require the protection function actuation. Therefore, the protection function requires only two additional channels to provide the protection function actuation (i.e., three channels total). When there are less than three OPERABLE pressure channels, the SSA cannot prevent erroneous control system operation due to an input failure. This is reflected in the LCO Completion Times for Pressurizer Pressure channels, since there are only three required channels.

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a.   Low Pressurizer Pressure

The Low Pressurizer Pressure trip Function ensures that protection is provided against violating the DNBR limit due to low pressure.

The LCO requires three channels of Low Pressurizer Pressure to be OPERABLE.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

In MODE 1, when DNB is a major concern, the Low Pressurizer Pressure trip must be OPERABLE. This trip Function is automatically enabled on increasing power by the P-7 interlock (NIS power range P-10 or ~~t~~Turbine ~~i~~Inlet ~~p~~Pressure greater than approximately 10% of full power equivalent (P-13)). On decreasing power, this trip Function is automatically blocked below P-7. Below the P-7 setpoint, no conceivable power distributions can occur that would cause DNB concerns.

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This Function has a dynamic transfer function. The Time Constants for this Function are recorded and maintained in a document established by the Setpoint Control Program (SCP).

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b.   High Pressurizer Pressure

The High Pressurizer Pressure trip Function ensures that protection is provided against over pressurizing the RCS. This trip Function operates in conjunction with the pressurizer relief and safety valves to prevent RCS overpressure conditions.

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The LCO requires three channels of the High Pressurizer Pressure to be OPERABLE.

The High Pressurizer Pressure LSSS is selected to be below the pressurizer safety valve actuation pressure setting. This setting minimizes challenges to safety valves.

In MODE 1 or 2, the High Pressurizer Pressure trip must be OPERABLE to help prevent RCS overpressurization and minimize challenges to the safety valves. In MODE 3, 4, 5, or 6, the High Pressurizer Pressure trip Function does not have to be OPERABLE because transients that could cause an overpressure condition will be slow to occur. Therefore, the operator will have sufficient time to evaluate unit conditions and take corrective actions. Additionally, low temperature overpressure protection systems provide overpressure protection when below MODE 4.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

9.   High Pressurizer Water Level

The High Pressurizer Water Level trip Function provides a backup signal for the High Pressurizer Pressure trip and also provides protection against water relief through the pressurizer safety valves. These valves are designed to pass steam in order to achieve their design energy removal rate. A ~~r~~Reactor ~~t~~Trip is actuated prior to the pressurizer becoming water solid. The LCO requires three channels of High Pressurizer Water Level to be OPERABLE. The pressurizer level channels are used as input to the Pressurizer Level Control System. The interface from the safety channels in the PSMS to the PCMS is through the SSA. When three or more High Pressurizer Water Level channels are OPERABLE, ~~T~~the SSA ensures an input failure to the control system does not result in erroneous control system action that would require the protection function actuation. Therefore, the protection function requires only two additional channels to provide the protection function actuation (i.e.~~,~~ three channels total). When there are less than three OPERABLE High Pressurizer Water Level channels, the SSA cannot prevent erroneous control system operation due to an input failure. This is reflected in the LCO Completion Times for High Pressurizer Water Level channels, since there are only three required channels.

In MODE 1, when there is a potential for overfilling the pressurizer, the High Pressurizer Water Level trip must be OPERABLE. This trip Function is automatically enabled on increasing power by the P-7 interlock. On decreasing power, this trip Function is automatically blocked below P-7. Below the P-7 setpoint, transients that could raise the ~~p~~Pressurizer ~~w~~Water ~~l~~Level will be slow and the operator will have sufficient time to evaluate unit conditions and take corrective actions.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

10. Low Reactor Coolant Flow

The Low Reactor Coolant Flow trip Function ensures that protection is provided against violating the DNBR limit due to low flow in one or more RCS loops, while avoiding Reactor Trips due to normal variations in loop flow. Above the P-7 setpoint, the Reactor Trip on low flow in any one RCS loop is automatically enabled. Each RCS loop has four flow detectors to monitor flow. The flow signals are not used for any control system input.

The LCO requires three Low Reactor Coolant Flow channels per loop to be OPERABLE in MODE 1 above P-7.

In MODE 1 above the P-7 setpoint, a loss of flow in one RCS loop could result in DNB conditions in the core. Below the P-7 setpoint, all Reactor Trips on low flow are automatically blocked since there is insufficient heat production to generate DNB conditions.

11. Low Reactor Coolant Pump (RCP) Speed

The Low RCP Speed trip Function ensures that protection is provided against violating the DNBR limit due to a loss of flow in two or more RCS loops. The speed of each RCP is monitored. Above the P-7 setpoint a low speed detected on two or more RCPs will initiate a Reactor Trip. The Nominal Trip Setpoint reflects only steady state instrument uncertainties as the detectors do not provide primary protection for any event that results in a harsh environment.

The LCO requires three Low RCP Speed channels (one channel per loop) to be OPERABLE in MODE 1 above P-7. One channel per loop is sufficient for this trip Function because the Low RCS Flow trip alone provides sufficient protection of unit SLs for loss of flow events. The Low RCP Speed trip serves only to anticipate the low flow trip, minimizing the thermal transient associated with loss of a pump. Below the P-7 setpoint, all Reactor Trips on loss of flow are automatically blocked since no power distributions are expected to occur that would cause a DNB concern at this low power level. Above the P-7 setpoint, the Reactor Trip on loss of flow in two or more loops is automatically enabled.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

12.   Steam Generator Water Level

The same sensors provide inputs to the Low SG Water Level trip and the High-High SG Water Level trip. Additionally, the level transmitters provide control inputs to the SG Level Control System. The interface from the safety channels in the PSMS to the PCMS is through the SSA. When three or more High-High SG Water Level channels are OPERABLE for each Steam Generator, Tthe SSA ensures an input failure to the control system does not result in erroneous control system action that would require the protection function actuation. Therefore, the protection function requires only two additional channels to provide the protection function actuation (i.e., three channels total). When there are less than three OPERABLE High-High SG Water Level channels for each Steam Generator, the SSA cannot prevent erroneous control system operation due to an input failure. This is reflected in the LCO Completion Times for High-High SG Water Level channels, since there are only three required channels for each Steam Generator.

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a.   Low SG Water Level

The Low SG Water Level trip Function ensures that protection is provided against a loss of heat sink and actuates the Emergency Feedwater (EFW) System prior to uncovering the SG tubes. The SGs are the heat sink for the reactor. In order to act as a heat sink, the SGs must contain a minimum amount of water. A narrow range low level in any SG is indicative of a loss of heat sink for the reactor. This Function also performs the ESFAS function of starting the EFW pumps on low SG level.

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The LCO requires three channels of Low SG Water Level per SG to be OPERABLE.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

In MODE 1 or 2, when the reactor requires a heat sink, the Low SG Water Level trip must be OPERABLE. The normal source of water for the SGs is the Main Feedwater (MFW) System (not safety related). The MFW System is only in operation in MODE 1 or 2. The EFW System is the safety related backup source of water to ensure that the SGs remain the heat sink for the reactor. During normal startups and shutdowns, the EFW System provides feedwater to maintain SG level. In MODE 3, 4, 5, or 6, the Low SG Water Level Function does not have to be OPERABLE because the MFW System is not in operation and the reactor is not operating or even critical. Decay heat removal is accomplished by the EFW System in MODE 3 and by the Residual Heat Removal (RHR) System in MODE 4, 5, or 6.

b.   High-High SG Water Level

The High-High SG Water Level trip Function ensures that protection is provided against an excessive cooldown due to increase in feedwater flow. An increase in the feedwater flow rate will cause an increase in SG ~~w~~Water ~~l~~Level and reduction in the reactor coolant temperature. Reduction in the coolant temperature adds reactivity as a result of the positive moderator density coefficient, thereby increasing the reactor power.

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This Function also performs the ESFAS functions of generating a ~~t~~Turbine ~~t~~Trip and initiating ~~m~~Main ~~f~~Feedwater ~~i~~Isolation.

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The LCO requires three channels of the High-High SG Water Level trip Function to be OPERABLE in MODE 1 above P-7. The trip Function is automatically enabled on increasing power by the P-7 interlock and automatically blocked on decreasing power once the P-7 interlock is cleared. Although the High-High SG Water Level trip is blocked below the P-7 setpoint, the ESFAS functions to trip the turbine and isolate Main Feedwater are OPERABLE above and below the P-7 setpoint. These ESFAS functions allow the operator sufficient time to evaluate plant conditions and take corrective actions.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

13. Turbine Trip

    a. Turbine Emergency Trip Oil Pressure

    The Turbine Emergency Trip Oil Pressure trip Function anticipates the loss of heat removal capabilities of the secondary system following a Turbine Trip. This trip Function acts to minimize the pressure/temperature transient on the reactor. Any Turbine Trip from a power level below the P-7 setpoint, approximately 10% power, will not actuate a Reactor Trip. Four pressure switches monitor the control oil pressure in the Turbine Electrohydraulic Control System. A low pressure condition sensed by two-out-of-four pressure switches will actuate a Reactor Trip. These pressure switches do not provide any input to the control system. The unit is designed to withstand a complete loss of load and not sustain core damage or challenge the RCS pressure limitations. Core protection is provided by the High Pressurizer Pressure trip Function and RCS integrity is ensured by the pressurizer safety valves.

    The LCO requires three channels of Turbine Emergency Trip Oil Pressure to be OPERABLE in MODE 1 above P-7.

    Below the P-7 setpoint, a Turbine Trip does not actuate a Reactor Trip. In MODE 2, 3, 4, 5, or 6, there is no potential for a Turbine Trip, and the Turbine Emergency Trip Oil Pressure trip Function does not need to be OPERABLE.

    b. Turbine Trip - Main Turbine Stop Valve Position

    The Main Turbine Stop Valve Position trip Function anticipates the loss of heat removal capabilities of the secondary system following a Turbine Trip from a power level above the P-7 setpoint. This action will actuate a Reactor Trip. The trip Function anticipates the loss of secondary heat removal capability that occurs when the stop valves close. Tripping the reactor in anticipation of loss of secondary heat removal acts to minimize the pressure and temperature transient on the reactor. This trip Function will normally operate in the presence of a single failure due to redundant limit switches on each valve. However this trip Function isnot required to operate in the presence of a single channel failure. The unit is designed to withstand a

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

complete loss of load and not sustain core damage or challenge the RCS pressure limitations. Core protection is provided by the High Pressurizer Pressure trip Function, and RCS integrity is ensured by the pressurizer safety valves. This trip Function is diverse to the Turbine Emergency Trip Oil Pressure ~~t~~Turbine ~~t~~Trip Function. Each main turbine stop valve is equipped with two limit switches that input to the RTS. If the limit switches indicate that all four stop valves are closed, a ~~r~~Reactor ~~t~~Trip is initiated.

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The LSSS for this Function is set to assure channel trip occurs when the associated stop valve is completely closed.

The LCO requires four Main Turbine Stop Valve Position channels, one per valve, to be OPERABLE in MODE 1 above P-7. One channel on each valve must trip to cause ~~r~~Reactor ~~t~~Trip.

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Below the P-7 setpoint, a load rejection can be accommodated by the Turbine Bypass System. In MODE 2, 3, 4, 5, or 6, there is no potential for a load rejection, and the Turbine Trip - Main Turbine Stop Valve Position trip Function does not need to be OPERABLE.

14.   ECCS ~~a~~Actuation

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The ECCS ~~a~~Actuation ~~r~~Reactor ~~t~~Trip function ensures that if a ~~r~~Reactor ~~t~~Trip has not already been generated by the RTS, the ESFAS ~~a~~Automatic ~~a~~Actuation ~~l~~Logic will initiate a ~~r~~Reactor ~~t~~Trip upon any signal that initiates ECCS ~~a~~Actuation. This is a condition of acceptability for the loss of coolant accident (LOCA). However, other transients and accidents take credit for varying levels of ESF performance and rely upon rod insertion, except for the most reactive rod that is assumed to be fully withdrawn, to ensure reactor shutdown. Therefore, a ~~r~~Reactor ~~t~~Trip is initiated every time an ~~SI~~ECCS Actuation signal is present.

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Nominal Trip Setpoint and Allowable Values are not applicable to this Function. The ECCS ~~a~~Actuation signals are provided within the RPS. Therefore, there is no measurement signal with which to associate an LSSS.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The LCO requires three trains of ECCS ~~a~~Actuation to be OPERABLE in MODE 1 or 2.

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A ~~r~~Reactor ~~t~~Trip is initiated every time an ECCS ~~a~~Actuation signal is present. Therefore, this trip Function must be OPERABLE in MODE 1 or 2, when the reactor is critical, and must be shut down in the event of an accident. In MODE 3, 4, 5, or 6, the reactor is not critical, and this trip Function does not need to be OPERABLE.

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15.   Reactor Trip System Interlocks

Reactor protection interlocks are provided to ensure ~~r~~Reactor ~~t~~Trips are in the correct configuration for the current unit status. They back up operator actions to ensure protection system Functions are not bypassed during unit conditions under which the safety analysis assumes the Functions are not bypassed. Therefore, the interlock Functions do not need to be OPERABLE when the associated ~~r~~Reactor ~~t~~Trip functions are outside the applicable MODES. These are:

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a.   Intermediate Range Neutron Flux, P-6

The Intermediate Range Neutron Flux, P-6 interlock is actuated when any NIS intermediate range channel goes approximately one decade above the minimum channel eading. If both channels drop below the setpoint, the permissive will automatically be defeated. The LCO requirement for the P-6 interlock ensures that the following Functions are performed:

•   on increasing power, the P-6 interlock allows the manual block of the NIS Source Range, Neutron Flux ~~r~~Reactor ~~t~~Trip. This prevents a premature block of the source range trip and allows the operator to ensure that the intermediate range is OPERABLE prior to leaving the source range. When the source range trip is blocked, the high voltage to the detectors is also removed,

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•   on decreasing power, the P-6 interlock automatically energizes the NIS source range detectors and enables the NIS Source Range Neutron Flux ~~r~~Reactor ~~t~~Trip, and

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

•   ron increasing power, the P-6 interlock provides a backup block signal to the source range flux doubling circuit. Normally, this Function is manually blocked by the control room operator during the reactor startup.

The LCO requires two channels of Intermediate Range Neutron Flux, P-6 interlock to be OPERABLE in MODE 2 when below the P-6 interlock setpoint.

Above the P-6 interlock setpoint, the NIS Source Range Neutron Flux ~~r~~Reactor ~~t~~Trip will be blocked, and this Function will no longer be necessary. | MIC-03-16-0 0007

In MODE 3, 4, 5, or 6, the P-6 interlock does not have to be OPERABLE because the NIS Source Range is providing core protection.

b.   <u>Low Power Reactor Trips Block, P-7</u>

The Low Power Reactor Trips Block, P-7 interlock is actuated by input from either the Power Range Neutron Flux, P-10, or the Turbine Inlet Pressure, P-13 interlock. The LCO requirement for the P-7 interlock ensures that the following Functions are performed:

(1)   on increasing power, the P-7 interlock automatically enables ~~r~~Reactor ~~t~~Trips on the following Functions: | MIC-03-16-0 0007

•   Low Pressurizer Pressure,

•   High Pressurizer Water Level,

•   Low Reactor Coolant Flow,

•   Low RCP Speed,

•   High Steam Generator <u>(SG) Water</u> Level, | MIC-03-16-0 0007

•   Turbine Trip - Turbine Emergency Trip Oil Pressure, and

•   Turbine Trip - Main Turbine Stop Valve Position.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

These ~~r~~Reactor ~~t~~Trips are only required when operating above the P-7 setpoint (approximately 10% power). The ~~r~~Reactor ~~t~~Trips provide protection against violating the DNBR limit. Below the P-7 setpoint, the RCS is capable of providing sufficient natural circulation without any RCP running.

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(2)   on decreasing power, the P-7 interlock automatically blocks ~~r~~Reactor ~~t~~Trips on the following Functions:

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•   Low Pressurizer Pressure,

•   High Pressurizer Water Level,

•   Low Reactor Coolant Flow,

•   Low RCP Speed,

•   High Steam Generator (SG) Water Level,

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•   Turbine Trip - Turbine Emergency Trip Oil Pressure, and

•   Turbine Trip - Main Turbine Stop Valve Position.

Nominal Trip Setpoint and Allowable Value are not applicable to the P-7 interlock because it is a logic Function and thus has no parameter with which to associate an LSSS.

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The P-7 interlock is a logic Function with train and not channel identity. Therefore, the LCO requires the Low Power Reactor Trips Block, P-7 interlock to be OPERABLE in each OPERABLE RTS train in MODE 1.

The low power trips are blocked below the P-7 setpoint and unblocked above the P-7 setpoint. In MODE 2, 3, 4, 5, or 6, this Function does not have to be OPERABLE because the interlock performs its Function when power level drops below 10% power, which is in MODE 1.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

c.   Power Range Neutron Flux, P-10

The Power Range Neutron Flux, P-10 interlock is actuated at approximately 10% power, as determined by two-out-of-four NIS power range detectors. If power level falls below 10% RTP on 3 of 4 channels, the nuclear instrument trips will be automatically unblocked. The LCO requirement for the P-10 interlock ensures that the following Functions are performed:

- on increasing power, the P-10 interlock allows the operator to manually block the Intermediate Range Neutron Flux Reactor Trip. Note that blocking the Reactor Trip also blocks the signal to prevent automatic and manual rod withdrawal, |MIC-03-16-0 0007

- on increasing power, the P-10 interlock allows the operator to manually block the High Power Range Neutron Flux (Low Setpoint) Reactor Trip, |MIC-03-16-0 0007

- on increasing power, the P-10 interlock automatically provides a backup signal to block the Source Range Neutron Flux Reactor Trip, and also to de-energize the NIS source range detectors, |MIC-03-16-0 0007

- the P-10 interlock provides one of the two inputs to the P-7 interlock, and

- on decreasing power, the P-10 interlock automatically enables the High Power Range Neutron Flux (Low Setpoint) Reactor Trip and the Intermediate Range Neutron Flux Reactor Trip (and rod stop). |MIC-03-16-0 0007

The LCO requires four channels of Power Range Neutron Flux, P-10 interlock to be OPERABLE in MODE 1 or 2.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

OPERABILITY in MODE 1 ensures the Function is available to perform its decreasing power Functions in the event of a reactor shutdown. This Function must be OPERABLE in MODE 2 to ensure that core protection is provided during a startup or shutdown by the High Power Range Neutron Flux (Low Setpoint) and High Intermediate Range Neutron Flux Reactor Trips. In MODE 3, 4, 5, or 6, this Function does not have to be OPERABLE because the reactor is not at power and the Source Range Neutron Flux Reactor Trip provides core protection.

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d.   Turbine Inlet Pressure, P-13

The Turbine Inlet Pressure, P-13 interlock is actuated when the pressure in the first stage of the high pressure turbine is greater than approximately 10% of the rated full power pressure. This is determined by two-out-of-four pressure detectors. The LCO requirement for this Function ensures that three of the inputs to the P-7 interlock are available.

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The LCO requires three channels of Turbine Inlet Pressure, P-13 interlock to be OPERABLE in MODE 1.

The Turbine Inlet Chamber Pressure, P-13 interlock must be OPERABLE when the turbine generator is operating. The interlock Function is not required OPERABLE in MODE 2, 3, 4, 5, or 6 because the turbine generator is not operating.

16.   Reactor Trip Breakers

This trip Function applies to the RTBs exclusive of individual trip mechanisms. The LCO requires three OPERABLE trains of trip breakers. A trip breaker train consists of all trip breakers associated with a single RTS logic train that are racked in, closed, and capable of supplying power to the Rod Control System. Thus, the train consists of two main breakers. Three OPERABLE trains ensure no single random failure can disable the RTS trip capability.

These trip Functions must be OPERABLE in MODE 1 or 2 when the reactor is critical. In MODE 3, 4, or 5, these RTS Functions must be OPERABLE when the Rod Control System is capable of rod withdrawal or one or more rods are not fully inserted.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

17.   Reactor Trip Breaker Undervoltage and Shunt Trip Mechanisms

The LCO requires both the Undervoltage and Shunt Trip Mechanisms to be OPERABLE for each RTB that is in service. The trip mechanisms are not required to be OPERABLE for trip breakers that are open, racked out, incapable of supplying power to the Rod Control System, or declared inoperable under Function 19 above. OPERABILITY of both trip mechanisms on each breaker ensures that no single trip mechanism failure will prevent opening any breaker on a valid signal.

These trip Functions must be OPERABLE in MODE 1 or 2 when the reactor is critical. In MODE 3, 4, or 5, these RTS ~~trip~~ Functions must be OPERABLE when the Rod Control System is capable of rod withdrawal or one or more rods are not fully inserted.

> MIC-03-16-0 0007

18.   Automatic Trip Logic

The LCO requirement for the RTBs (Functions 16 and 17) and Automatic Trip Logic (Function 18) ensures that means are provided to interrupt the power to allow the rods to fall into the reactor core. Each RTB is equipped with an undervoltage coil and a shunt trip coil to trip the breaker open when needed. The ~~r~~Reactor ~~t~~Trip signals generated by the RTS Automatic Trip Logic cause the RTBs to open and shut down the reactor.

> MIC-03-16-0 0007

The LCO requires three trains of RTS Automatic Trip Logic to be OPERABLE. Having three OPERABLE trains ensures that random failure of a single logic train will not prevent ~~r~~Reactor ~~t~~Trip.

> MIC-03-16-0 0007

These trip Functions must be OPERABLE in MODE 1 or 2 when the reactor is critical. In MODE 3, 4, or 5, these RTS ~~trip~~ Functions must be OPERABLE when the Rod Control System is capable of rod withdrawal or one or more rods are not fully inserted.

> MIC-03-16-0 0007

The RTS instrumentation satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii) (Ref. 8).

ACTIONS   A Note has been added to 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 3.3.1-1.

In the event a channel's accuracy is found nonconservative with respect to the Allowable Value, or the transmitter, instrument loop, signal processing electronics, or digital bistable is found inoperable, then all affected Functions provided by that channel must be declared inoperable and the LCO Condition(s) entered for the protection Function(s) affected.

When the number of inoperable channels in a trip Function exceeds those specified in one or other related Conditions associated with a trip Function, then the unit is outside the safety analysis. Therefore, LCO 3.0.3 must be immediately entered if applicable in the current MODE of operation.

In all cases where the LCO states "Restore channel or train to OPERABLE status", this means restore the required number of channels or trains to OPERABLE status. Therefore, restoration of an alternate channel or train, other than the failed channel or train, is also acceptable.

A.1

Condition A applies to all RTS protection Functions. Condition A addresses the situation where one or more required channels or trains for one or more Functions are inoperable at the same time. The Required Action is to refer to Table 3.3.1-1 and to take the Required Actions for the protection functions affected. The Completion Times are those from the referenced Conditions and Required Actions.

B.1 and B.2

Condition B applies to the Manual Reactor Trip in MODE 1 or 2. This action addresses the train orientation for this Function. With one required train inoperable, the inoperable train must be restored to OPERABLE status within 72 hours. In this Condition, the remaining two OPERABLE trains are adequate to perform the safety function.

The Completion Time of 72 hours is reasonable considering that there are three automatic actuation trains and two other Manual Reactor Trip trains OPERABLE, and the low probability of an event occurring during this interval. The completion time also considers that the manual reactor trip function, for the inoperable Manual Reactor Trip train, can also be actuated from the Safety VDU for that train. Therefore, the ability to initiate a manual reactor trip through safety related equipment remains functional in all three required trains.

BASES

ACTIONS (continued)

If the Manual Reactor Trip Function cannot be restored to OPERABLE status within the allowed 72 hour Completion Time, the unit must be brought to a MODE in which the requirement does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 6 additional hours (78 hours total time). The 6 additional hours to reach MODE 3 is reasonable, based on operating experience, to reach MODE 3 from full power operation in an orderly manner and without challenging unit systems.

With the unit in MODE 3, ACTION C would apply to any inoperable Manual Reactor Trip Function if the Rod Control System is capable of rod withdrawal or one or more rods are not fully inserted.

The ~~initial c~~Completion ~~t~~Time of 72 hours is justified ~~in~~because two trains are adequate to perform the ~~PSMS reliability analysis. For detail information, refer to the US APWR Technical Report MUAP-07030 PRA, Attachment 6A.12. The result of the PSMS reliability analysis is evaluated and confirmed in the US APWR PRA Chapter 19. The manual reactor trip~~safety function ~~remains fully operable from the Safety VDUs, even when one~~, and there are three autoamtic actuation trains and two other Manual Reactor Trip ~~channel is~~trains OPERABLE. In addition, the Completion Time considers that the Manual Reactor Trip Function, for the inoperable Manual Reactor Trip Function, can be actuated from the Safety VDU for that train. Therefore, the ability to initiate a manual Reactor Trip through safety related equipment remains functional in all three trains.

The Completion Time of 72 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 10).

MIC-03-16-0 0007

C.1, C.2.1, and C.2.2

Condition C applies to the Manual ~~r~~Reactor ~~t~~Trip Function in MODE 3, 4, or 5 with the Rod Control System capable of rod withdrawal or one or more rods not fully inserted.

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•   ~~Manual Reactor Trip~~

MIC-03-16-0 0007

BASES

ACTIONS (continued)

This action addresses the train orientation for ~~one~~this Function. With one required train inoperable, the inoperable train must be restored to OPERABLE status within 72 hours. If the affected Function cannot be restored to OPERABLE status within the allowed 72 hour Completion Time, the unit must be placed in a MODE in which the requirement does not apply. To achieve this status, action must be initiated within the same 72 hours to ensure that all rods are fully inserted, and the Rod Control System must be placed in a condition incapable of rod withdrawal within the next hour. The additional hour provides sufficient time to accomplish the action in an orderly manner. With rods fully inserted and the Rod Control System incapable of rod withdrawal, this Functionis no longer required.

MIC-03-16-0 0007

The Completion Time of 72 hours is ~~reasonable considering that~~justified because two trains are adequate to perform the safety function, and there are three automatic actuation trains and two other Manual Reactor Trip ~~trains~~Functions OPERABLE~~, and the low probability of an event occurring during this interval. The completion time also~~. In addition, the Completion Time considers that the ~~m~~Manual ~~r~~Reactor ~~t~~Trip ~~f~~Function, for the inoperable Manual Reactor Trip train, can~~ also~~ be actuated from the Safety VDU for that train. Therefore, the ability to initiate a manual ~~r~~Reactor ~~t~~Trip through safety related equipment remains functional in all three~~ required~~ trains.

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~~The initial completion time~~The Completion Time of 72 hours is also justified in the ~~PSMS~~US-APWR reliability ~~analysis. For detail information, refer to the US APWR Technical Report MUAP-07030 PRA, Attachment 6A.12. The~~and risk analyses, the summary and result of ~~the PSMS reliability analysis is evaluated and confirmed~~which are documented in ~~the US-APWR PRA~~FSAR Chapter 19~~. The manual reactor trip function remains fully operable from the Safety VDUs, even when one Manual Reactor Trip channel is inoperable~~ (Ref. 10).

MIC-03-16-0 0007

<u>D.1, D.2.1, and D.2.2</u>

Condition D applies to the following ~~r~~Reactor ~~t~~Trip Functions in MODE 3, 4, or 5 with the Rod Control System capable of rod withdrawal or one or more rods not fully inserted:

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•   RTBs,

•   RTB Undervoltage and Shunt Trip Mechanisms, and

•   Automatic Trip Logic.

BASES

ACTIONS (continued)

This action addresses the train orientation for these Functions. With one required train inoperable, the inoperable train must be restored to OPERABLE status within 48 hours. If the affected Function(s) cannot be restored to OPERABLE status within the allowed 48 hour Completion Time, the unit must be placed in a MODE in which the requirement does not apply. To achieve this status, action must be initiated within the same 48 hours to ensure that all rods are fully inserted, and the Rod Control System must be placed in a condition incapable of rod withdrawal within the next hour. The additional hour provides sufficient time to accomplish the action in an orderly manner. With rods fully inserted and the Rod Control System incapable of rod withdrawal, these Functions are no longer required.

MIC-03-16-0 0007

The Completion Time of 48 hours is reasonable considering that in this Condition, justified because the two remaining OPERABLE trains are adequate to perform the safety function, and given. In addition, the low probability of an event occurring during this interval. The Completion Time also considers that the two remaining OPERABLE trains each have continuous automatic self-testing and redundant RTBs for the Automatic Trip Logic.

MIC-03-16-0 0007

The Completion Time of 48 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 10).

E.1.1, E.1.2, E.2.1, E.2.2, and E.3

Condition E applies to the Power Range Neutron Flux (hHigh sSetpoint) Function.

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The NIS power range detectors provide input to the Rod Control System and the SG Water Level Control System and, therefore, have a two-out-of-four trip logic. A known

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With one channel inoperable, the inoperable channel must be placed in the tripped condition within 72 hours. This results in a partial trip condition requiring only one-out-of-three logic for actuation. of the two-out-of-four trips.

The Completion Time of 72 hours allowed to place the inoperable channel in the tripped condition is justified because the three remaining OPERABLE channels are adequate to perform the safety function. In addition, the Completion Time considers that the three remaining OPERABLE channels have continuous automatic self-testing (as described for COT), and continuous automatic CHANNEL CHECKS. In addition, with the remaining three OPERABLE channels, the SSA within the PCMS ensure the control

BASES

ACTIONS (continued)

systems can withstand an input failure to the control system without causing erroneous control system operation, which would otherwise require the protection function actuation.

The Completion Time of 72 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 10).

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In addition to placing the inoperable channel in the trip~~ped~~ condition, THERMAL POWER must be reduced to $\leq$ 75% RTP within 78 hours. Reducing the power level prevents operation of the core with radial power distributions beyond the design limits. With one of the NIS power range detectors inoperable, 1/4 of the radial power distribution monitoring capability is lost.

MIC-03-16-0 0007

As an alternative to the above ~~actions~~Required Actions, the inoperable channel can be placed in the trip~~ped~~ condition within 72 hours and the QPTR monitored once every 12 hours as per SR 3.2.4.2, QPTR verification. Calculating QPTR every 12 hours compensates for the lost monitoring capability due to the inoperable NIS power range channel and allows continued unit operation at power levels < 75% RTP. The 12 hour Surveillance Frequency is consistent with LCO 3.2.4, "QUADRANT POWER TILT RATIO (QPTR)."

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As an alternative to the above Required Actions, the plant must be placed in a MODE where this Function is no longer required OPERABLE. Seventy-eight hours are allowed to place the plant in MODE 3. The 78 hour Completion Time includes 72 hours for channel corrective maintenance~~,~~ and an additional 6 hours for the MODE reduction as required by Required Action E.3. This is a reasonable time, based on operating experience, to reach MODE 3 from full power in an orderly manner and without challenging plant systems. If Required Actions cannot be completed within their allowed Completion Times, LCO 3.0.3 must be entered.

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~~One~~The Required Actions are modified by a Note that allows placing one channel ~~may be bypassed~~in bypass for up to 12 hours ~~for~~while performing surveillance testing ~~and~~, or setpoint adjustments when a setpoint ~~adjustment. The 12 hours bypass limit is justified in the PSMS reliability analysis, considering that the remaining operable channels have continuous self-testing. For detail information, refer to the US-APWR~~reduction is required by other Technical ~~Report MUAP-07030 PRA, Attachment 6A.12. The result of the PSMS reliability analysis is evaluated and confirmed in the US-APWR PRA Chapter 19.~~Specifications, provided the other channels are OPERABLE, or two channels are OPERABLE and one is placed in the trip condition. With one channel bypassed, the system can detect all anomalies, but it cannot also sustain a single failure.

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BASES

ACTIONS (continued)

The Bypass Time of 12 hours is justified because the remaining OPERABLE channels are adequate to perform the safety function. In addition, the Bypass Time considers that the remaining OPERABLE channels have continuous automatic self-testing and continuous automatic CHANNEL CHECKS.

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The Bypass Time of 12 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 10).

The Required Actions have been modified by a Note that allows placing the inoperable channel in the bypass condition for up to 12 hours while performing routine surveillance testing of other channels. The Note also allows placing the inoperable channel in the bypass condition to allow setpoint adjustments of other channels when required to reduce the setpoint in accordance with other Technical Specifications. The 12 hour time limit is justified based on operating experience.

Required Action E.2.2 has been modified by a Note which only requires SR 3.2.4.2 to be performed if the Power Range Neutron Flux input to QPTR becomes inoperable. Failure of a component in the Power Range Neutron Flux Channel which renders the High Flux Trip Function inoperable may not affect the capability to monitor QPTR. As such, determining QPTR using the movable incore detectors once per 12 hours may not be necessary.

The initial completion time of 72 hours is justified in the PSMS reliability analysis, considering that the remaining operable channels have continuous self testing. For detail information, refer to the US-APWR Technical Report MUAP-07030 PRA, Attachment 6A.12. The result of the PSMS reliability analysis is evaluated and confirmed in the US-APWR PRA Chapter 19.

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F.1 and F.2

Condition F applies to the following rReactor tTrip Functions:

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•   High Power Range Neutron Flux (lLow sSetpoint),

•   Overtemperature ΔT,

•   Overpower ΔT,

BASES

ACTIONS (continued)

- High Power Range Neutron Flux Rate (Positive Rate), and MIC-03-16-0 0007

- High Power Range Neutron Flux Rate (Negative Rate).

- ~~High Pressurizer Pressure, and~~

- ~~Low SG Water Level.~~

~~A known~~With one ~~required~~channel inoperable, the inoperable channel must be placed in the trip~~ped~~ condition within 72 hours. Placing the channel in the trip~~ped~~ condition results in a partial trip condition requiring only one-out-of-~~two logic (for the trip functions where the required number of operable channels is three) or one-out-of~~three logic ~~(for the trip functions where the required number of operable channels is four)~~ for actuation of the two-out-of-~~N~~four trips.~~, where N is three or four (depending on the required number of operable channels). The 72 hours allowed to place the inoperable channel in the tripped condition is justified because the remaining two operable channels (for the trip functions where the required number of operable channels is three) or the remaining three operable channels (for the trip functions where the required number of operable channels is four) have automatic self-testing (as described for COT), and automatic CHANNEL CHECKS.~~

The Completion Time of 72 hours to place the inoperable channel in the trip condition is justified because the three remaining OPERABLE channels are adequate to perform the safety function. In addition, the Completion Time considers that the three remaining OPERABLE channels have continuous automatic self-testing and continuous automatic CHANNEL CHECKS.

In addition, with the remaining three OPERABLE channels, the SSA within the PCMS ensures the control systems can withstand an input failure to the control system without causing erroneous control system operation, which would otherwise require the protection function actuation.

The Completion Time of 72 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 10).

If the inoperable channel cannot be placed in the trip condition within the specified Completion Time, the unit must be placed in a MODE where these Functions are not required OPERABLE. An additional 6 hours ~~is~~are MIC-03-16-0 0007
allowed to place the unit in MODE 3. Six hours is a reasonable time, based on operating experience, to place the unit in MODE 3 from full power in an orderly manner and without challenging unit systems.

BASES

ACTIONS (continued)

~~The number of Required Channels for the High Power Range Neutron Flux Rate is four. Four channels are required because each channel measures neutron flux in one quadrant of the core. Anomalies occurring in one core quadrant can be seen by the neutron flux detector in that quadrant and by the neutron detectors in the two adjacent quadrants, but not by the deterctor in the opposite quadrant. So to ensure event detection and accomodate a single failure, neutron flux detectors must be operable in all four quadrants.~~

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The Required Actions ~~have been~~are modified by a Note that allows placing ~~the inoperable~~one channel in ~~the bypassed condition~~bypass for up to 12 hours while performing ~~routine~~ surveillance testing~~, of~~provided the other channels are OPERABLE, or two channels are OPERABLE and one is placed in the trip condition. With one channel bypassed, the system can detect all anomalies, but it cannot also sustain a single failure. ~~The 12 hour time limit is based on operating experience.~~

The Bypass Time of 12 hours is justified because the remaining OPERABLE channels are adequate to perform the safety function. In addition, the Bypass Time considers that the remaining OPERABLE channels have continuous automatic self-testing and continuous automatic CHANNEL CHECKS.

The Bypass Time of 12 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 10).

~~The initial completion time of 72 hours is justified in the PSMS reliability analysis, considering that the remaining operable channels have continuous self-testing. For detail information, refer to the US-APWR Technical Report MUAP-07030 PRA, Attachment 6A.12. The result of the PSMS reliability analysis is evaluated and confirmed in the US-APWR PRA Chapter 19.~~

~~One channel may be bypassed for up to 12 hours for surveillance testing and setpoint adjustment. The 12 hour bypass limit is justified in the PSMS reliability analysis, considering that the remaining operable channels have continuous self-testing. For detail information, refer to the US-APWR Technical Report MUAP-07030 PRA, Attachment 6A.12. The result of the PSMS reliability analysis is evaluated and confirmed in the US-APWR PRA Chapter 19.~~

BASES

ACTIONS (continued)

G.1 and G.2

Condition G applies to the Intermediate Range Neutron Flux trip when THERMAL POWER is above the P-6 setpoint and below the P-10 setpoint, and one channel is inoperable. Above the P-6 setpoint and below the P-10 setpoint, the NIS intermediate range detector performs the monitoring Functions. If THERMAL POWER is greater than the P-6 setpoint but less than the P-10 setpoint, 24 hours is allowed to reduce THERMAL POWER below the P-6 setpoint or increase to THERMAL POWER above the P-10 setpoint.

The NIS Intermediate Range Neutron Flux channels must be OPERABLE when the power level is above the capability of the source range, P-6, and below the capability of the power range, P-10. If THERMAL POWER is greater than the P-10 setpoint, the NIS power range detectors perform the monitoring and protection functions and the intermediate range is not required.

The Completion Times allow for a slow and controlled power adjustment above P-10 or below P-6 and take into account the redundant capability afforded by the redundant OPERABLE channel, and the low probability of its failure during this period.

This action does not require the inoperable channel to be tripped because the Function uses one-out-of-two logic. Tripping one channel would trip the reactor. Thus, the Required Actions specified in this Condition are only applicable when channel failure does not result in Reactor Trip.

H.1 and H.2

Condition H applies to two inoperable Intermediate Range Neutron Flux trip channels in MODE 2 when THERMAL POWER is above the P-6 setpoint and below the P-10 setpoint. Required Actions specified in this Condition are only applicable when channel failures do not result in Reactor Trip. Above the P-6 setpoint and below the P-10 setpoint, the NIS intermediate range detector performs the monitoring Functions.

With no intermediate range channels OPERABLE, the Required Actions are to suspend operations involving positive reactivity additions immediately. This will preclude any power level increase since there are no OPERABLE Intermediate Range Neutron Flux channels. The operator must also reduce THERMAL POWER below the P-6 setpoint within two hours. Below P-6, the Source Range Neutron Flux channels will be able to monitor the core power level. The Completion Time of 2 hours will allow

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BASES

ACTIONS (continued)

a slow and controlled power reduction to less than the P-6 setpoint ~~and takes into account the low probability of occurrence of an event during this period that may require the protection afforded by the NIS Intermediate Range Neutron Flux trip~~.

Required Action H.1 is modified by a Note to indicate that normal plant control operations that individually add limited positive reactivity (e.g., temperature or boron fluctuations associated with RCS inventory management or temperature control) are not precluded by this Action, provided they are accounted for in the calculated SDM.

I.1

Condition I applies to one inoperable Source Range Neutron Flux trip channel when in MODE 2, below the P-6 setpoint, and performing a reactor startup. With the unit in this Condition, below P-6, the NIS source range performs the monitoring and protection functions. With one of the two channels inoperable, operations involving positive reactivity additions shall be suspended immediately.

This will preclude any power escalation. With only one source range channel OPERABLE, core protection is severely reduced and any actions that add positive reactivity to the core must be suspended immediately.

Required Action I.1 is modified by a Note to indicate that normal plant control operations that individually add limited positive reactivity (e.g., temperature or boron fluctuations associated with RCS inventory management or temperature control) are not precluded by this Action, provided they are accounted for in the calculated SDM.

J.1

Condition J applies to two inoperable Source Range Neutron Flux trip channels when in MODE 2, below the P-6 setpoint, and in MODE 3, 4, or 5 with the Rod Control System capable of rod withdrawal or one or more rods not fully inserted. With the unit in this Condition, below P-6, the NIS source range performs the monitoring and protection functions. With both source range channels inoperable, the RTBs must be opened immediately. With the RTBs open, the core is in a more stable condition.

K.1, K.2.1, and K.2.2

Condition K applies to one inoperable source range channel in MODE 3, 4, or 5 with the Rod Control System capable of rod withdrawal or one or more rods not fully inserted. With the unit in this Condition, below P-6, the NIS

BASES

ACTIONS (continued)

source range performs the monitoring and protection functions. With one of the source range channels inoperable, 48 hours is allowed to restore it to an OPERABLE status. If the channel cannot be returned to an OPERABLE status, action must be initiated within the same 48 hours to ensure that all rods are fully inserted, and the Rod Control System must be placed in a condition incapable of rod withdrawal within the next hour.

L.1 and L.2

Condition L applies to the following ~~r~~Reactor ~~t~~Trip Functions:

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- ~~Low Pressurizer Pressure,~~

- ~~High Pressurizer Water Level,~~

- Low Reactor Coolant Flow,

- Low Reactor Coolant Pump Speed, and

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- ~~High-High SG Water Level, and~~

- Turbine Trip – Turbine Emergency Trip Oil Pressure.

With one required channel inoperable, the inoperable channel must be placed in the trip~~ped~~ condition within 72 hours. Failure of one channel places the Function in a two-out-of-two configuration, when the failed channel does not result in a trip channel. This configuration provides adequate plant protection, but does not meet the single failure criteria. Therefore, within 72 hours the inoperable channel must be tripped to place the Function in a one-out-of-two configuration that satisfies the single failure criteria. Placing the channel in the trip~~ped~~ condition when above the P-7 setpoint, results in a partial trip condition requiring only one additional channel to initiate a ~~r~~Reactor ~~t~~Trip.

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These Functions do not have to be OPERABLE below the P-7 setpoint because there is insufficient heat production to generate DNB conditions below the P-7 setpoint. ~~The 72 hours allowed to place the channel in the tripped condition is justified because the remaining two operable channels have automatic self-testing (as described for COT), and automatic CHANNEL CHECKS. An additional 6 hours is allowed to reduce THERMAL POWER to below P-7 if the inoperable channel cannot be restored to OPERABLE status or placed in trip within the specified Completion Time.~~

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BASES

ACTIONS (continued)

~~Allowance of this time interval takes into consideration the redundant capability provided by the remaining redundant OPERABLE channels, and the low probability of occurrence of an event during this period that may require the protection afforded by the Functions associated with Condition L.~~The Completion Time of 72 hours to place the inoperable channel in the trip condition is justified because the two remaining OPERABLE channels are adequate to perform the safety function. The Completion Time also considers that the two remaining OPERABLE channels have continuous automatic self-testing.

In addition, the two remaining OPERABLE channels have continuous automatic CHANNEL CHECKS, except for Turbine Trip – Turbine Emergency Trip Oil Pressure. This additional justification is not needed for Turbine Trip – Turbine Emergency Trip Oil Pressure, because this is an anticipatory function that is not credited in the safety analysis.

~~Except for Pressurizer~~For all functions (except Turbine Trip – Turbine Emergency Trip Oil Pressure)~~, Pressurizer Level, and SG Water Level, one channel may be bypassed for up to 12 hours for surveillance testing. The 12 hours bypass limit is~~the Completion Time of 72 hours is also justified in the ~~PSMS~~US-APWR reliability ~~analysis, considering that the remaining operable channels have continuous self testing. For detail information, refer to~~and risk analyses, the ~~US APWR Technical Report MUAP-07030 PRA, Attachment 6a.12. The~~summary and result of ~~the PSMS reliability analysis is evaluated and confirmed in the US APWR PRA~~which are documented in FSAR Chapter 19~~. This bypass is not allowed for Pressurizer Pressure, Pressurizer Level, and SG Water Level because these channels are also used for control. If a failure were to occur in one of the two remaining control channels, a plant transient could occur that would require a plant trip, but a plant trip would not occur with only one remaining operable channel.~~ (Ref. 10).

~~The initial completion time of 72 hours is justified in the PSMS reliabilty analysis, considering that the remaining operable channels have continuous self testing. For detail information, refer to the US APWR Technical Report MUAP-07030 PRA, Attachment 6A.12. The result of the PSMS reliability analysis is evaluated and confirmed in the US APWR PRA Chapter 19.~~The Required Actions are modified by a Note that allows placing one required channel in bypass for up to 12 hours while performing surveillance testing, provided the other required channels are OPERABLE, or one required channel is OPERABLE and the other required channel is placed in the trip condition. With one required channel bypassed, the system can detect all anomalies, but it cannot also sustain a single failure.

BASES

ACTIONS (continued)

The Bypass Time of 12 hours is justified because the remaining OPERABLE channels are adequate to perform the safety function. The Bypass Time also considers that the remaining OPERABLE channels have continuous automatic self-testing.

In addition the remaining OPERABLE channels have continuous automatic CHANNEL CHECKS, except for Turbine Trip – Turbine Emergency Trip Oil Pressure. This additional justification is not needed for Turbine Trip – Turbine Emergency Trip Oil Pressure, because this is an anticipatory function that is not credited in the safety analysis.

The Bypass Time of 12 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 10).

MIC-03-16-0 0007

<u>M.1 and M.2</u>

Condition M applies to the ECCS ~~a~~Actuation input in MODES 1 and 2. These actions address the train orientation of the RTS for these Functions. With one required train inoperable, 24 hours are allowed to restore the train to OPERABLE status or the unit must be placed in MODE 3 within the next 6 hours.

MIC-03-16-0 0007

The Completion Time of 24 hours is ~~reasonable considering that in this Condition,~~justified because the two remaining OPERABLE trains are adequate to perform the safety function ~~and given~~. In addition, the ~~low probability of an event during this interval. The 24 hours allowed to restore the train to OPERABLE status also~~Completion Time considers that the two remaining OPERABLE trains each have continuous automatic self-testing ~~as described for ACTUATION LOGIC TEST~~.

MIC-03-16-0 0007

The Completion Time of 24 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 10).

The Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power in an orderly manner and without challenging unit systems.

The Required Actions have been modified by a Note that allows ~~bypassing~~placing one ~~inoperable~~required train in bypass for up to 4 hours ~~for~~while performing surveillance testing, provided the other ~~two~~required trains are OPERABLE.

MIC-03-16-0 0007

BASES

ACTIONS (continued)

The Bypass Time of 4 hours is justified because the remaining OPERABLE trains are adequate to perform the safety function. In addition, the Bypass Time considers that the remaining OPERABLE trains have continuous automatic self-testing.

MIC-03-16-0 0007

The Bypass Time of 4 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 10).

N.1 and N.2

Condition N applies to the RTBs in MODES 1 and 2. These actions address the train orientation of the RTS for the RTBs. With one required train inoperable, 24 hours ~~is~~are allowed for train corrective maintenance to restore the train to OPERABLE status.

MIC-03-16-0 0007

The ~~24 hour~~ Completion Time ~~is reasonable considering that in this Condition,~~of 24 hours is justified because the two remaining OPERABLE trains are adequate to perform the safety function ~~and given the low probability of an event during this interval~~. In addition, the Completion Time considers that the two remaining OPERABLE trains each have continuous automatic self-testing.

The Completion Time of 24 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 10).

Required Action N.2 allows the option to apply the requirements of Specification 5.5.18 to determine a Risk Informed Completion Time.

~~The initial completion time of 24 hours is justified in the PSMS reliability analysis. For detail information, refer to the US-APWR Technical Report MUAP-07030 PRA, Attachment 6A.12. The result of the PSMS reliability analysis is evaluated and confirmed in the US-APWR PRA Chapter 19.~~

MIC-03-16-0 0007

O.1 and O.2

Condition O applies to the P-6 and P-10 interlocks. With one or more ~~required~~ channels inoperable ~~for one out of two or two out of four coincidence logic~~, the associated interlock must be verified to be in its required state for the existing unit condition within 1 hour or the unit must be placed in MODE 3 within the next 6 hours. Verifying the interlock status manually accomplishes the interlock's Function.

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The Completion Time of 1 hour is based on operating experience and the minimum amount of time allowed for manual operator actions.

BASES

ACTIONS (continued)

The Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power in an orderly manner and without challenging unit systems.

The 1 hour and 6 hour Completion Times are equal to the time allowed by LCO 3.0.3 for shutdown actions in the event of a complete loss of RTS Function.

MIC-03-16-0 0007

P.1 and P.2

Condition P applies to the P-7 and P-13 interlocks in MODE 1. With one or more required channels/ inoperable (P-13), or one or more trains inoperable for two out of four coincidence logic(P-7), the associated interlock must be verified to be in its required state for the existing unit condition within 1 hour or the unit must be placed in MODE 2 within the next 6 hours. These actions are conservative for the case where power level is being raised. Verifying the interlock status manually accomplishes the interlock's Function.

MIC-03-16-0 0007

The Completion Time of 1 hour is based on operating experience and the minimum amount of time allowed for manual operator actions.

MIC-03-16-0 0007

The Completion Time of 1 hour is required because the P-13 interlock is generated using the Turbine Inlet Pressure instrumentation channels, which are shared with the PCMS. The SSA within the PCMS prevents erroneous control system actions due to a single failed shared instrument channel, which would otherwise require the protection function actuation. When there are less than three OPERABLE required Turbine Inlet Pressure instrumentation channels, the SSA cannot prevent erroneous control system operation due to an input failure.

The Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 2 from full power in an orderly manner and without challenging unit systems.

Q.1 and Q.2

Condition Q applies to the RTB Undervoltage and Shunt Trip Mechanisms, i.e., diverse trip features, in MODES 1 and 2. For one RTBeither of the two RTBs in a required train, with one of the diverse trip features inoperable, it must be restored to an OPERABLE status within 48 hours.

MIC-03-16-0 0007

The Completion Time of 48 hours for Required Action Q.1 is reasonable considering that in this Condition there is one remaining diverse feature for the affected RTB, one OPERABLE RTB in the affected RTB train and two OPERABLE RTB trains capable of performing the safety function and given the low probability of an event occurring during this interval.

MIC-03-16-0 0007

BASES

ACTIONS (continued)

The Completion Time of 48 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 10).

MIC-03-16-0 0007

Required Action Q.2 allows the option to apply the requirements of Specification 5.5.18 to determine a Risk Informed Completion Time.

<u>R.1 and R.2</u>

Condition R applies to the RTS Automatic Trip Logic in MODES 1 and 2. These actions address the train orientation of the RTS for these Functions. With one required train inoperable, 24 hours are allowed to restore the train to OPERABLE status.

MIC-03-16-0 0007

The Completion Time of 24 hours is ~~reasonable considering that in this Condition,~~ justified because the two remaining OPERABLE required trains are adequate to perform the safety function ~~and given~~. In addition, the ~~low probability of an event during this interval. The 24 hours allowed to restore the train to OPERABLE status also~~Completion Time considers that the two remaining OPERABLE required trains each have continuous automatic self-testing ~~as described for ACTUATION LOGIC TEST~~.

The Completion Time of 24 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 10).

Required Action R.2 allows the option to apply the requirements of Specification 5.5.18 to determine a Risk Informed Completion Time.

The Required Actions have been modified by a Note that allows ~~bypassing~~placing one ~~inoperable~~required train in bypass for up to 4 hours ~~for~~while performing surveillance testing, provided the other ~~two~~required trains are OPERABLE.

MIC-03-16-0 0007

The Bypass Time of 4 hours is justified because the remaining OPERABLE trains are adequate to perform the safety function. In addition, the Bypass Time considers that the remaining OPERABLE trains have continuous automatic self-testing.

MIC-03-16-0 0007

The Bypass Time of 4 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 10).

BASES

ACTIONS (continued)

S.1

Condition S applies when the Required Action and associated Completion Time for Condition N, Q, or R have not been met. If the train cannot be returned to OPERABLE status, the unit must be placed in a MODE where the requirement does not apply. This is accomplished by placing the unit in MODE 3 within 6 hours. The Completion Time of 6 hours is a reasonable time, based on operating experience, to reach MODE 3 from full power in an orderly manner and without challenging unit systems.

Placing the unit in MODE 3 ~~from Condition N~~, with any of the applicable Functions inoperable, results in Condition D entry ~~while an RTB is inoperable~~.

MIC-03-16-0 0007

~~(From Condition Q) With the unit in MODE 3, Condition D would apply to any inoperable RTB trip mechanism.~~

T.1 and T.2

Condition T applies to Main Turbine Stop Valve Closure. With one channel inoperable, the inoperable channel must be placed in the trip condition within 12 hours. If placed in the trip~~ped~~ condition, this results in a partial trip condition requiring three additional channels to initiate a ~~r~~Reactor ~~t~~Trip. If the channel can not be restored to OPERABLE status or placed in the trip condition, then power must be reduced below the P-7 setpoint within the next 6 hours. The 6 hours allowed for reducing power ~~is~~are consistent with other power reduction action ~~c~~Completion ~~t~~Times.

MIC-03-16-0 0007

MIC-03-16-0 0007

The Required Actions are modified by a Note that allows placing one channel in bypass for up to 12 hours while performing ~~routine~~ surveillance testing.

MIC-03-16-0 0007

~~These times~~The Completion Time and Bypass Time are justified because this is an anticipatory trip that is not credited in the safety analysis, and a diverse ~~t~~Turbine ~~t~~Trip is also initiated from the Turbine Emergency Oil Pressure.

MIC-03-16-0 0007

BASES

ACTIONS (continued)

U.1 and U.2

MIC-03-16-0
0007

Condition U applies to the following Reactor Trip Functions:

- Overtemperature ΔT,

- Overpower ΔT,

- High Pressurizer Pressure, and

- Low SG Water Level.

With one required channel inoperable, the inoperable channel must be placed in the trip condition within 1 hour and restored to OPERABLE status in 72 hours.

This Condition applies to functions that operate on two-out-of-three logic and have channels that are shared with the control systems. Normally the SSA can prevent erroneous control system operations. However, when there are less than three OPERABLE required channels, the SSA cannot prevent erroneous control system operation due to an input failure. With two OPERABLE required channels and one required channel in the trip condition, if a channel failure occurs in an OPERABLE required channel and results in erroneous control system operation, the remaining OPERABLE required channel can provide a plant trip. However, the channel that causes the erroneous control system operation cannot be credited as the single failure; therefore, this configuration does not satisfy the single failure criteria. To satisfy the single failure criteria, three required channels must be restored to OPERABLE status within 72 hours.

The Completion Time of 1 hour to place the failed channel in the trip condition is based on operating experience and the minimum amount of time allowed for manual operator actions.

The Completion Time of 72 hours to restore the inoperable channel is justified because the two remaining OPERABLE channels are adequate to perform the safety function. In addition, the two remaining OPERABLE channels have continuous automatic self-testing and continuous automatic channel checks.

The Completion Time of 72 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref.10).

BASES

ACTIONS (continued)

Bypass of a required channel is not allowed because there are only three required channels and these channels are also used for control. If a failure were to occur in one of the two remaining required control channels, a plant transient could occur that would require a plant trip, but a plant trip would not occur with only one remaining OPERABLE required channel.

V.1

If the Required Action and associated Completion Time of Condition U is not met, the unit must be placed in a MODE where these Functions are not required OPERABLE. An additional 6 hours are allowed to place the unit in MODE 3. Six hours is a reasonable time, based on operating experience, to place the unit in MODE 3 from full power in an orderly manner and without challenging unit systems.

W.1 and W.2

Condition W applies to the following Reactor Trip Functions:

- Low Pressurizer Pressure,

- High Pressurizer Water Level, and

- High-High SG Water Level.

With one required channel inoperable, the inoperable channel must be placed in the trip condition within 1 hour and restored to OPERABLE status in 72 hours.

This Condition applies to functions that operate on two-out-of-three logic and have channels that are shared with the control systems. Normally the SSA can prevent erroneous control system operations. However, when there are less than three OPERABLE required channels, the SSA cannot prevent erroneous control system operation due to an input failure. With two OPERABLE required channels and one required channel in the trip condition, if a channel failure occurs in an OPERABLE required channel and results in erroneous control system operation, the remaining OPERABLE required channel can provide a plant trip. However, the channel that causes the erroneous control system operation cannot be credited as the single failure; therefore, this configuration does not satisfy the single failure criteria. When above the P-7 setpoint, to satisfy the single failure criteria, three channels must be restored to OPERABLE status within 72 hours.

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BASES

ACTIONS (continued)

These Functions do not have to be OPERABLE below the P-7 setpoint because there is insufficient heat production to generate DNB conditions below the P-7 setpoint.

The Completion Time of 1 hour to place the failed channel in the trip condition is based on operating experience and the minimum amount of time allowed for manual operator actions.

The Completion Time of 72 hours to restore the inoperable channel is justified because the two remaining OPERABLE channels are adequate to perform the safety function. In addition, the two remaining OPERABLE channels have continuous automatic self-testing and continuous automatic CHANNEL CHECKS.

The Completion Time of 72 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref.10).

Bypass of a required channel is not allowed because there are only three required channels and these channels are also used for control. If a failure were to occur in one of the two remaining required control channels, a plant transient could occur that would require a plant trip, but a plant trip would not occur with only one remaining OPERABLE required channel.

X.1

If the Required Action and associated Completion Time of Condition W is not met, the unit must be placed in which THERMAL POWER is below P-7. Six hours are allowed to reduce THERMAL POWER to below P-7 if the inoperable channel cannot be restored to OPERABLE status or placed in trip within the specified Completion Time.

The Completion Time of 6 hours is reasonable, based on operating experience, to reduce THERMAL POWER to below P-7 from full power in an orderly manner and without challenging unit systems.

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BASES

SURVEILLANCE REQUIREMENTS	The SRs for each RTS Function are identified by the SRs column of Table 3.3.1-1 for that Function.

A Note has been added to the SR Table stating that Table 3.3.1-1 determines which SRs apply to which RTS Functions.

Note that each channel of process protection supplies all trains of the RTS. However, when testing a Channel, it is only necessary to manually verify that the channel is OPERABLE in its respective train. This is because the interface to other trains is continuously verified through continuous automatic self-testing. ~~Self~~Continuous automatic self-testing is confirmed through periodic ~~COT and ACTUATION LOGIC TEST~~MIC. The CHANNEL CALIBRATION is performed in a manner that is consistent with the method~~s~~ and assumptions of ~~Section~~Specification 5.5.21, Setpoint Control Program (SCP).

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SR 3.3.1.1

Performance of the CHANNEL CHECK ensures that gross failure of instrumentation has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between ~~the two~~ instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

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Agreement criteria are determined based on a combination of the channel instrument uncertainties. If a channel is outside the criteria, it may be an indication that the sensor or the signal processing equipment has drifted outside its limit. If the channels are within the criteria, it is an indication that the channels are OPERABLE.

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~~The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.~~

BASES

SURVEILLANCE REQUIREMENTS (continued)

A CHANNEL CHECK may be conducted manually or automatically. For the US APWR an automated CHANNEL CHECK is normally conducted continuously. Where the CHANNEL CHECK is conducted automatically, an alarm shall be generated when the agreement criteria is not met.   MIC-03-16-0 0007

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

The equipment that performs the automated CHANNEL CHECK, and continuous self testing described for COT and ACTUATION LOGIC TEST, shall be confirmed OPERABLE every 12 hours. This shall include the capability to generate fault alarms.

SR 3.3.1.2

SR 3.3.1.2 compares the calorimetric heat balance calculation to the power range channel output. If the calorimetric heat balance calculation results exceed the power range channel output by more than 2% RTP, the power range channel is not declared inoperable, but must be adjusted. The power range channel output shall be adjusted consistent with the calorimetric heat balance calculation results if the calorimetric calculation exceed the power range channel output by more than + 2% RTP. If the power range channel output cannot be properly adjusted, the channel is declared inoperable.

If the calorimetric is performed at part power (<70% RTP), adjusting the power range channel indication in the increasing power direction will assure a Reactor Trip below the safety analysis limit (<118% RTP). Making no   MIC-03-16-0 0007
adjustment to the power range channel in the decreasing power direction due to a part power calorimetric assures a Reactor Trip consistent with   MIC-03-16-0 0007
the safety analyses.

BASES

SURVEILLANCE REQUIREMENTS (continued)

This allowance does not preclude making indicated power adjustments, if desired, when the calorimetric heat balance calculation is less than the power range channel output. To provide close agreement between indicated power and to preserve operating margin, the power range channels are normally adjusted when operating at or near full power during steady-state conditions. However, discretion must be exercised if the power range channel output is adjusted in the decreasing power direction due to a part power calorimetric (< 70% RTP). This action may introduce a non-conservative bias at higher power levels which may result in an NIS ~~r~~Reactor ~~t~~Trip above the safety analysis limit (> 118% RTP). The cause of the potential non-conservative bias is the decreased accuracy of the calorimetric at reduced power conditions. The primary error contributor to the instrument uncertainty for a secondary side power calorimetric measurement is the feedwater flow measurement, which is typically a ΔP measurement across a feedwater venturi. While the measurement uncertainty remains constant in ΔP as power decreases, when translated into flow, the uncertainty increases as a square term.

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Thus a 1% flow error at 100% power can approach a 10% flow error at 30% RTP even though the ΔP error has not changed. An evaluation of extended operation at part power conditions would conclude that it is prudent to administratively adjust the digital setpoint of the High Power Range Neutron Flux (~~h~~High ~~s~~Setpoint) digital bistables to $\leq$ 85% RTP when: 1) the power range channel output is adjusted in the decreasing power direction due to a part power calorimetric below 70% RTP; or 2) for a post refueling startup. The evaluation of extended operation at part power conditions would also conclude that the potential need to adjust the indication of the High Power Range Neutron Flux in the decreasing power direction is quite small, primarily to address operation in the intermediate range about P-10 (nominally 10% RTP) to allow enabling of the High Power Range Neutron Flux (~~l~~Low ~~s~~Setpoint) and the Intermediate Range Neutron Flux ~~r~~Reactor ~~t~~Trips. Before the High Power Range Neutron Flux (~~h~~High ~~s~~Setpoint) digital bistables are reset to $\leq$ 109% RTP, the power range channel adjustment must be confirmed based on a calorimetric performed at $\geq$ 70% RTP.

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MIC-03-16-0 0007

The Note clarifies that this ~~Surveillance~~SR is required only if reactor power is $\geq$ 15% RTP and that 12 hours are allowed for performing the first ~~Surveillance~~SR after reaching 15% RTP. A power level of 15% RTP is chosen based on plant stability, i.e., automatic rod control capability and turbine generator synchronized to the grid.

MIC-03-16-0 0007

MIC-03-16-0 0007

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program. In addition, control room operators periodically monitor redundant indications and alarms to detect deviations in channel outputs.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.3

SR 3.3.1.3 compares the incore system to the NIS channel output. If the absolute difference is ≥ 3%, the NIS channel is still OPERABLE, but must be readjusted. The excore NIS channel shall be adjusted if the absolute difference between the incore and excore AFD is ≥ 3%.

If the NIS channel cannot be properly readjusted, the channel is declared inoperable. This ~~Surveillance~~SR is performed to verify the f(ΔI) input to the Overtemperature ΔT Function and Overpower ΔT Function. | MIC-03-16-0 0007

A Note clarifies that the ~~Surveillance~~SR is required only if reactor power is ≥ 15% RTP and that 24 hours ~~is~~are allowed for performing the first ~~Surveillance~~SR after reaching 15% RTP. | MIC-03-16-0 0007

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.3.1.4

SR 3.3.1.4 is the performance of a TADOT. This test shall verify RTB train OPERABILITY by actuation of the two RTBs for each train to their trip~~ped~~ state. Each RTB may be actuated together or individually. | MIC-03-16-0 0007

The RTB train test shall include three separate but overlapping tests: (1) The Undervoltage ~~T~~test for verification of RTB operability using only the ~~u~~Undervoltage ~~t~~Trip ~~m~~Mechanism~~.~~. (2) The Shunt Trip test for verification of RTB operability using only the ~~s~~Shunt ~~t~~Trip ~~m~~Mechanisms~~.~~, and (3) The Manual Reactor Trip ~~T~~test for verification of RTB operability using the hardwired switches. The Undervoltage ~~T~~test shall bypass the ~~s~~Shunt ~~t~~Trip ~~m~~Mechanism, so each RTB actuates using only the ~~u~~Undervoltage Trip ~~m~~Mechanism. The Shunt Trip ~~T~~test shall bypass the ~~u~~Undervoltage Trip ~~m~~Mechanism, so each RTB actuates using only the ~~s~~Shunt ~~t~~Trip ~~m~~Mechanism. The Manual Reactor Trip ~~T~~test shall actuate the RTB with both mechanisms. Figure 4.4-1 of ~~Topical Report~~ MUAP-07004 (Ref. 6) describes an acceptable overlapping method for conducting these three separate tests that confirms OPERABLE status. | MIC-03-16-0 0007

~~The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.~~ | MIC-03-16-0 0007

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.5

SR 3.3.1.5 is the performance of an ACTUATION LOGIC TEST. The PSMS is self tested on a continuous basis from the digital side of all input modules to the digital side of all output modules. Self testing also encompasses all data communications within a PSMS train, between PSMS trains and between the PSMS and PCMS. The self testing is described in Reference 6 and 7. The ACTUATION LOGIC TEST is a check of the RTS software memory integrity to ensure there is no change to the internal RTS software that would impact its functional operation or the continuous self test function. The software memory integrity test is described in Reference 6 and 7. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

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The complete continuity check from the input device to the output device is performed by the combination of the continuous CHANNEL CHECK, the 24 month CHANNEL CALIBRATION for the non digital side of the input module, the continuous self testing for the digital side, the 24 month COT, the 24 month ACTUATION LOGIC TEST and the STAGGERED 62 days TADOT for the non digital side of the output module. The CHANNEL CALIBRATION, COT, ACTUATION LOGIC TEST and TADOT, which are manual tests, overlap with the CHANNEL CHECK and self testing and confirm the functioning of the self testing.

MIC-03-16-0 0007

The ACTUATION LOGIC TEST interval of 24 months with the self test capability is justified in the PSMS reliability analysis. For detailed information, refer to the US APWR Technical Report MUAP-07030 PRA, Attachment 6A.12. The result of the PSMS reliability analysis is evaluated and confirmed in the US APWR PRA Chapter 19.

SR 3.3.1.65

SR 3.3.1.65 is a calibration of the excore channels to the incore channels. If the measurements do not agree, the excore channels are not declared inoperable but must be calibrated to agree with the incore detector measurements. If the excore channels cannot be adjusted, the channels are declared inoperable. This SurveillanceSR is performed to verify the f(ΔI) input to the Overtemperature ΔT Function and Overpower ΔT Function.

MIC-03-16-0 0007

A Note modifies SR 3.3.1.65. The Note states that this SurveillanceSR is required only if reactor power is > 50% RTP and that 24 hours isare allowed for performing the first surveillanceSR after reaching 50% RTP.

MIC-03-16-0 0007

BASES

SURVEILLANCE REQUIREMENTS (continued)

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.3.1.~~7~~6   MIC-03-16-0
                                                                                        0007

SR 3.3.1.~~7~~6 is the performance of a ~~COT~~MIC for the RTS Instrumentation. This includes the RPS.

The PSMS is self-tested automatically on a continuous basis from the digital side of all input modules to the digital side of all output modules. ~~Self~~Continuous automatic self-testing encompasses all ~~digital~~PSMS safety-related functions including digital Nominal Trip Setpoints, Time Constants and ~~trip~~actuation logic functions. -The continuous automatic self-testing also encompasses all data communications within a PSMS train, between PSMS trains and between the PSMS and PCMS. The continuous automatic self-testing is described in Reference 6 and Reference 7.

MIC-03-16-0
0007

The ~~COT~~MIC is a diverse check of the ~~RTS~~PSMS software memory integrity, consistent with the Setpoint Control Program (SCP), to ensure there is no change to the internal ~~RTS~~PSMS software that would impact its functional operation, including digital Nominal Trip Setpoint~~s, values~~Time Constants, actuation logic functions or the continuous automatic self-testing. ~~self test function.~~ The ~~software memory integrity test~~MIC is described in Reference 6 and Reference 7.

~~A COT ensures the entire channel will perform the intended Function. A COT also ensures that the logic processing for interlocks (i.e., P 6 and P 10) is operating correctly. The combination of the COT, CHANNEL CALIBRATION, continuous self testing and continuous CHANNEL CHECK ensures the comple P 6 and P 10 interlocks are operating correctly.~~

~~The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.~~The capability to generate continuous automatic self-testing fault alarms shall be confirmed OPERABLE during the MIC.

BASES

SURVEILLANCE REQUIREMENTS (continued)

The complete ~~continuity~~OPERABILITY check from the measurement channel input device to the ~~output device~~Reactor Trip Breaker is performed by the combination of the continuous automatic self-testing for the digital devices (the RPS and data communication interfaces), the continuous automatic CHANNEL CHECK (SR 3.3.1.1 and SR 3.3.1.7), the CHANNEL CALIBRATION (SR 3.3.1.8, SR 3.3.1.9 and SR 3.3.1.10), the MIC (SR 3.3.1.6) and the TADOT (SR 3.3.1.4 and SR 3.3.1.11). The CHANNEL CALIBRATION ~~for the non digital side of the input module~~, the ~~continuous self-testing for the digital side, the COT, the ACTUATION LOGIC TEST~~MIC and the ~~TADOT for the non digital side of the output module. The CHANNEL CALIBRATION, COT, and~~ TADOT, which are manual tests, overlap with the ~~CHANNEL CHECK~~continuous automatic ~~and~~ self-testing and confirm the functioning of the continuous automatic self-testing.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

~~The Note allows a normal shutdown to proceed without a delay for testing in MODE 2 and for a short time in MODE 3 until the RTBs are open and SR 3.3.1.7 is no longer required to be performed. If the unit is to be in MODE 3 with the RTB closed for 4 hours this Surveillance must be performed prior to 4 hours after entry into MODE 3.~~

SR 3.3.1.~~8~~7

Performance of the CHANNEL CHECK within 4 hours after reducing power below P-6 and the frequency in accordance with the Surveillance Frequency Control Program ensures that gross failure of instrumentation has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between ~~the two~~ instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria are determined based on a combination of the channel instrument uncertainties. If a channel is outside the criteria, it may be an indication that the sensor or the signal processing equipment has drifted outside its limit.

The Surveillance Frequency of 4 hours is based on the need to verify OPERABILITY of the SR instruments within a reasonable time after being re-energized.

MIC-03-16-00007

BASES

SURVEILLANCE REQUIREMENTS (continued)

~~The Surveillance Frequency thereafter is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.~~ | MIC-03-16-0 0007

~~A CHANNEL CHECK may be conducted manually or automatically. For the US-APWR an automated CHANNEL CHECK is normally conducted continuously. Where the CHANNEL CHECK is conducted automatically, an alarm shall be generated when the agreement criteria is not met.~~

~~The equipment that performs the automated CHANNEL CHECK, and continuous self testing described for COT and ACTUATION LOGIC TEST, shall be confirmed OPERABLE including the capability to generate fault alarms.~~ The Surveillance Frequency thereafter is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.3.1.~~9~~8

SR 3.3.1.8 is the performance of a CHANNEL CALIBRATION.

CHANNEL CALIBRATION is a complete check of the instrument loop, including the sensor. The test ~~verifies~~must be performed consistent with the methods and assumptions of Specification 5.5.21, SCP, to verify that the channel responds to a measured parameter within the necessary range and accuracy ~~as defined by the Allowable Value~~. | MIC-03-16-0 0007 | MIC-03-16-0 0007

The CHANNEL CALIBRATION confirms the accuracy of the channel from sensor to digital VDU readout as described in Reference 6.

For analog measurements, the CHANNEL CALIBRATION confirms the ~~accuracy of the channel from sensor to digital VDU read out (Ref. 6). The CHANNEL CALIBRATION confirms the analog measurement accuracy conforms to~~calibration settings are within the Allowable Value at multiple points over the entire measurement channel span, encompassing all ~~r~~Reactor ~~t~~Trip and interlock Nominal Trip Setpoint values. Digital ~~r~~Reactor ~~t~~Trip and interlock Nominal Trip Setpoint values are confirmed through a ~~COT~~MIC. | MIC-03-16-0 0007 | MIC-03-16-0 0007

For binary measurements, the CHANNEL CALIBRATION confirms the accuracy of the channel's state change~~, as described in Reference 6~~. The state change must occur within the Allowable Value of the Nominal Trip Setpoint. | MIC-03-16-0 0007

BASES

SURVEILLANCE REQUIREMENTS (continued)

~~CHANNEL CALIBRATIONS must be performed consistent with the methods and assumptions in Section 5.5.21 SCP~~The equipment that performs the automated CHANNEL CHECK shall be confirmed OPERABLE, including the capability to generate fault alarms during the CHANNEL CALIBRATION. | MIC-03-16-0 0007

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

~~SR 3.3.1.9 is modified by a Note stating that this test shall include verification that the time constants are adjusted to the prescribed values where applicable.~~ | MIC-03-16-0 0007

SR 3.3.1.~~10~~9

SR 3.3.1.~~10~~9 is the performance of a CHANNEL CALIBRATION, as described in SR 3.3.1.~~9~~8, for the neutron flux channels. This SR is modified by a Note stating that the neutron detectors are excluded from the CHANNEL CALIBRATION.

~~The CHANNEL CALIBRATION~~For this SR the calibration for the power range neutron detectors consists of a normalization of the detectors based on a power calorimetric and flux map performed above 15% RTP. ~~The CHANNEL CALIBRATION~~For this SR the calibration for the source range and intermediate range neutron detectors consists of obtaining the detector plateau or discriminator curves, evaluating those curves, and comparing the curves to the manufacturer's data. This ~~Surveillance~~SR is not required for the NIS power range detectors for entry into MODE 2 or 1, and is not required for the NIS intermediate range detectors for entry into MODE 2, because the unit must be in at least MODE 2 to perform the test for the intermediate range detectors and MODE 1 for the power range detectors. | MIC-03-16-0 0007 | MIC-03-16-0 0007 | MIC-03-16-0 0007

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.3.1.~~11~~10 | MIC-03-16-0 0007

SR 3.3.1.~~11~~10 is the performance of a CHANNEL CALIBRATION, as described in SR 3.3.1.~~9~~8. ~~Whenever a sensing element is replaced, the next required~~ CHANNEL CALIBRATION ~~of the resistance temperature detectors (RTD) sensors~~ is accomplished by ~~an in-place~~a cross calibration that compares the ~~other sensing elements with the recently~~signals from the installed ~~sensing element~~channels to a channel with a reference RTD, in accordance with FSAR Section 7.1.3.14 (Ref. 13).

BASES

SURVEILLANCE REQUIREMENTS (continued)

~~This test will verify t~~The rate lag compensation for flow from the core to the RTDs is implemented in the RPS through digital functions; this rate lag function is confirmed through the MIC, SR 3.3.1.6.

| | MIC-03-16-0 0007 |

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.3.1.~~12~~11

| | MIC-03-16-0 0007 |

SR 3.3.1.~~12~~11 is the performance of a TADOT of Turbine Trip Functions. This TADOT is performed prior to exceeding the P-7 interlock whenever the unit has been in MODE 3. This ~~Surveillance~~SR is not required if it has been performed within the previous 31 days. Verification of the Nominal Trip Setpoint ~~does~~is not ~~have to be~~ performed ~~for this~~during the TADOT ~~Surveillance~~SR; the Nominal Trip Setpoint is verified during CHANNEL CALIBRATION. Performance of this test will ensure that the ~~t~~Turbine ~~t~~Trip Function is OPERABLE prior to exceeding the P-7 interlock.

| | MIC-03-16-0 0007 |

SR 3.3.1.~~13~~12

| | MIC-03-16-0 0007 |

SR 3.3.1.~~13~~12 verifies that the ~~response times for all~~ RTS ~~functions are~~RESPONSE TIME is less than or equal to the maximum values assumed in the accident analysis. Accident analysis response time values are ~~defined~~specified in Reference 2. Individual component response times are not modeled in the analyses.

The analyses model the overall or total elapsed time, from the point at which the parameter exceeds the ~~Trip Setpoint value at the sensor~~Analytical Limit to the point at which the equipment reaches the required functional state (i.e., control and shutdown rods fully inserted in the reactor core).

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~~The PSMS dynamic transfer functions employ time constants that are installed as digital values and processed through digital algorithms. Therefore, the time response of the dynamic transfer functions has no potential for variation due to time or environmental drift or component aging. The COT confirms the integrity of the time constants and algorithms through the periodic software memory integrity check. The complete PSMS response time is determined one time by analysis and confirmed one time in the factory test. The response times of analog instruments that provide input to the dynamic transfer functions are periodically checked in Surveillance 3.3.1.13, because they do have the potential for response time variation. RTBs and RTDs are known to have aging or wear out mechanisms that can impact response time and require response time measurement. Response time for other components can be affected by~~

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BASES

SURVEILLANCE REQUIREMENTS (continued)

~~random failures or calibration discrepancies, which can be detected by other testing and calibration methods required by other surveillances.~~

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Response time may be verified by actual response time tests in any series of sequential, overlapping or total channel measurements, or by the summation of allocated sensor, signal processing and actuation logic response times with actual response time tests on the remainder of the channel.

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0007

Allocations for sensor~~s~~, signal ~~conditioning,~~processing and actuation logic response times may be obtained from: (1) historical records based on acceptable response time tests (hydraulic, noise, or power interrupt tests), (2) in place, onsite, or offsite (e.g., vendor) test measurements, or (3) utilizing vendor engineering specifications. ~~MUAP-09021-P "Response Time of safety I&C System"~~

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The PSMS MELTAC controllers employ dynamic transfer functions with Time Constants that are installed as digital values and processed through digital algorithms. Therefore, the time response of all digital PSMS functions has no potential for variation due to time, environmental drift or component aging.

PSMS Time Constants are set at the nominal values assumed in the safety analysis. The combination of continuous automatic self-testing and MIC confirms the integrity of the dynamic transfer functions, Time Constants and actuation logic functions.

The response time for the digital portion of the PSMS is determined one time by analysis and confirmed one time in the factory test. Therefore, for PSMS digital functions, including Functions with Time Constants, response time tests are not required; instead, a response time allocation may be applied.

Response time for PSMS MELTAC input signal conditioning, can be affected by random failures or degradation, which can be detected by CHANNEL CALIBRATION. Section 4.6 of MUAP-07005, "Safety System Digital Platform -MELTAC-" (Ref. 7) describes the basis for crediting CHANNEL CALIBRATION for detecting PSMS signal conditioning response time degradation. Therefore, for PSMS input signal conditioning, response time tests are not required; instead, a response time allocation may be applied.

BASES

SURVEILLANCE REQUIREMENTS (continued)

MUAP-09021-P, "Response Time of Safety I&C System" (Ref. 11), provides the basis and methodology for using allocated sensor response times in the overall verification of the channel response time for specific sensors identified in the report. Response time verification for other sensor types must be demonstrated by test. MUAP-09021-P also provides the basis and methodology for using allocated signal processing and actuation logic response times in the overall verification of the protection system channel response time. ~~Section 4.4 of MUAP-07005, "Safety System Digital Platform – MELTAC," describes how response times of each individual MELTAC module are combined to determine the total digital system response time.~~

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In addition, MUAP-09021-P identifies the acceptance criteria for RTS components that require response time measurement (such as RTBs and RTDs which are known to have aging or wear-out mechanisms that can impact response time), taking into consideration the total RTS RESPONSE TIME requirement and the allocations for other components that do not require testing.

The allocations for sensor, signal conditioning, and actuation logic response times must be verified prior to placing the component in operational service and re-verified following maintenance that may adversely affect response time. In general, electrical repair work does not impact response time provided the parts used for repair are of the same type and value. One example where response time could be affected is replacing the sensing assembly of a transmitter.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.3.1.~~13~~12 is modified by a Note stating that neutron detectors are excluded from RTS RESPONSE TIME testing. This Note is necessary because of the difficulty in generating an appropriate detector input signal. Excluding the detectors is acceptable because the principles of detector operation ensure a virtually instantaneous response.

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BASES

SURVEILLANCE REQUIREMENTS (continued)

REFERENCES

1. Regulatory Guide 1.105, Revision 3, "Setpoints for Safety Related Instrumentation."

2. FSARSection 7.2.

3. FSAR Chapter 15.

4. IEEE-603-1991.

5. 10 CFR 50.49.

6. MUAP-07004-P ~~(Proprietary) and MUAP-07004-NP (Non-Proprietary)~~ Revision 7, "Safety I&C System Description and Design Process." | MIC-03-16-00007

7. MUAP-07005-P ~~(Proprietary) and MUAP-07005-NP (Non-Proprietary)~~ Revision 8, "Safety System Digital Platform — -MELTAC-." | MIC-03-16-00007

8. 10 CFR 50.36.

9. FSAR Section 6.2.1.

10. FSAR Chapter 19. | MIC-03-16-00007

11. MUAP-09021-P, Revision 2, "Response Time of Safety I&C System."

12. MUAP-09022-P, Revision 2, "US-APWR Instrument Setpoint Methodology."

13. FSAR Section 7.1.

B 3.3 INSTRUMENTATION

B 3.3.2 Engineered Safety Features Actuation System (ESFAS) Instrumentation

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BASES

| BACKGROUND | The ESFAS initiates necessary safety systems, based on the values of selected unit parameters, to protect against violating core design limits and the Reactor Coolant System (RCS) pressure boundary, and to mitigate accidents. |

The ESFAS instrumentation is segmented into ~~three~~four distinct but interconnected modules as identified below:

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• Field transmitters or process sensors and instrumentation: provide a measurable electronic signal based on the physical characteristics of the parameter being measured,

• The Reactor Protection System (RPS) provides signal conditioning, analog to digital conversion, ~~bistable~~digital bistables for setpoint comparison, process algorithm actuation, ~~compatible electrical signal~~digital output to ~~plant process components~~the ESFAS, and digital output to control board/~~m~~Main ~~c~~Control ~~r~~Room (MCR)/miscellaneous VDUs,~~and~~

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• The ESFAS and Safety Logic System (SLS) provides Actuation Logic, and Actuation Outputs to initiate the proper unit shutdown or ~~e~~Engineered ~~s~~Safety ~~f~~Features (ESF) actuation in accordance with the defined logic ~~and~~. based on the partial actuation inputs from the RPS~~.~~, and

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• The Safety VDUs (S-VDU) and Communication Subsystems (COM) provide Manual Control of ESF Components and backup manual initiation of Reactor Trip and ESFAS Functions.

The Nominal Trip Setpoint, recorded and maintained in a document established by the Setpoint Control Program (SCP), is a predetermined setting for a protective device chosen to ensure automatic actuation prior to the process variable reaching the Analytical Limit and thus ensuring that the SL would not be exceeded. As such, the Nominal Trip Setpoint accounts for uncertainties in setting the device (e.g., calibration), uncertainties in how the device might actually perform (e.g., repeatability), changes in the point of action of the device over time (e.g., drift during surveillance intervals), and any other factors which may influence its actual performance (e.g., harsh accident environments). In this manner, the Nominal Trip Setpoint plays an important role in ensuring that SLs are not exceeded. As such, the Nominal Trip Setpoint meets the definition of an LSSS (Ref. 13) and is used to meet the requirement that they be contained in the Technical Specifications. This is an acceptable approach for digital systems because the digital setpoints do

BASES

BACKGROUND (continued)

not drift as in analog systems. The Nominal Trip Setpoint is applicable to automatic protection instrumentation functions for Reactor Trip, ESFAS actuation and permissive interlocks.

Technical Specifications contain Allowable Values related to the OPERABILITY of equipment required for safe operation of the facility. The Allowable Value accommodates expected drift in the analog components of the channel that would have been specifically accounted for in the setpoint methodology for calculating the Nominal Trip Setpoint and thus the automatic protective action would still have ensured that the SL would not be exceeded with the "as-found" setting of the protective device. Therefore, the device would still be OPERABLE since it would have performed its safety function and the only corrective action required would be to recalibrate the device to account for further drift during the next surveillance interval.

However, there is also some point beyond which the device would have not been able to perform its function due, for example, to greater than expected drift. This value needs to be specified in the Technical Specifications in order to define OPERABILITY of the devices and is designated as the Allowable Value.

The Allowable Value, in conjunction with the Nominal Trip Setpoint and LCO, establishes the threshold for ESFAS action to prevent exceeding acceptable limits such that the consequences of Postulated Accidents (PAs) will be acceptable. The Allowable Value, recorded and maintained in a document established by the Setpoint Control Program (SCP), is considered a limiting value such that a channel is OPERABLE if the measured accuracy is as-found value does not to exceed the Allowable Value during the CHANNEL CALIBRATION. The Allowable Value is applicable to automatic protection instrumentation functions for Reactor Trip, ESFAS actuation and permissive interlocks.

For analog measurements, the CHANNEL CALIBRATION verifies the instrumentchannel accuracy at five calibration setpointssettings corresponding to 0%, 25%, 50%, 75% and 100% of the instrument range. For binary measurements, the CHANNEL CALIBRATION verifies the accuracy of the channel's state change at the required setpoint. As such, the Allowable Value accounts for the expected instrument loop uncertainties, such as drift, during the surveillance interval. In this manner, the actual setting of the device will still meet the LSSS definition and ensure that a SL is not exceeded at any given point of time as long as the device has not drifted beyond that expected during the surveillance interval.

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BASES

BACKGROUND (continued)

Note that, although ~~a~~the channel is "OPERABLE" under these circumstances, the channel ~~must~~shall be left adjusted to a value within the established channel ~~c~~Calibration ~~t~~Tolerance (CT) band in accordance with the uncertainty assumptions stated in the referenced setpoint methodology~~,~~ (as-left criteria)~~.~~ ~~and confirmed to be operating within the statistical allowances of the uncertainty terms assigned.~~ The Calibration Tolerance, recorded and maintained in a document established by the SCP, is applicable to automatic protection instrumentation functions for Reactor Trip, ESFAS actuation and permissive interlocks.

If the as-found value of the device is found to have exceeded the Allowable Value, or the as-left value of the device cannot be adjusted to a value within the Calibration Tolerance, the device would be considered inoperable from a technical specification perspective. This requires corrective action including those actions required by 10 CFR 50.36 when automatic protective devices do not function as required.

In the Protection and Safety Monitoring System (PSMS), setpoints associated with analog measurements are stored as digital values that have no potential for variation due to time, environmental drift or component aging. For analog measurements, the only factors that can result in variation in the trip functions reside in the uncertainties that are pertinent to the analog portion of the system. Therefore, for analog measurements in the PSMS, it is appropriate for the Allowable Value to be expressed in terms of values that are measured during periodic testing of the analog portion of the system (i.e., CHANNEL CALIBRATION).

For PSMS analog measurements, the as-found and as-left values are measured from sensor to digital Visual Display Unit (VDU) readout during CHANNEL CALIBRATION. The US-APWR enhances human performance by establishing a standard CHANNEL CALIBRATION method for all analog measurements, whereby the as-found and as-left values read at the VDU are measured at the same five calibration settings, regardless of the PSMS trip setpoint(s).

Since the PSMS trip logic and setpoints for analog measurements are stored as digital values with no drift potential, and those digital values are confirmed through the MEMORY INTEGRITY CHECK (MIC), the only untested area required to confirm channel operability pertains to the accuracy of the analog input signal. When the analog input accuracy is confirmed, by reading the digital values of the five point CHANNEL CALIBRATION settings on any VDU driven by the same digital value used in the controller that executes the trip functions, the operability of the complete channel is confirmed, including the accuracy of all trip setpoints associated with that channel.

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BASES

BACKGROUND (continued)

In the PSMS, setpoints associated with binary measurements are stored within the binary device itself. These setpoints have potential for variation due to time, environmental drift or component aging. However, these sensors are interfaced to the digital portion of the PSMS, which has no potential for variation due to time, environmental drift or component aging. For binary measurements, the only factors that can result in variation in the trip functions reside in the uncertainties that are pertinent to the binary sensor itself. Therefore, for binary measurements in the PSMS, it is appropriate for the Allowable Value to be expressed in terms of values that are measured during periodic testing of the binary device (i.e., CHANNEL CALIBRATION).

For PSMS binary measurements, the as-found and as-left state change values are measured from sensor to VDU readout during CHANNEL CALIBRATION. The US-APWR enhances human performance by establishing a standard CHANNEL CALIBRATION method for all binary measurements, whereby the as-found and as-left values read at the VDU are measured at the channel's required state change.

Since the PSMS trip logic for binary sensors is stored as digital values with no drift potential, and those digital values are confirmed through the MIC, the only untested area required to confirm channel operability pertains to the accuracy of the binary input signal. When the binary input accuracy is confirmed, by reading the channel's state change on any VDU driven by the same digital value used in the controller that executes the trip functions, the operability of the complete channel is confirmed, including the accuracy of the trip setpoint associated with that channel.

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Field Transmitters or Sensors

To meet the design demands for redundancy and reliability, more than one, and often as many as four, field transmitters or sensors are used to measure unit parameters. In many cases, field transmitters or sensors that input to the ESFAS are shared with the Reactor Trip System (RTS). In some cases, the same channels also provide control system inputs. To account for calibration tolerances and instrument drift, which are assumed to occur between calibrations, statistical allowances are provided in the Nominal Trip Setpoint and Allowable Values. The OPERABILITY of each transmitter or sensor is determined by ~~either~~ "as-found" calibration data evaluated during the CHANNEL CALIBRATION ~~or~~and by qualitative assessment of field transmitter or sensor, as related to the channel behavior observed during performance of the CHANNEL CHECK.

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BASES

BACKGROUND (continued)

~~Signal Processing Equipment~~Protection and Safety Monitoring System | MIC-03-16-0 0007

Generally, four channels of process control equipment are used for the signal processing of unit parameters measured by the field instruments. The process control equipment provides signal conditioning, analog to digital conversion, comparable digital output signals for VDUs located on the main control board, and comparison of measured input signals with setpoints established by safety analyses. These setpoints are ~~defined~~recorded and maintained in ~~FSAR Chapter 7 (Ref. 2) and FSAR Chapter 8 (Ref. 8)~~a document established by the Setpoint Control Program (SCP). If the measured value of a unit parameter exceeds the predetermined setpoint, a digital output from a digital bistable ~~output~~ is forwarded to the ESFAS for decision evaluation. Channel separation is maintained throughout the PSMS. Some unit parameters provide input only to the PSMS, while others are used by the PSMS and are retransmitted to the Plant Control and Monitoring System (PCMS) for use in one or more control systems. | MIC-03-16-0 0007

Generally, if a parameter is used only for input to the protection circuits, three channels with a two-out-of-three logic are sufficient to provide the required reliability and redundancy. If one channel fails in a direction that would not result in a partial Function trip, the Function is still OPERABLE with a two-out-of-two logic. If one channel fails such that a partial Function trip occurs, a trip will not occur and the Function is still OPERABLE with a one-out-of- two logic. | MIC-03-16-0 0007

Generally, if a parameter is used for input to the protection circuits and a control function, three channels with a two-out-of-three logic are also sufficient to provide the required reliability and redundancy. ~~The~~When three or more channels are OPERABLE, the Signal Selection Algorithm (SSA) within the PCMS ensures the control systems can withstand an input failure to the control system without causing erroneous control system operation which would otherwise require the protection function actuation. Since the input failure does not cause an erroneous control system action that challenges the protection function, the input failure is considered a single failure in the ESFAS and the ESFAS remains capable of providing its protective function with the remaining two ~~operable~~OPERABLE channels. Again, a single failure will neither cause nor prevent the protection function actuation. When there are less than three OPERABLE channels, the SSA cannot prevent erroneous control system operation due to an input failure. This is reflected in the LCO Completion Times for shared channels, when there are only three required channels. | MIC-03-16-0 0007

These requirements are described in IEEE-603-1991 (Ref. 4). The actual number of channels required for each unit parameter is specified in Reference 2.

BASES

BACKGROUND (continued)

Allowable Values and ESFAS Setpoints

The Nominal Trip Setpoints used in the digital bistables or binary sensors are based on the Analytical Limits defined in the accident analysis and the channel uncertainty. The selection of these Nominal Trip Setpoints is such that adequate protection is provided when all sensor and processing ~~t~~Time ~~d~~Delays are taken into account. | MIC-03-16-0 0007 | MIC-03-16-0 0007

To allow for calibration tolerances, instrumentation uncertainties, instrument drift, and severe environment errors for those ESFAS channels that must function in harsh environments as defined by 10 CFR 50.49 (Ref. 5), the Allowable Values and Nominal Trip Setpoints ~~recorded and maintained in a document established by the SCP in the accompanying LCO~~ are conservative ~~with respect~~ to protect the Analytical Limits. The ~~SCP~~ methodology identified in the SCP, used to calculate the Allowable Values and ~~ESFAS~~Nominal Trip setpoints, incorporates all of the known uncertainties applicable to each channel (Ref. ~~7~~12). The magnitudes of these uncertainties are factored into the determination of each ~~ESFAS~~Nominal Trip Setpoint and ~~corresponding~~ Allowable Value. | MIC-03-16-0 0007

The ~~ESFAS~~Nominal Trip Setpoint entered into the bistable or binary sensor is more conservative than that specified by the Analytical Limit ~~to account~~. The Nominal Trip Setpoint accounts for measurement errors detectable by the CHANNEL CALIBRATION and other unmeasurable errors (such as the effects of anticipated environmental conditions), which are both considered in the Allowable Value for CHANNEL CALIBRATION. The Allowable Value serves as the Technical Specification OPERABILITY limit for the purpose of the CHANNEL CALIBRATION. One example of such a change in measurement error is drift during the surveillance interval. If the ~~measured accuracy~~as-found value does not exceed the Allowable Value, the channel is considered OPERABLE. | MIC-03-16-0 0007

The ~~ESFAS~~ Nominal Trip Setpoint~~s are~~ (i.e., LSSS) is the value~~s~~ at which the ~~bistables are~~digital bistable or binary sensor is set. The ~~ESFAS~~Nominal Trip Setpoint value ensures the safety analysis limits are met for the surveillance interval selected when a channel is adjusted based on stated channel uncertainties. Any channel is considered to be properly adjusted when the "as-left" value is within the established Calibration Tolerance (CT) band, in accordance with the methods and assumptions ~~in~~of the SCP. The ~~ESFAS~~Nominal Trip Setpoint value (i.e., expressed as a value without inequalities) ~~is used~~ for digital bistables, is confirmed during the ~~purposes of the COT~~MIC. The Nominal Trip Setpoint value (i.e., expressed as a value with inequalities) for binary sensors is confirmed during the CHANNEL CALIBRATION. | MIC-03-16-0 0007 | MIC-03-16-0 0007

BASES

BACKGROUND (continued)

~~ESFAS~~ Nominal Trip Setpoints and Allowable Values, consistent with the requirements of the ~~Allowable Value~~SCP, ensure that SLs are not violated during AOOs and that the consequences of ~~Postulated Accidents (~~PAs~~)~~ will be acceptable, ~~providing~~provided the unit is operated from within the LCOs at the onset of the PA and the equipment functions as designed.

<div style="text-align:right">MIC-03-16-0 0007</div>

~~Digital~~Within the PSMS controllers, Nominal Trip Setpoints, Time Constants and Time Delays are digital settings maintained in non-volatile software memory within each RPS train. ~~-~~Digital settings have no potential for variation due to time, environmental drift or component aging; therefore, these digital settings have no surveillance tolerance. Each ~~train is~~PSMS controller has continuous automatic self-~~tested continuously on line to verify~~testing, which verifies that the digital Nominal Trip Setpoint and Time Constant settings are correct. ~~ESFAS Trip Setpoints~~Nominal Trip Setpoints and Time Constants are also verified periodically through ~~a diverse software memory integrity test, which is~~the MIC which must be conducted with the ~~RPS train~~affected PSMS controller out of service. A designated instrument channel is taken out of service for periodic ~~calibration~~CHANNEL CALIBRATION. SRs for the channels and trains are specified in the SR section.

<div style="text-align:right">MIC-03-16-0 0007</div>

The Allowable Value is the maximum deviation that can be measured during CHANNEL CALIBRATION, whereby the channel is considered OPERABLE. This value includes the deviations that are included in the calculations that determined the Nominal Trip Setpoint. The "expected as-found value" shall be as specified in the plant-specific setpoint analysis. The expected as-found value reflects the expected normal drift of actual plant equipment, so that a degraded device can be identified before the Allowable Value limit is reached. The expected as-found value is also referred to as the Performance Test Acceptance Criteria (PTAC). The PTAC, recorded and maintained in a document established by the SCP, is applicable to automatic protection instrumentation functions for Reactor Trip, ESFAS actuation and permissive interlocks.

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ESFAS and SLS

The ESFAS and SLS equipment ~~is~~are used for the decision logic processing of outputs from the RPS. The SLS is also used for manual control of ESF components for accident mitigation and to achieve safe shutdown. To meet the ~~redundancy requirements~~single failure criteria and accomodate on-line maintenance for four train ESF systems, four trains of ESFAS-SLS, each performing the same functions, are provided. If one train is taken out of service for maintenance or test purposes, the remaining trains will provide ESF actuation for the unit. Two train ESF systems are actuated by Trains A and D, or B and C of the ESFAS-SLS.

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<div style="text-align:right">MIC-03-16-0 0007</div>

BASES

BACKGROUND (continued)

Each train is packaged in its own cabinet for physical and electrical separation to satisfy separation and independence requirements. ~~In addition, each train provides qualified features, such as separate function processors and communication processors, to ensure communications independence.~~ | MIC-03-16-0 0007

The ESFAS~~-~~ and SLS performs~~s~~ the decision logic for most ESF equipment actuation; generates the electrical output signals that initiate the required actuation; and provides the status, permissive, and annunciator output signals to the ~~main control room~~MCR of the unit. | MIC-03-16-0 0007

The ~~bistable outputs~~digital output signals from all trains of the RPS are sensed by each ESFAS train and combined into logic that represent combinations indicative of various transients. If a required logic combination is completed, the ESFAS train will send actuation signals via the Safety Bus to its respective SLS train. The SLS actuates those components whose aggregate Function best serves to alleviate the condition and restore the unit to a safe condition. Examples are given in the Applicable Safety Analyses, LCO, and Applicability sections of ~~this~~these Bases. The SLS also actuates ESF components based on manual control signals received from non-safety Operational VDUs, and based on signals from Safety VDUs for the Manual Control of ESF Components Function. | MIC-03-16-0 0007

The ESFAS and SLS ~~are continuously automatically~~have continuous automatic self-~~tested while the unit is at power~~testing. When any one train is taken out of service for manual testing, the remaining trains are capable of providing unit monitoring and protection until the testing has been completed.

The automatic or manual actuation of ESF components is accomplished through solid state Actuation Outputs. The SLS energizes the Actuation Outputs appropriate for the condition of the unit. Each Actuation Output energizes one plant component. Actuation Outputs are tested in conjunction with their respective plant components. This test overlaps with the continuous automatic self-testing. | MIC-03-16-0 0007

S-VDU and COM | MIC-03-16-0 0007

The Safety VDUs (S-VDU) and Communication Subsystems (COM) provide backup controls for manual initiation of Reactor Trip and ESFAS Functions, and credited controls and indications for the Manual Control of ESF Components.

The S-VDU in each train consists of a VDU and S-VDU processor. There are two COM Subsystems in each train, COM-1 and COM-2.

BASES

BACKGROUND (continued)

The S-VDU provides backup controls for Manual Initiation of Reactor Trip (LCO 3.3.1) and ESFAS functions. Manual initiation signals are interfaced from the S-VDU to the RPS and ESFAS through COM-2, where they are combined with corresponding signals from non-safety Operational VDUs (O-VDU), through logic that prioritizes the S-VDU signal. The combined and prioritized S-VDU and O-VDU signals are then interfaced to the RPS or ESFAS where it is combined with the Manual Initiation pushbuttons, which are required by this LCO. These backup S-VDU controls are not credited in determining when the Manual Initiation Function is OPERABLE or in determining the number of required trains. However, these backup controls are considered in the Manual Initiation Function Completion Times for the Required Actions.

The S-VDU provides credited safety related displays and controls for the Manual Control of ESF Components Function. This Function supports the ESFAS and is used to achieve and maintain safe shutdown (e.g., LCO 3.5.2 for Safety Injection). Component control signals are interfaced from the S-VDU to the SLS through COM-2, where they are combined with corresponding signals from non-safety Operational VDUs (O-VDU), through logic that prioritizes the S-VDU signal. The combined and prioritized S-VDU and O-VDU signals are then interfaced to the SLS. Component position feedback signals for status displays are interfaced from the SLS to the S-VDU.

To meet the single failure criteria and accommodate on-line maintenance, for four train ESF systems, four trains of S-VDU and COM-2 are provided, each performing the same functions. If one train is taken out of service for maintenance or test purposes, the remaining trains will provide displays and manual controls for the unit. The S-VDU and COM-2 for Trains A and D, or Trains B and C support ESF systems with only two trains.

The S-VDU and COM-2 for each train are packaged in their own cabinet for physical and electrical separation to satisfy separation and independence requirements.

The S-VDU and COM-2 have continuous automatic self-testing while in service. When any one train is taken out of service for manual testing, the remaining trains are capable of providing unit monitoring and protection until the testing has been completed.

COM-1 provides signal interfaces from the ESFAS and SLS to the PCMS for non-safety functions only, such as the display of ESF component position on non-safety Operational VDUs (O-VDU). Therefore, there are no operability requirements for COM-1.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY	Each of the analyzed accidents can be detected by one or more ESFAS Functions. One of the ESFAS Functions is the primary actuation signal for that accident. An ESFAS Function may be the primary actuation signal for more than one type of accident. An ESFAS Function may also be a secondary, or backup, actuation signal for one or more other accidents. For example, Low Pressurizer Pressure is a primary actuation signal for small loss of coolant accidents (LOCAs) and a backup actuation signal for steam line breaks (SLBs) outside containment. Functions such as ~~m~~Manual ~~i~~Initiation, not specifically credited in the accident safety analysis, are qualitatively credited in the safety analysis and the NRC staff approved licensing basis for the unit. These Functions may provide protection for conditions that do not require dynamic transient analysis to demonstrate Function performance. These Functions may also serve as backups to Functions that were credited in the accident analysis (Ref. 3).

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The LCO requires all instrumentation performing an ESFAS Function, listed in Table 3.3.2-1 in the accompanying LCO, to be OPERABLE. A channel is OPERABLE provided the "as-found" <u>measured during surveillance testing,</u> value does not exceed its associated Allowable Value. ~~A trip setpoint may be set more conservative than the Trip Setpoint as necessary in response to plant conditions.~~<u>, and provided the "as-left" value is within the specified calibration tolerance at the completion of each CHANNEL CALIBRATION. For analog measurements, Allowable Values are defined in terms pertinent to the five channel calibration settings 0%, 25%, 50%, 75% and 100%. For binary measurements there is one Allowable Value defined in terms pertinent to the state change at the Nominal Trip Setpoint. A Nominal Trip Setpoint is set more conservative than the Allowable Value to account for channel uncertainties.</u> Failure of any instrument renders the affected channel(s) inoperable and reduces the reliability of the affected Functions.

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The LCO generally requires OPERABILITY of <u>two or</u> three channels in each instrumentation ~~f~~<u>F</u>unction<u>, two or three trains of Manual Initiation,</u> and two or three trains in each logic ~~and manual initiation function. The two out of three and the two out of four configurations allow~~<u>Function. Three OPERABLE instrumentation channels in a two-out-of-three configuration are required when one ESFAS channel is also used as a control system input. When there are three or more OPERABLE channels, the SSA within the control system prevents the possibility of a shared channel failing in such a manner that it creates a transient that requires ESFAS action. The input failure is considered a single failure in the ESFAS and ESFAS remains capable of providing its protective function with the remaining two OPERABLE channels. The SSA ensures there is no potential for control system and protection system interaction that could simultaneously create a need for ESFAS initiation and disable one ESFAS channel. When there are less than three OPERABLE channels, the SSA cannot prevent erroneous control system operation due to an input failure. This is reflected in the LCO Completion Times for shared channels, when there are only three required channels.</u>

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The two-out-of-three configuration allows one channel to be tripped during maintenance or testing without causing an ESFAS initiation. Two or three trains of logic ~~or manual initiation channels are required~~and Manual Initiation functions are required to ensure no single random failure disables the ESFAS. The required channels of ESFAS instrumentation provide unit protection in the event of any of the analyzed accidents.

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Due to redundant components within the PSMS, such as controllers, communication links and power supplies, an inoperable component may or may not result in an inoperable channel or train. Where an inoperable component results in an inoperable required channel or train, LCOs are entered. For inoperable components that do not result in inoperable channels or trains, LCOs are not entered.

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ESFAS protection functions are as follows:

1.   ECCS Actuation

ECCS Actuation (ECCS) provides two primary functions:

1.   Primary side water addition to ensure maintenance or recovery of ~~r~~Reactor ~~v~~Vessel ~~w~~Water ~~l~~Level (coverage of the active fuel for heat removal, clad integrity, and for limiting peak clad temperature to < 2200°F), and

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2.   Boration to ensure recovery and maintenance of SDM (k_{eff}< 1.0).

These functions are necessary to mitigate the effects of high energy line breaks (HELBs) both inside and outside of containment. The ECCS signal is also used to initiate other Functions such as:

•   Phase A Isolation,

•   Containment Purge Isolation,

•   Reactor Trip,

•   Feedwater Isolation,

•   Start of Emergency Feedwater (EFW) pumps,

•   ~~Main Control Room~~MCR Isolation, and

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•   Reactor Coolant Pump Trip.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

These other functions ensure:

- Isolation of nonessential systems through containment penetrations,

- Trip of the reactor to limit power generation,

- Isolation of main feedwater (MFW) to limit secondary side mass losses,

- Start of EFW to ensure secondary side cooling capability,

- Isolation of the ~~main control room~~MCR to ensure habitability, and

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- Trip of the Reactor Coolant Pump to prevent the unexpected Reactor Coolant Pump Trip after a small break LOCA.

a. ECCS Actuation - Manual Initiation

The LCO requires three trains to be OPERABLE. The operator can initiate ECCS at any time by using any two-out-of-four ECCS - Manual Initiation switches in the ~~main control room~~MCR. This action will cause actuation of all components in the same manner as any of the automatic actuation signals.

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The LCO for the Manual Initiation Function ensures the proper amount of redundancy is maintained in the manual ESFAS actuation circuitry to ensure the operator has manual ESFAS initiation capability.

Each train consists of one push button and the interconnecting wiring to the actuation logic cabinet. Each push button actuates its own train directly. A signal from each pushbutton is also interfaced to all other trains via internal PSMS communication links. In addition to direct actuation by its own train pushbutton, each train is also actuated by two out of three Manual Initiation signals received from the other trains. The signals from the other trains are not credited in determining when the Manual Initiation Function is OPERABLE or in determining the number of required trains. However, these additional signals are considered in the Completion Times for the Required Actions.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

  b. ECCS Actuation - Actuation Logic and Actuation Outputs

   This LCO requires three trains to be OPERABLE. Actuation logic consists of all circuitry housed within the actuation subsystems, including the actuation output devices responsible for actuating the ESF equipment.

   Manual and automatic initiation of ECCS must be OPERABLE in MODES 1, 2, and 3. In these MODES, there is sufficient energy in the primary and secondary systems to warrant automatic initiation of ESF systems. Manual Initiation is also required in MODE 4 even though automatic actuation is not required. In this MODE, adequate time is available to manually actuate required components in the event of a PA, but because of the large number of components actuated on an ECCS, actuation is simplified by the use of the manual actuation push buttons. Actuation Logic and Actuation Outputs must be OPERABLE in MODE 4 to support system level Manual Initiation.

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   These Functions are not required to be OPERABLE in MODES 5 and 6 because there is adequate time for the operator to evaluate unit conditions and respond by manually starting individual systems, pumps, and other equipment to mitigate the consequences of an abnormal condition or accident. Unit pressure and temperature are very low and many ESF components are administratively locked out or otherwise prevented from actuating to prevent inadvertent over-pressurization of unit systems.

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  c. ECCS Actuation - High Containment Pressure

   This signal provides protection against the following accidents:

   • SLB inside containment,

   • LOCA, and

   • Feed line break inside containment.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

High Containment Pressure provides no input to any control functions. There are four High Containment Pressure channels in a two-out-of-four logic configuration. Three OPERABLE channels are sufficient to satisfy protective requirements with a two-out-of-three logic. The transmitters (d/p cells) and electronics are located outside of containment with the sensing line (high pressure side of the transmitter) located inside containment.

Thus, the high pressure Function will not experience any adverse environmental conditions and the Nominal Trip Setpoint reflects only steady state instrument uncertainties.

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High Containment Pressure must be OPERABLE in MODES 1, 2, and 3 when. In these MODES, there is sufficient energy in the primary and secondary systems to pressurize the containment following a pipe break. In MODES 4, 5, and 6, there is insufficient energy in the primary or secondary systems to pressurize the containment.

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d.   ECCS Actuation - Low Pressurizer Pressure

This signal provides protection against the following accidents:

•   Inadvertent opening of a steam generator (SG) relief or safety valve,

•   SLB,

•   A spectrum of rod cluster control assembly ejection accidents (rod ejection),

•   Inadvertent opening of a pressurizer relief or safety valve,

•   LOCAs, and

•   SG Tube Rupture.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

There are four Low Pressurizer Pressure channels in a two-out-of-four logic configuration. Pressurizer Pressure provides both control and protection functions: input to the Pressurizer Pressure Control System, ~~r~~Reactor ~~t~~Trip, and ECCS. The interface from the safety channels in the PSMS to the PCMS is through the Signal ~~Selector~~Selection Algorithm (SSA). ~~The~~When three or more Low Pressurizer Pressure channels are OPERABLE, the SSA ensures an input failure to the control system does not result in erroneous control system action that would require the protection function actuation. Therefore, the protection function requires only two additional channels to provide the protection function actuation (i.e., three channels total). Three channels total must be OPERABLE. When there are less than three OPERABLE Low Pressurizer Pressure channels, the SSA cannot prevent erroneous control system operation due to an input failure. This is reflected in the LCO Completion Times for shared Low Pressurizer Pressure channels.

The transmitters are located inside containment, with the taps in the vapor space region of the pressurizer, and thus possibly experiencing adverse environmental conditions (LOCA, SLB inside containment, rod ejection). Therefore, the Nominal Trip Setpoint reflects the inclusion of both steady state and adverse environmental instrument uncertainties.

This Function must be OPERABLE in MODES 1~~,~~ and 2, and in MODE 3 ~~(~~above the P-11~~)~~ setpoint to mitigate the consequences of an HELB inside containment. This signal may be manually ~~blocked~~bypassed by the operator in MODE 3 below the P-11 setpoint. Automatic ECCS ~~a~~Actuation below this pressure setpoint is then performed by the High Containment Pressure signal.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

This Function is not required to be OPERABLE in MODE 3 below the P-11 setpoint, because the plant is in hot standby in preparation for a startup or shutdown process. Under hot standby conditions, reactor power is limited to decay heat so LOCA is not a critical condition in this situation. For SLB, the RCS boron concentration is higher (larger shutdown margin) and the moderator density coefficient is smaller due to the higher boron concentration compared to the FSAR Chapter 15 analysis. Thus, there is no need for automatic ECCS Actuation under these less limiting conditions. Therefore, when shutting down, the Low Pressurizer Pressure ECCS signal can be bypassed in MODE 3 below the P-11 setpoint. There is sufficient time margin for manual ECCS Actuation, if necessary. When starting up, the Low Pressurizer Pressure ECCS signal is automatically enabled above the P-11 setpoint.

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Other ESF functions are used to detect accident conditions and actuate the ESF systems in this MODE. In MODES 4, 5, and 6, this Function is not needed for accident detection and mitigation.

e. ECCS Actuation - Low Main Steam Line Pressure

Low Main Steam Line Pressure provides protection against the following accidents:

• SLB,

• Feed line break, and

• Inadvertent opening of an SG relief or an SG safety valve.

Low Main Steam Line Pressure provides no input to any control functions. There are four Low Main Steam Line Pressure channels on each steam line in a two-out-of-four logic configuration. Main Steam Line Pressure provides control inputs to the Steam Generator Pressure Control System, and protection inputs to ECCS and Main Steam Line Isolation protective functions. The interface from the safety channels in the PSMS to the PCMS is through the Signal Selection Algorithm (SSA). When three or more Main Steam Line Pressure channels are OPERABLE, the SSA ensures an input failure to the control system does not result in erroneous control system action that would require the protection

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

function actuation. Therefore, the protection function requires only two additional channels to provide the protection function actuation (i.e., three channels total). Three OPERABLE channels on each steam line are sufficient to satisfy the protective requirements with a two-out-of-three logic on each steam line. When there are less than three OPERABLE Main Steam Line Pressure channels, the SSA cannot prevent erroneous control system operation due to an input failure. This is reflected in the LCO Completion Times for shared Main Steam Line Pressure channels.

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This Function is anticipatory and has a typical lead/lag ratio of 50/5dynamic transfer function. The Time Constants for this Function are recorded and maintained in a document established by the Setpoint Control Program (SCP).

Low Main Steam Line Pressure must be OPERABLE in MODES 1, and 2, and MODE 3 (above the P-11) when setpoint. In these MODES, a secondary side break or stuck open valve could result in the rapid depressurization of the steam lines. This signal may be manually blockedbypassed by the operator in MODE 3 below the P-11 setpoint. Below P-11, feed line break is not a concern. Inside containment SLB will be terminated by automatic ECCS actuation via High Containment Pressure, and outside containment SLB will be terminated by the High Main Steam Line Pressure Negative Rate signal for main steam line isolation.

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This Function is not required to be OPERABLE in MODE 3 below the P-11 setpoint because the plant is in hot standby in preparation for a startup or shutdown process. Under hot standby conditions, the RCS boron concentration is higher (larger shutdown margin) and the moderate density coefficient is smaller due to the higher boron concentration compared to the FSAR Chapter 15 analysis. Thus, there is no need for automatic ECCS Actuation under these less limiting conditions. Therefore, when shutting down, the Low Main Steam Line Pressure ECCS signal can be bypassed in MODE 3 below the P-11 setpoint. There is sufficient time margin for manual ECCS Actuation, if necessary. However, considering the potential impact to containment integrity due to pressure increase from a SLB, the High Main Steam Line Pressure Negative Rate signal is required to be OPERABLE in MODE 3 below the P-11 setpoint to provide automatic Main Steam Line Isolation. The High Main Steam Line Pressure Negative Rate signal is automatically enabled when the Low Main Steam

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Line Pressure ECCS signal is bypassed. When starting up, the Low Main Steam Line Pressure ECCS signal is automatically enabled above the P-11 setpoint, and the High Main Steam Line Pressure Negative Rate signal is automatically disabled.

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This Function is not required to be OPERABLE in MODE 4, 5, or 6 because there is insufficient energy in the secondary side of the unit to cause an accident.

2.   Containment Spray

Containment Spray provides two primary functions:

1.   Lowers containment pressure and temperature after an HELB in containment, and

2.   Reduces the amount of radioactive iodine in the containment atmosphere.

These functions are necessary to:

•   Ensure the pressure boundary integrity of the containment structure,

•   Limit the release of radioactive iodine to the environment in the event of a failure of the containment structure, and

•   Minimize corrosion of the components and systems inside containment following a LOCA.

The ~~c~~Containment ~~s~~Spray actuation signal starts the containment spray pumps and aligns the discharge of the pumps to the containment spray nozzle headers in the upper levels of containment. Containment spray is actuated manually or by High 3 Containment Pressure.

MIC-03-16-00007

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

a. Containment Spray - Manual Initiation

The operator can initiate ~~c~~Containment ~~s~~Spray at any time from the ~~main control room~~MCR by simultaneously actuating two ~~c~~Containment ~~s~~Spray actuation switches per train for any two~~-~~out~~-~~of~~-~~four trains. Because an inadvertent actuation of ~~c~~Containment ~~s~~Spray could have such serious consequences, two switches must be actuated ~~simultaneously~~concurrently to initiate ~~c~~Containment ~~s~~Spray for each train. There are four sets of two switches each in the ~~main control room~~MCR. ~~Simultaneously~~Concurrently actuating the two switches will actuate ~~c~~Containment ~~s~~Spray in each train in the same manner as the automatic actuation signal. ~~Two~~Therefore, two Manual Initiation switches in ~~each of three trains~~a train are required to be OPERABLE for a train to ~~ensure no single failure disables the Manual Initiation Function.~~be OPERABLE. Note that Manual Initiation of ~~c~~Containment ~~s~~Spray also actuates Phase B ~~c~~Containment ~~i~~Isolation.

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Each train consists of two push buttons and the interconnecting wiring to the actuation logic cabinet. Each push button actuates its own train directly through two out of two logic. A signal from the output of this two out of two logic is also interfaced to all other trains via internal PSMS communication links. In addition to direct actuation by its own train pushbuttons, each train is also actuated by two out of three Manual Initiation signals received from the other trains. The signals from the other trains are not credited in the determining when the Manual Initiation Function is OPERABLE or in determining the number of required trains. However, these additional signals are considered in the Completion Times for the Required Actions.

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For Containment Spray only two 50% trains are needed to achieve 100% capacity; therefore, only three of four trains of manual initiation are needed to meet the single failure criteria. However, for Phase B Containment Isolation, although only two trains are needed to meet the single failure criteria for any single containment penetration, the containment penetrations are distributed to all four trains. Therefore, since Containment Spray - Manual Initiation is a combined Function for Containment Spray and Phase B Containment Isolation, two switches in each of all four trains are required to be OPERABLE.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

b.   Containment Spray - Actuation Logic and Actuation Outputs

Actuation Logic and Actuation Outputs consist of the same features and operate in the same manner as described for ESFAS Function 1.b.

Manual and automatic initiation of ~~c~~Containment ~~s~~Spray must be OPERABLE in MODES 1, 2, and 3 ~~when~~. In these MODES, there is a potential for an accident to occur, and sufficient energy in the primary or secondary systems to pose a threat to containment integrity due to overpressure conditions. Manual initiation is also required in MODE 4, even though automatic actuation is not required. In this MODE, adequate time is available to manually actuate required components in the event of a PA. However, because of the large number of components actuated on a ~~c~~Containment ~~s~~Spray, actuation is simplified by the use of the manual actuation push buttons. Actuation Logic and Actuation Outputs must be OPERABLE in MODE 4 to support system level ~~m~~Manual ~~i~~Initiation. In MODES 5 and 6, there is insufficient energy in the primary and secondary systems to result in containment overpressure. In MODES 5 and 6, there is also adequate time for the operators to evaluate unit conditions and respond, to mitigate the consequences of abnormal conditions by manually starting individual components.

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c.   Containment Spray - High-3 Containment Pressure

This signal provides protection against a LOCA or an SLB inside containment. The transmitters (d/p cells) are located outside of containment with the sensing line (high pressure side of the transmitter) located inside containment. The transmitters and electronics are located outside of containment. Thus, they will not experience any adverse environmental conditions and the Nominal Trip Setpoint reflects only steady state instrument uncertainties.

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High-3 Containment Pressure has four channels in a two-out-of-four logic configuration. Three OPERABLE channels are sufficient to satisfy protective requirements with two-out-of-three logic.

High-3 Containment Pressure must be OPERABLE in MODES 1, 2, and 3 ~~when~~. In these MODES, there is sufficient energy in the primary and secondary sides to pressurize the containment following a pipe break. In MODES 4, 5, and 6, there is insufficient energy in the primary and secondary sides to pressurize the containment and reach the High-3 Containment Pressure setpoint.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

   3.   Containment Isolation

Containment Isolation provides isolation of the containment atmosphere, and all process systems that penetrate containment, from the environment. This Function is necessary to prevent or limit the release of radioactivity to the environment in the event of a large break LOCA.

For any single containment penetration, isolation can be accomplished by either of two redundant trains. However, all ~~c~~Containment ~~i~~Isolation functions are distributed among all four ESFAS trains. | MIC-03-16-0 0007

There are two separate Containment Isolation signals, Phase A and Phase B. Phase A ~~i~~Isolation isolates all automatically isolable process lines, except component cooling water (CCW), at a relatively low containment pressure indicative of primary or secondary system leaks. For these types of events, forced circulation cooling using the reactor coolant pumps (RCPs) and SGs is the preferred (but not required) method of decay heat removal. Since CCW is required to support RCP operation, not isolating CCW on the low pressure Phase A signal enhances unit safety by allowing operators to use forced RCS circulation to cool the unit. Isolating CCW on the low pressure signal may force the use of feed and bleed cooling, which could prove more difficult to control. | MIC-03-16-0 0007

Phase A ~~c~~Containment ~~i~~Isolation is actuated automatically by ECCS Actuation, or manually via the Actuation Logic. All process lines penetrating containment, with the exception of CCW, are isolated. | MIC-03-16-0 0007

CCW is not isolated at this time to permit continued operation of the RCPs with cooling water flow to the thermal barrier heat exchangers and air or oil coolers. All process lines not equipped with remote operated isolation valves are manually closed, or otherwise isolated, prior to reaching MODE 4.

Manual Phase A Containment Isolation is accomplished by two switches in the ~~main control room~~MCR. Each push button actuates its own train directly. ~~A signal from each pushbutton is also interfaced to all other trains via internal PSMS communication links. In addition to direct actuation by its own train pushbutton, each train is also actuated by two out of three Manual Initiation signals received from the other trains.~~ | MIC-03-16-0 0007

Note that manual actuation of Phase A Containment Isolation also actuates Containment Purge Isolation.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The Phase B signal isolates CCW. This occurs at a relatively high containment pressure that is indicative of a large break LOCA or an SLB. For these events, forced circulation using the RCPs is no longer desirable. Isolating the CCW at the higher pressure does not pose a challenge to the containment boundary because the CCW System is a closed loop inside containment. Although some system components do not meet all of the ASME Code requirements applied to the containment itself, the system is continuously pressurized to a pressure greater than the Phase B setpoint. Thus, routine operation demonstrates the integrity of the system pressure boundary for pressures exceeding the Phase B setpoint. Furthermore, because system pressure exceeds the Phase B setpoint, any system leakage prior to initiation of Phase B ~~i~~Isolation would be into containment. Therefore, the combination of CCW System design and Phase B ~~i~~Isolation ensures the CCW System is not a potential path for radioactive release from containment.

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Phase B ~~c~~Containment ~~i~~Isolation is actuated by the same signals that actuate Containment Spray including High-3 Containment Pressure, or Containment Spray - Manual Initiation, via the Actuation Logic. For containment pressure to reach a value high enough to actuate High-3 Containment Pressure, a large break LOCA or SLB must have occurred, and ~~c~~Containment ~~s~~Spray must have been actuated. RCP operation will no longer be required and CCW to the RCPs is, therefore, no longer necessary. The RCPs can be operated with seal injection flow alone and without CCW flow to the thermal barrier heat exchanger.

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Manual Phase B Containment Isolation is accomplished by the same switches that actuate Containment Spray. When the two switches per train for two-out-of-four trains are actuated ~~simultaneously~~concurrently, Phase B Containment Isolation and Containment Spray will be actuated in all trains.

MIC-03-16-00007

a.   Containment Isolation - Phase A Isolation

(1)   Phase A Isolation - Manual Initiation

Manual Phase A Containment Isolation is actuated by two switches in the ~~main control room~~MCR. Each push button actuates its own train directly.

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Note that ~~m~~Manual ~~i~~Initiation of Phase A Containment Isolation also actuates Containment Purge Isolation.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

(2)   Phase A Isolation - Actuation Logic and Actuation Outputs

Actuation Logic and Actuation Outputs consist of the same features and operate in the same manner as described for ESFAS Function 1.b. Phase A Isolation valves are distributed to Trains A and D. Both trains must be OPERABLE.

Manual and automatic initiation of Phase A Containment Isolation must be OPERABLE in MODES 1, 2, and 3~~, when~~. In these MODES, there is a potential for an accident to occur. Manual ~~i~~Initiation is also required in MODE 4 even though automatic actuation is not required. In this MODE, adequate time is available to manually actuate required components in the event of a PA, but because of the large number of components actuated on a Phase A Containment Isolation, actuation is simplified by the use of the manual actuation push buttons. Actuation Logic and ~~a~~Actuation ~~o~~Outputs must be OPERABLE in MODE 4 to support system level ~~m~~Manual ~~i~~Initiation. In MODES 5 and 6, there is insufficient energy in the primary or secondary systems to pressurize the containment to require Phase A Containment Isolation. There also is adequate time for the operator to evaluate unit conditions and manually actuate individual isolation valves in response to abnormal or accident conditions.

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(3)   Phase A Isolation - ECCS Actuation

Phase A Containment Isolation is also initiated by all Functions that initiate ECCS Actuation. The Phase A Containment Isolation requirements for these Functions are the same as the requirements for their ECCS Actuation function. Therefore, the requirements are not repeated in Table 3.3.2-1. Instead, Function 1, ECCS Actuation, is referenced for all initiating Functions and requirements. Note that all four Containment Isolation trains are actuated when any two~~-~~out~~-~~of~~-~~four ECCS Actuation - Automatic or Manual Initiation signals are actuated.

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b.   Containment Isolation - Phase B Isolation

Phase B Containment Isolation is accomplished by Manual Initiation, Actuation Logic and Actuation Outputs, and by Containment Pressure channels (the same channels that actuate Containment Spray, Function 2).

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

(1)   Phase B Isolation - Manual Initiation

Phase B Containment Isolation is manually initiated by Containment Spray – Manual Initiation. The Phase B Containment Isolation requirements for these Functions are the same as the requirements for their Containment Spray function. Therefore, the requirements are not repeated in Table 3.3.2-1. Instead, Function 2, Containment Spray, is referenced for all initiating Functions and requirements.

Note that all four Phase B Containment Isolation trains are actuated when any two-out-of-four Containment Spray – Manual Initiation signals are actuated.

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(2)   Phase B Isolation - Actuation Logic and Actuation Outputs

Manual and automatic initiation of Phase B ~~c~~Containment ~~i~~Isolation must be OPERABLE in MODES 1, 2, and 3~~, when~~. In these MODES, there is a potential for an accident to occur. Manual ~~i~~Initiation is also required in MODE 4 even though automatic actuation is not required. In this MODE, adequate time is available to manually actuate required components in the event of a PA. However, because of the large number of components actuated on a Phase B ~~c~~Containment ~~i~~Isolation, actuation is simplified by the use of the manual actuation push buttons. Actuation Logic and ~~a~~Actuation ~~o~~Outputs must be OPERABLE in MODE 4 to support system level ~~m~~Manual ~~i~~Initiation. In MODES 5 and 6, there is insufficient energy in the primary or secondary systems to pressurize the containment to require Phase B ~~c~~Containment ~~i~~Isolation. There also is adequate time for the operator to evaluate unit conditions and manually actuate individual isolation valves in response to abnormal or accident conditions.

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Four trains of Phase B Containment Isolation - Actuation Logic and Actuation Outputs must be ~~operable~~OPERABLE due to the distribution of ~~c~~Containment ~~i~~Isolation ~~v~~Valves to all four trains.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

 4. Main Steam Line Isolation

Isolation of the main steam lines provides protection in the event of an SLB inside or outside containment. Rapid isolation of the main steam lines will limit the steam break accident to the blowdown from one SG, at most. For an SLB upstream of the main steam isolation valves (MSIVs), inside or outside of containment, closure of the MSIVs limits the accident to the blowdown from only the affected SG. For an SLB downstream of the MSIVs, closure of the MSIVs terminates the accident as soon as the main steam lines depressurize. Main Steam Line Isolation also mitigates the effects of a feed line break and ensures a source of steam for the turbine driven EFW pump during a feed line break.

Main Steam Line Isolation components are distributed to Trains A and D.

 a. Main Steam Line Isolation - Manual Initiation

Manual ~~i~~Initiation of Main Steam Line Isolation can be accomplished from the ~~main control room~~MCR. There are two switches in the ~~main control room~~MCR, one for each train. ~~Either~~Each MSIV is actuated from both trains. Therefore, either switch can initiate action to immediately close all MSIVs. The LCO requires two trains to be OPERABLE.

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 b. Main Steam Line Isolation - Actuation Logic and Actuation Outputs

Actuation Logic and ~~a~~Actuation ~~o~~Outputs consist of the same features and operate in the same manner as described for ESFAS Function 1.b. Main Steam Line Isolation valves are distributed to Trains A and D. Both trains must be OPERABLE.

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Manual Initiation and ~~automatic initiation~~Actuation Logic and Actuation Outputs of Main Steam Line Isolation must be OPERABLE in MODES 1, 2, and 3 ~~when~~. In these MODES, there is sufficient energy in the RCS and SGs to have an SLB or other accident. This could result in the release of significant quantities of energy and cause a cooldown of the primary system. ~~The Main Steam Line Isolation Function is required in MODES 2 and 3 unless all MSIVs are closed.~~ In MODES 4, 5, and 6, there is insufficient energy in the RCS and SGs to experience an SLB or other accident releasing significant quantities of energy.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

    c.   Main Steam Line Isolation - High-High Containment Pressure

This Function actuates closure of the MSIVs in the event of a LOCA or an SLB inside containment to maintain at least one unfaulted SG as a heat sink for the reactor, and to limit the mass and energy release to containment. The transmitters (d/p cells) are located outside containment with the sensing line (high pressure side of the transmitter) located inside containment. High-High Containment Pressure provides no input to any control functions. There are four High-High Containment Pressure channels in a two-out-of-four logic configuration. Three OPERABLE channels are sufficient to satisfy protective requirements with two-out-of-three logic. The transmitters and electronics are located outside of containment. ~~Thus~~Therefore, they will not experience any adverse environmental conditions~~, and the~~. The Nominal Trip Setpoint reflects only steady state instrument uncertainties.

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High-High Containment Pressure must be OPERABLE in MODES 1, 2, and 3~~, when~~. In these MODES, there is sufficient energy in the primary and secondary side to pressurize the containment following a pipe break. This would cause a significant increase in the containment pressure, thus allowing detection and closure of the MSIVs. ~~The Main Steam Line Isolation Function remains OPERABLE in MODES 2 and 3 unless all MSIVs are closed.~~ In MODES 4, 5, and 6, there is not enough energy in the primary and secondary sides to pressurize the containment to the High-High Containment Pressure setpoint.

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    d.   Main Steam Line Isolation - Main Steam Line Pressure

    (1)   Low Main Steam Line Pressure

Low Main Steam Line Pressure provides closure of the MSIVs in the event of an SLB to maintain at least ~~one~~two unfaulted SG~~s~~ as a heat sink for the reactor, and to limit the mass and energy release to containment. This Function provides closure of the MSIVs in the event of a feed line break to ensure a supply of steam for the turbine driven EFW pump. Low Main Steam Line Pressure was discussed previously under ECCS Function 1.e.

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Low Main Steam Line Pressure Function must be OPERABLE in MODES 1 and 2, and MODE 3 above the P-11 setpoint, in these MODES, a secondary side break, spuriously opened valve, or stuck open valve could result in the rapid depressurization of the steam

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

lines. This signal may be manually bypassed by the operator in MODE 3 below the P-11 setpoint. In MODE 3 below the P-11 setpoint, an SLB inside containment will be terminated by automatic actuation via the High-High Containment Pressure signal. Stuck valve transients and SLBs outside containment will be terminated by the High Main Steam Line Pressure Negative Rate signal for Main Steam Line Isolation in MODE 3 below the P-11 setpoint when ECCS has been manually bypassed.

This Function is not required to be OPERABLE in MODES 4, 5, and 6 because there is insufficient energy in the secondary side of the unit to have an accident.

This Function has a dynamic transfer function. The Time Constants for this Function are recorded and maintained in a document established by the Setpoint Control Program (SCP).

(2)   High Main Steam Line Pressure Negative Rate

High Main Steam Line Pressure Negative Rate provides closure of the all MSIVs for an SLB in MODE 3 below the P-11 setpoint, to maintain at least two unfaulted SGs as a heat sink for the reactor, and to limit the mass and energy release to containment. When the operator manually bypasses the Low Main Steam Line Pressure Main Steam Line Isolation signal in MODE 3 below the P-11 setpoint, the High Main Steam Line Pressure Negative Rate signal is automatically enabled. Main Steam Line Pressure provides both control and protection functions, as described previously under ECCS Function 1.e. There are four High Main Steam Line Pressure Negative Rate signals in a two-out-of-four logic configuration. Three OPERABLE channels are sufficient to satisfy requirements with a two-out-of-three logic on each steam line.

~~Low~~High Main Steam Line Pressure ~~Function~~Negative Rate must be OPERABLE in MODE~~S 1, 2, and~~ 3 ~~(above~~below the~~ P-11)~~, ~~with any main steam valve open, when~~ setpoint. In this MODE, a secondary side break or stuck open valve could result in the rapid depressurization of the main steam line~~(s)~~. ~~This signal may be manually blocked by the operator below~~Above the P-11 setpoint~~.~~, ~~Below P-11, an inside containment~~

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

~~SLB will be terminated by automatic actuation via High-High Containment Pressure. Stuck valve transients~~ this signal is automatically disabled and ~~outside containment SLBs will be terminated by~~ the ~~High~~Low Main Steam Line Pressure ~~Negative Rate~~ signal ~~for Steam Line Isolation below P-11 when ECCS has been manually blocked.~~ is automatically enabled. The Main Steam Line Isolation Function is required ~~in MODES 2 and 3 unless all MSIVs are closed. This Function is not required~~ to be OPERABLE in MODES 1, 2 and 3. In MODES 4, 5, and 6 ~~because~~. there is insufficient energy in the primary and secondary side~~s~~ ~~of the unit~~ to have an SLB or other accident that would result in a release of significant enough quantities of energy to cause a cooldown of the RCS.

(2) ~~High Main Steam Line Pressure Negative Rate~~

~~High Main Steam Line Pressure Negative Rate provides closure of the MSIVs for an SLB when less than the P-11 setpoint, to maintain at least one unfaulted SG as a heat sink for the reactor, and to limit the mass and energy release to containment. When the operator manually blocks the Low Main Steam Line Pressure main steam isolation signal when less than the P-11 setpoint, the High Main Steam Line Pressure Negative Rate signal is automatically enabled. High Main Steam Line Pressure Negative Rate provides no input to any control functions. There are four High Main Steam Line Pressure Negative Rate signals in a two-out-of-four logic configuration. Three OPERABLE channels are sufficient to satisfy requirements with a two-out-of-three logic on each steam line.~~

While the transmitters may experience elevated ambient temperatures due to an SLB, the trip function is based on rate of change, not the absolute accuracy of the indicated steam pressure. Therefore, the Nominal Trip Setpoint reflects only steady state instrument uncertainties.

This Function has a dynamic transfer function. The Time Constants for this Function are recorded and maintained in a document established by the Setpoint Control Program (SCP).

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

All Main Steam Isolation Functions are applicable in MODES 1, 2 and 3 as stated above, regardless of valve position, because the Functions are credited to mitigate spurious valve opening from Operational VDUs. In MODES 4, 5, and 6, these Functions are not required to be OPERABLE, as stated above.

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High Main Steam Line Pressure Negative Rate must be OPERABLE in MODE 3 when less than the P-11 setpoint, when a secondary side break or stuck open valve could result in the rapid depressurization of the main steam line(s). In MODES 1 and 2, and in MODE 3, when above the P-11 setpoint, this signal is automatically disabled and the Low Main Steam Line Pressure signal is automatically enabled. The Main Steam Line Isolation Function is required to be OPERABLE in MODES 2 and 3 unless all MSIVs are closed. In MODES 4, 5, and 6, there is insufficient energy in the primary and secondary sides to have an SLB or other accident that would result in a release of significant enough quantities of energy to cause a cooldown of the RCS.

While the transmitters may experience elevated ambient temperatures due to an SLB, the trip function is based on rate of change, not the absolute accuracy of the indicated steam pressure. Therefore, the Trip Setpoint reflects only steady state instrument uncertainties.

5.   Main Feedwater Isolation

5A.   Main Feedwater Regulation Valve Closure

The primary function of the Main Feedwater Regulation Valve Closure is to stop the excessive flow of feedwater into the SGs. This Function is necessary to mitigate the effects of a high water level in the SGs, which could result in excessive cooldown of the primary system.

This Function is actuated when T_{avg} is less than the low setpoint coincident with reactor trip, and closes all the main Feedwater Regulation valves.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

a.   ~~Main Feedwater Isolation – Low T~~$_{avg}$

~~There are four Low T~~$_{avg}$ ~~channels per loop in a two out of four configuration. Three channels of T~~$_{avg}$ ~~per loop are required to be OPERABLE. The T~~$_{avg}$ ~~channels are combined in a logic such that two out of three channels tripped cause a trip for the parameter. The accidents that this Function protects against cause reduction of T~~$_{avg}$ ~~in the entire primary system. Therefore, the provision of two OPERABLE channels in a two out of four configuration ensures no single random failure disables the Low T~~$_{avg}$ ~~Function. The T~~$_{avg}$ ~~channels provide control inputs interfaced from the PSMS to the PCMS through an SSA. But the control function cannot initiate events that the Function acts to mitigate. Therefore, the SSA is not required to address control protection interaction issues.~~

~~With the T~~$_{avg}$ ~~resistance temperature detectors (RTDs) located inside the containment, it is possible for them to experience adverse environmental conditions during an SLB event. Therefore, the Trip Setpoint reflects both steady state and adverse environmental instrumental uncertainties.~~

~~The Main Feedwater Isolation – Low T~~$_{avg}$ ~~signal is enabled by the Main Feedwater Isolation – Reactor Trip, P-4 interlock, described below.~~

~~Coincident with Reactor Trip, P-4~~

~~The Main Feedwater Isolation – Low T~~$_{avg}$ ~~signal is enabled when the reactor is tripped as indicated by the P-4 interlock. Therefore, the requirements for the P-4 interlock are not repeated in Table 3.3.2-1. Instead, Function 11, Reactor Trip P-4, is referenced for the initiating Function and requirements. Note that all four Turbine Trip actuation trains are actuated when any two out of four RTB trains are actuated.~~

5B.   ~~Main Feedwater Isolation~~

5.   <u>Main Feedwater Isolation</u>

The primary function of the Main Feedwater Isolation is to stop the excessive flow of feedwater into the SGs. This Function is necessary to mitigate the effects of a high water level in the SGs, which could

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

result in excessive cooldown of the primary system. The High SG Water Level is due to excessive feedwater flows.

The Function on High-High SG Water Level is actuated when the level in any SG exceeds the high-high setpoint., and   MIC-03-16-0
                                                                                       0007

The Main Feedwater Isolation Function performs the following functions:

•   Trips the MFW pumps,

•   Initiates feedwater isolation, and   MIC-03-16-0
                                                                                       0007

•   Shuts the MFW regulatingIsolation valves, the MFW bypass feedwater regulating valves and the SG water filling control valves.

•   Shuts the MFW Regulation Valves, the MFW Bypass Regulation Valves, and the SG Water Filling Control Valves.

This Function is actuated by High-High SG Water Level or by. an ECCS Actuation signal or manually. or Manual Initiation.

The ECCS Actuation signal was discussed previously.

The Function on Low T_{avg} coincident with Reactor Trip closes all the Main Feedwater Regulation valves.

Main Feedwater Isolation componentsValves, MFW Regulation Valves, MFW Bypass Regulation Valves, and SG Water Filling Control Valves are distributed to Trains A and D.

a.   Main Feedwater Isolation - Manual Initiation

        Manual iInitiation of Main Feedwater Isolation can be   MIC-03-16-0
        accomplished from the main control roomMCR. There are two   0007
        switches in the main control roomMCR, one for each train.
        EitherEach of the valves is actuated from both trains.
        Therefore, either switch can initiate action to immediately
        closeactuate all feedwater isolation valves.Main Feedwater
        Isolation Components. The LCO requires two trains to be
        OPERABLE..

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

b.   Main Feedwater Isolation - Actuation Logic and Actuation Outputs

Actuation Logic and Actuation Outputs consist of the same features and operate in the same manner as described for ESFAS Function 1.b. All Main Feedwater ~~i~~Isolation ~~valves~~Components are distributed to Trains A and D. Both trains must be OPERABLE.

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c.   Main Feedwater Isolation - High High Steam Generator Water Level

This signal provides protection against excessive feedwater flow. There are four High High Steam Generator Water Level channels in a two-out-of-four logic configuration for each Steam Generator. The ESFAS SG ~~w~~Water ~~l~~Level instruments provide input to the SG Water Level Control System. The interface from the safety channels in the PSMS to the PCMS is through the Signal ~~Selector~~Selection Algorithm (SSA). ~~The~~When there are three or more OPERABLE High-High Steam Generator Water Level channels for each Steam Generator, the SSA ensures an input failure to the control system does not result in erroneous control system action that would require the protection function actuation (i.e., three channels total). ~~Therefore, the protection function requires only two additional channels to provide the protection function actuation.~~ Three channels total must be OPERABLE. When there are less than three OPERABLE High-High Steam Generator Water Level channels for each Steam Generator, the SSA cannot prevent erroneous control system operation due to an input failure. This is reflected in the LCO Completion Times for High-High Steam Generator Water Level channels, since there are only three required channels for each Steam Generator.

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The transmitters (d/p cells) are located inside containment. However, the events that this Function protects against cannot cause a severe environment in containment. Therefore, the Nominal Trip Setpoint reflects only steady state instrument uncertainties.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

    d.   Main Feedwater Isolation - ECCS Actuation

Main Feedwater Isolation is also initiated by all Functions that initiate ECCS Actuation. The Feedwater Isolation Function requirements for these Functions are the same as the requirements for their ECCS Actuation function. Therefore, the requirements are not repeated in Table 3.3.2-1. Instead Function 1, ECCS Actuation, is referenced for all initiating functions and requirements. Note that both Main Feedwater Isolation trains are actuated when any two-out-of-four ECCS Actuation - Automatic or Manual Initiation signals are actuated. | MIC-03-16-0 0007

    e.   Main Feedwater Isolation - Low T_{avg} | MIC-03-16-0 0007

This Function is actuated when T_{avg} is less than the low setpoint coincident with Reactor Trip. It closes only the Main Feedwater Regulation valves.

There are four Low T_{avg} channels (one per loop) in a two-out-of-four configuration. Three channels of T_{avg} are required to be OPERABLE. The T_{avg} channels are combined in a logic such that two out of three channels cause a trip for the Function. The accidents that this Function protects against cause reduction of T_{avg} in the entire primary system. Therefore, the provision of three OPERABLE channels in a two-out-of-four configuration ensures no single random failure disables the Low T_{avg} Function.

T_{avg} channels provide inputs to both control and protection functions. T_{avg} channels provide control inputs to the Rod Control System, Pressurizer Water Level Control System, and Turbine Bypass Control System. The interface from the safety channels in the PSMS to the PCMS is through the Signal Selection Algorithm (SSA). When three or more T_{avg} channels are OPERABLE, the SSA ensures an input failure to the control system does not result in erroneous control system action that would require the protection function actuation. Therefore, the protection function requires only two additional channels to provide the protection function actuation (i.e., three channels total). Three channels total must be OPERABLE. When there are less than three OPERABLE T_{avg} channels, the SSA cannot prevent erroneous control system operation due to an input failure. This is reflected in the LCO Completion Times for shared T_{avg} channels.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

With the T_{avg} resistance temperature detectors (RTDs) located inside the containment, it is possible for them to experience adverse environmental conditions during an SLB event. Therefore, the Nominal Trip Setpoint reflects both steady state and adverse environmental instrument uncertainties.

The Main Feedwater Isolation - Low T_{avg} signal is enabled by the Main Feedwater Isolation - Reactor Trip, P-4 interlock, described below.

Coincident with Reactor Trip, P-4

The Main Feedwater Isolation - Low T_{avg} signal is enabled when the reactor is tripped as indicated by the P-4 interlock. Therefore, the requirements for the P-4 interlock are not repeated in Table 3.3.2-1. Instead, Function 11.a, Reactor Trip, P-4, is referenced for the initiating Function and requirements. Note that both Turbine Trip actuation trains, Trains A and D, are actuated when any two-out-of-four RTB trains are actuated.

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All Main Feedwater Isolation Functions, except for the sub-function of High-High Steam Generator Water Level ~~must be OPERABLE in MODES 1 and 2 and 3 except when all~~, which trips the MFW pumps and closes the MFIVs, ~~MFRVs, MFBRVs~~ and SGWFCVs ~~are closed when the MFW System is in operation~~, msut be OPERABLE in MODES 1, 2 and 3. In MODES 4, 5, and 6, the MFW System is not in service and ~~this Function is~~ the Isolation Functions are not required to be OPERABLE.

The sub-function of the MFW Isolation on High-High Steam Generator Water Level, which trips the MFW pumps and closes the MFIVs and SGWFCVs, must be OPERABLE in MODES 1 and 2, and in MODE 3 (above the P-11 ~~) except when all MFIVs, MFRVs, MFBRVs and SGWFCVs are closed when the MFW System is in operation. This signal~~ setpoint.

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The sub-function may be manually ~~blocked~~ bypassed by the operator in MODE 3 below the P-11 setpoint. This manual bypass is needed to allow control of steam generator water level using the SGWFCVs under these conditions. The MFIVs and SGWFCVs are configured in series such that the feedwater flow rate is limited by the SGWFCV capacity which is a very small fraction of the nominal feedwater flow. The manual bypass is acceptable because expected feedwater flow due to open SGWFCVs is not a critical concern under these

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

conditions. Sufficient time margin exists for manual SGWFCV closure, if necessary. Therefore, manual bypass of the automatic trip of MFW pumps and automatic closure of MFIVs and SGWFCVs on High-High SG Water Level in MODE 3 below the P-11 setpoint is acceptable and necessary to maintain the Steam Generators filled with water in preparation for shutdown conditions (wet layup operation). When starting up, the automatic trip of MFW pumps and automatic closure of MFIVs and SGWFCVs on High-High SG Water Level is automatically enabled above the P-11 setpoint.

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These Functions are applicable in MODES 1, 2 and 3 as stated above, regardless of valve position, because the Functions are credited to mitigate spurious valve opening from Operational VDUs. In MODES 4, 5, and 6, the MFW System is not in service and this Function is not required to be OPERABLE.

6. Emergency Feedwater Actuation

The EFW Actuation System is designed to provide a secondary side heat sink for the reactor in the event that the MFW System is not available. The system has four trains, with two motor driven pumps and two turbine driven pumps, making it available during normal unit operation, during a loss of AC power, a loss of MFW, and during a Feedwater System pipe break. The LCO requires three OPERABLE EFW trains. The normal source of water for the EFW System is the Emergency Feedwater pit (EFW pit). This pit has a sufficient capacity to lead the plant safe shutdown. If the water level of EFW pit reached low-low level, operators are given alarm in ~~main control room~~MCR. Then the EFW pumps will be stopped or the water source will be switched to Demineralized Water Storage Tank manually to keep the sufficient EFW if necessary.

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a. Emergency Feedwater Actuation - Manual Initiation

Manual ~~i~~Initiation of Emergency Feedwater Actuation can be accomplished from the ~~main control room~~MCR. There are four switches in the ~~main control room~~MCR, one for each train. Each switch actuates its own train directly. A signal from each switch is also interfaced to all other trains via internal PSMS communication links. In addition to direct actuation by its own train switch, each train is also actuated by two out of three Manual Initiation signals received from the other trains. The signals from the other trains are not credited in determining when the Manual Initiation Function is OPERABLE or in determining the number of required trains. However, these additional signals are considered in the Completion Times for the Required Actions. The LCO requires three trains to be OPERABLE.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

    b.   <u>Emergency Feedwater Actuation - Actuation Logic and Actuation Outputs</u>

        Actuation Logic and ~~a~~Actuation ~~o~~Outputs consist of the same features and operate in the same manner as described for ESFAS Function 1.b. Three trains must be OPERABLE.

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    c.   <u>Emergency Feedwater Actuation - Low Steam Generator Water Level</u>

        Low SG Water Level provides protection against a loss of heat sink. A feed line break, inside or outside of containment, or a loss of MFW, would result in a loss of SG water level. There are four Low SG Water Level channels in a two-out-of-four logic configuration. Low SG Water Level provides input to the SG Level Control System. The interface from the safety channels in the PSMS to the PCMS is through the Signal ~~Selector~~Selection Algorithm (SSA). ~~The~~When three or more Low SG Water Level channels are OPERABLE for each Steam Generator, the SSA ensures an input failure to the control system does not result in erroneous control system action that would require the protection function actuation. Therefore, the protection function requires only two additional channels to provide the protection function actuation (i.e., three channels total). Three channels total must be OPERABLE. When there are less than three OPERABLE Low SG Water Level channels for each Steam Generator, the SSA cannot prevent erroneous control system operation due to an input failure. This is reflected in the LCO Completion Times for Low SG Water Level channels, since there are only three required channels for each Steam Generator.

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        With the transmitters (d/p cells) located inside containment and thus possibly experiencing adverse environmental conditions (feed line break), the Nominal Trip Setpoint reflects the inclusion of both steady state and adverse environmental instrument uncertainties.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

d.   Emergency Feedwater Actuation - ECCS Actuation

An ECCS Actuation signals all four EFW trains. The EFW initiation functions are the same as the requirements for their ECCS Actuation function. Therefore, the requirements are not repeated in Table 3.3.2-1. Instead, Function 1, ECCS Actuation, is referenced for all initiating functions and requirements.

e.   Emergency Feedwater Actuation - Loss of Offsite Power

A loss of offsite power will be accompanied by a loss of reactor coolant pumping power and the subsequent need for some method of decay heat removal. The loss of offsite power is detected by a voltage drop on each Class 1E bus (4 trains). The voltage drop is detected by three undervoltage devices on each bus, in a two out of three configuration. Loss of ~~p~~Power to a Class 1E bus will actuate its respective EFW train (with either its motor or turbine driven pump). This ensures that, for a sitewide loss of offsite power, at least two SGs contain enough water to serve as the heat sink for reactor decay heat and sensible heat removal following the ~~r~~Reactor ~~t~~Trip.

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The LCO requires three OPERABLE undervoltage devices on each Class 1E bus corresponding to each OPERABLE EFW train.

This Function has Time Delays. The Time Delays for this Function are recorded and maintained in a document established by the Setpoint Control Program (SCP).

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Functions 6.a through 6.e must be OPERABLE in MODES 1, 2, and 3 to ensure that the SGs remain the heat sink for the reactor. Low SG Water Level in any operating SG will cause the EFW trains to actuate. The system is aligned so that upon a start of the EFW pump, water immediately begins to flow to the SGs. These Functions do not have to be OPERABLE in MODES 5 and 6 because there is not enough heat being generated in the reactor to require the SGs as a heat sink. In MODE 4, EFW actuation does not need to be OPERABLE because either EFW or residual heat removal (RHR) will already be in operation to remove decay heat or sufficient time is available to manually place either system in operation.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

> f.   Emergency Feedwater Actuation - Trip of All Main Feedwater Pumps
>
> A Trip of all MFW pumps is an indication of a loss of MFW and the subsequent need for some method of decay heat and sensible heat removal to bring the reactor back to no load temperature and pressure. Each motor driven MFW pump is equipped with ~~a~~redundant breaker position sensing device~~s~~. An open supply breaker indicates that the pump is not running. Emergency Feedwater Actuation on ~~t~~Trip of all ~~m~~Main ~~f~~Feedwater ~~p~~Pumps is an anticipatory function that is not credited in the safety analysis. Therefore, this function does not need to meet the single failure criterion; the LCO requires one OPERABLE channel per pump (i.e., one of the redundant breaker position sensing devices on each pump). A trip of all MFW pumps actuates all EFW trains to ensure that at least two SGs are available with water to act as the heat sink for the reactor.

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> This function must be OPERABLE in MODES 1 and 2. This ensures that at least two SG~~s~~ ~~is~~are provided with water to serve as the heat sink to remove reactor decay heat and sensible heat in the event of an accident. In MODES 3, 4, and 5, the MFW pumps may be normally shut down, and thus ~~neither~~MFW pump trip is not indicative of a condition requiring automatic EFW initiation.

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> 7.   Emergency Feedwater Isolation
>
> One of the objectives of EFW Isolation is to prevent SG overfill in the event of SGTR. The Other objective of EFW Isolation is to stop the flow of EFW into the affected SG in the event of MSLB. For both objectives, the EFW ~~i~~Isolation Functions are automatically actuated by High SG Water Level signal, or by Low Main Steam Line Pressure signal. The Function may also be actuated manually. ~~EFW Isolation is distributed to Trains A and D~~The EFW Isolation Function is actuated separately for each SG, either manually or automatically. EFW Isolation valves are distributed to all four trains, with two trains of valves for each SG.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

a. Emergency Feedwater Isolation - Manual Initiation

This LCO requires 2 ~~Manual~~ EFW Isolation ~~Actuation~~ Manual Initiation trains for each SG. ~~This Function closes the EFW Isolation Valve for the SG associated with the switches~~Each Manual Initiation train closes the EFW isolation valve for one train on one SG. Two Manual Initiation trains must be OPERABLE for each SG to ensure each SG can be isolated with a single failure.

MIC-03-16-00007

b. Emergency Feedwater Isolation - Actuation Logic and Actuation Outputs

Actuation Logic and Actuation Outputs consist of the same features and operate in the same manner as described for ESFAS Function 1.b. ~~Emergency Feedwater isolation valves are distributed to Trains A and D. Trains A~~Each Actuation Logic and Actuation Outputs train closes the EFW isolation valve for one train on one SG. Two Actuation Logic and ~~D~~Actuation Outputs trains for each SG must be OPERABLE to ensure each SG can be isolation with a single failure.

MIC-03-16-00007

Manual and automatic initiation of EFW Isolation Functions must be OPERABLE in MODES 1, 2, and 3 ~~when~~. In these MODES, the SGs are in operation. In MODES 4, 5, and 6, SGs are not in service and this Function is not require to be OPERABLE.

MIC-03-16-00007

c. Emergency Feedwater Isolation - High Steam Generator Water Level Coincident with P-4 signal and No Low Main Steam Line Pressure

This signal provides protection against damaged SG overfill. There are four High Steam Generator Water Level channels in a two-out-of-four logic configuration for each Steam Generator. The ESFAS SG ~~w~~Water ~~l~~Level instruments provide input to the SG Water Level Control System. The interface from the safety channels in the PSMS to the PCMS is through the Signal ~~Selector~~Selection Algorithm (SSA). ~~The~~When three or more High SG Water Level channels are OPERABLE for each Steam Generator, the SSA ensures an input failure to the control system does not result in erroneous control system action that would require the protection function actuation. Therefore, the protection function requires only two additional channels to provide the protection function actuation (i.e., three channels total). Three channels total must be OPERABLE. When there are less than three OPERABLE High SG Water Level channels for each Steam Generator, the SSA cannot prevent erroneous control system operation due to an

MIC-03-16-00007

MIC-03-16-00007

MIC-03-16-00007

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

input failure. This is reflected in the LCO Completion Times for High SG Water Level channels, since there are only three required channels for each Steam Generator.

MIC-03-16-0 0007

The transmitters (d/p cells) are located inside containment. However, the events that this Function protects against cannot cause a severe environment in containment. Therefore, the Nominal Trip Setpoint reflects only steady state instrument uncertainties.

MIC-03-16-0 0007

High Steam Generator Water Level must be OPERABLE in MODES 1, 2 and 2, and MODE 3 (above the P-11) when setpoint. In these MODES, the SGs are in operation. This signal may be manually blockedbypassed by the operator in MODE 3 below the P-11 setpoint. This function is not required to be OPERABLE in MODE 3 below the P-11 setpoint., because the plant may be transitioning from using the SGs as a heat sink to using the RHR system. This function is bypassed in MODE 3 below the P-11 setpoint to allow the operator to control EFW during the transition to RHR cooling and to maintain the Steam Generators filled with water in preparation for shutdown conditions (wet layup operation). When starting up, the High Steam Generator Water Level signal is automatically enabled above the P-11 setpoint.

MIC-03-16-0 0007

MIC-03-16-0 0007

MIC-03-16-0 0007

In MODES 4, 5, and 6, SGs are not in service and this Function is not required to be OPERABLE.

d.   Emergency Feedwater Isolation - Low Main Steam Line Pressure

This signal provides protection against excessive cooling from damaged SG. A steam line break or a feed line brakebreak inside of containment, would result in a low steam line pressure.

MIC-03-16-0 0007

LowMain Steam Line Pressure provides no input to anyboth control and protection functions., as described previously under ECCS Function 1.e. There are four Low Main Steam Line Pressure channels on each steam line in a two-out-of-four logic configuration. Three OPERABLE channels on each main steam line are sufficient to satisfy the protective requirements with a two-out-of-three logic on each steam line.

MIC-03-16-0 0007

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Low Main Steam Line Pressure must be OPERABLE in MODES 1, and 2, and MODE 3 (above the P-11) when setpoint. In these MODES, the SGs are in operation. This signal may be manually blockedbypassed by the operator in MODE 3 below the P-11 setpoint. This function is not required to be OPERABLE in MODE 3 below the P-11 setpoint-. because a secondary break is not limiting under these conditions, as described previously. There is sufficient time margin for manual Emergency Feedwater Isolation, if necessary. When starting up, the Low Main Steam Line Pressure signal is automatically enabled above the P-11 setpoint.

MIC-03-16-0 0007

In MODES 4, 5, and 6, SGs are not in service and this Function is not required to be OPERABLE.

8.   CVCS Isolation

The objective of CVCS Isolation is to prevent Pressurizer overfill in the event of a CVCS malfunction. For this objective, the CVCS Isolation is automatically actuated by High Pressurizer Water Level signal. The Function may also be actuated manually.

CVCS Isolation valves are distributed to Trains A and D. Both trains must be OPERABLE.

a.   CVCS Isolation – Manual Initiation

Manual iInitiation of CVCS Isolation can be accomplished from the main control roomMCR. There are two switches in the main control roomMCR, one for each train. Each CVCS Isolation Valve is actuated from both trains. Therefore, either switch can initiate action to immediately close all CVCS Isolation Valves. This LCO requires 2 Manual CVCS Isolation Actuation switches. Operation of either switch will actuate this Function.

MIC-03-16-0 0007

b.   CVCS Isolation – Actuation Logic and Actuation Outputs

Actuation Logic and Actuation Outputs consist of the same features and operate in the same manner as described for ESFAS Function 1.b. CVCS Isolation valves are distributed to Trains A and D. Both trains must be OPERABLE.

Manual and automatic initiation of CVCS Isolation Functions must be OPERABLE in MODES 1, 2 and 3. In MODES 4, 5, and 6, the Pressurizer may be filled with water and this Function is not required to be OPERABLE.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

    c.   <u>CVCS Isolation - High Pressurizer Water Level</u>

This signal provides protection against that the Pressurizer overfill in the event of CVCS malfunction.

There are four High Pressurizer Water Level channels in a two-out-of-four logic configuration. Pressurizer Water Level provides input to the Pressurizer Level Control System. The interface from the safety channels in the PSMS to the PCMS is through the Signal ~~Selector~~<u>Selection</u> Algorithm (SSA). <u>When three or more High Pressurizer Water Level channels are OPERABLE,</u> ~~T~~<u>t</u>he SSA ensures an input failure to the control system does not result in erroneous control system action that would require the protection function actuation. Therefore, the protection function requires only two additional channels to provide the protection function actuation<u> (i.e., three channels total)</u>. Three channels total must be OPERABLE.<u> When there are less than three OPERABLE High Pressurizer Water Level channels, the SSA cannot prevent erroneous control system operation due to an input failure. This is reflected in the LCO Completion Times for High Pressurizer Water Level channels, since there are only three required channels.</u> | MIC-03-16-0 0007

| MIC-03-16-0 0007

The transmitters (d/p cells) are located inside containment. However, the events that this Function protects against cannot cause a severe environment in containment. Therefore, the <u>Nominal </u>Trip Setpoint reflects only steady state instrument uncertainties. | MIC-03-16-0 0007

High Pressurizer Water Level must be OPERABLE in MODES 1<u>,</u> ~~2~~ and <u>2, and MODE</u> 3 <u>(</u>above <u>the </u>P-11<u>)</u> ~~setpoint.~~ This signal may be manually ~~blocked~~<u>bypassed</u> by the operator <u>in MODE 3</u> below the P-11 setpoint. This function is not required to be OPERABLE in MODE 3 below the P-11 setpoint~~.~~<u>, because the Pressurizer Water Level is much lower than in higher MODES providing a larger time margin to the pressurizer becoming full. Therefore, the automatic CVCS Isolation on High Pressurizer Water Level function is not required under these conditions. When starting up, the High Pressurizer Water Level signal is automatically enabled above the P-11 setpoint.</u> | MIC-03-16-0 0007

| MIC-03-16-0 0007

In MODES 4, 5, and 6, the Pressurizer may be filled with water and this Function is not required to be OPERABLE.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

9.   Turbine Trip

The primary functions of the Turbine Trip are to prevent damage to the turbine due to water in the steam lines, and to stop the excessive cooldown of the primary system.

The Turbine Trip Function is actuated by High-High Steam Generator Water Level or on Reactor Trip ~~(~~.~~P-4)~~. | MIC-03-16-0 0007

a.   Turbine Trip - Actuation Logic and Actuation Outputs

Actuation Logic and Actuation Outputs consist of the same features and operate in the same manner as described for ESFAS Function 1.b. Four Turbine ~~t~~Trip solenoid valves are arranged in a ~~selective one~~two -out- of- two ~~twice~~ configuration~~.~~, taken separately for Train A ~~turbine trip will occur from Turbine Trip actuation from Trains A or C,~~ and Train~~s B or~~ D. A Turbine Trip will be generated by Train A or Train D. Therefore a single train failure will not prevent a valid Turbine Trip. The LCO requires ~~all four~~two trains, Trains A and D, to be OPERABLE. | MIC-03-16-0 0007

b.   Turbine Trip - Reactor Trip, P-4

The turbine is tripped on a ~~r~~Reactor ~~t~~Trip. Turbine trip on ~~r~~Reactor ~~t~~Trip is an un-credited non-safety function in the safety analysis. However, ~~t~~Turbine ~~t~~Trip on ~~r~~Reactor ~~t~~Trip is assumed in the safety analysis in order to prevent unnecessary ECCS Actuation and to shift to the safe shutdown state by appropriate actions after AOO and PA conditions. | MIC-03-16-0 0007

Turbine Trip is initiated when the reactor trips as indicated by the P-4 interlock. Therefore, the requirements for the P-4 interlock are not repeated in Table 3.3.2-1. Instead, Function 11, Reactor Trip P-4, is referenced for the initiating Function and requirements. Note that ~~all four~~both Turbine Trip actuation trains, Trains A and D, are actuated when any two- -out- of- four RTB trains are actuated. | MIC-03-16-0 0007

c.   High-High Steam Generator Water Level

The High-High Steam Generator Water Level signal prevents water in the steam lines that could lead to turbine generator damage. Turbine trip on High-High Steam Generator Water Level is an un-credited non-safety function in the safety analysis.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

There are four High-High Steam Generator Water Level channels in a two-out-of-four logic configuration for each Steam Generator. Note that both Turbine Trip actuation trains, Tains A and D, are actuated when any two-out-of-four High-High Steam Generator Water Level channels are actuated. | MIC-03-16-0
0007

The PSMS SG ~~w~~Water ~~l~~Level instruments provide input to the SG Water Level Control System. The interface from the safety channels in the PSMS to the PCMS is through the Signal ~~Selector~~Selection Algorithm (SSA). ~~The~~When three or more High-High SG Water Level channels are OPERABLE for each Steam Generator, the SSA ensures an input failure to the control system does not result in erroneous control system action that would require the protection function actuation. Therefore, the protection function requires only two additional channels to provide the protection function actuation (i.e., three channels total). Three channels total must be OPERABLE. When there are less than three OPERABLE High-High SG Water Level channels for each Steam Generator, the SSA cannot prevent erroneous control system operation due to an input failure. This is reflected in the LCO Completion Times for High-High SG Water Level channels, since there are only three required channels for each Steam Generator. | MIC-03-16-0
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10.   Reactor Coolant Pump Trip

TMI Action Plan Item II.K.3.5 (Ref. 1) requires automatic trip of reactor coolant pumps (RCPs) following a loss-of-coolant accident (LOCA). The requirement is based on the consideration that a delayed-trip or continuous operation of the RCPs during a small break LOCA would lead to more severe consequences than if the RCPs are tripped early following a postulated break. Tripping all the RCPs early during a small break LOCA precludes the occurrence of excessive fuel cladding temperature.

a.   Reactor Coolant Pump Trip – ECCS Actuation coincident with P-4 signal

The consequence of continuous RCP operation is the extensive liquid discharge from the break beyond the time that the system would drained down to allow steam discharge from the break had the pumps been immediately tripped. Therefore pump trip following a ~~r~~Reactor ~~t~~Trip and indication of ECCS ~~a~~Actuation would be effective. | MIC-03-16-0
0007

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

For the small break LOCA analysis, the loss of offsite power triggered by ~~r~~Reactor ~~t~~Trip signal is conservatively assumed, which would cause the earliest RCP trip. In case that the automatic RCP trip is enabled, an earlier RCP trip results in earlier flow coastdown leading to more severe consequences.

| MIC-03-16-0 0007

11.   Engineered Safety Features Actuation System Interlocks

| MIC-03-16-0 0007

To allow some flexibility in unit operations, several interlocksare included as part of the ESFAS. These interlocks permit the operator to ~~block~~bypass some signals, automatically enable other signals, prevent some actions from occurring, and cause other actions to occur. The interlock Functions back up manual actions to ensure bypassable functions are in operation under the conditions assumed in the safety analyses.

| MIC-03-16-0 0007

a.   Engineered Safety Features Actuation System Interlocks - Reactor Trip, P-4

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The P-4 ~~i~~Interlock is enabled when RTBs have opened in two-out-of-four RTB trains. RTB position signals from each RTB are interfaced to all PSMS trains via internal PSMS data links so that the P-4 interlock is generated independently within each train. Therefore this LCO requires three trains to be OPERABLE.

| MIC-03-16-0 0007

This Function allows operators to take manual control of ECCS systems after the initial phase of ECCS Actuation is complete. Once ECCS is overridden, automatic actuation of ECCS cannot occur again until the RTBs have been manually closed. The functions of the P-4 interlock are:

•   Trip the main turbine,

•   ~~Isolate~~Close MFW ~~with~~Regulation Valves coincident ~~low~~with Low T_{avg},

| MIC-03-16-0 0007

•   Enable a manual override of ECCS Actuation and prevent ECCS reactuation,

•   EFW Isolation ~~with~~ coincident with High SG Water Level and No Low Main Steam Line Pressure, and

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•   Trip the Reactor Coolant Pump ~~with~~ coincident with ECCS Actuation.

| MIC-03-16-0 0007

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Each of the above Functions except Reactor Coolant Pump Trip is interlocked with P-4 to avert or reduce the continued cooldown of the RCS following a ~~r~~Reactor ~~t~~Trip. An excessive cooldown of the RCS following a ~~r~~Reactor ~~t~~Trip could cause an insertion of positive reactivity with a subsequent increase in generated power. Reactor Coolant Pump Trip function is interlocked with P-4 to prevent the unexpected Reactor Coolant Pump Trip after a small break LOCA. The unexpected Reactor Coolant Pump Trip after a small break LOCA could cause the increasing of the Peak Clad Temperature (PCT). To avoid such these situations, the noted Functions have been interlocked with P-4 as part of the design of the unit control and protection system.

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The RTB position switches that provide input to the P-4 interlock only function to energize or de-energize or open or close contacts. Therefore, this Function has no adjustable trip setpoint

This Function must be OPERABLE in MODES 1, 2, and 3.~~-~~ ~~when~~ In these MODES, the reactor may be critical or approaching criticality. This Function does not have to be OPERABLE in MODE 4, 5, or 6 because the main turbine, the MFW System, and the Turbine Bypass System are not in operation.

MIC-03-16-0 0007

b.   Engineered Safety Features Actuation System Interlocks - Pressurizer Pressure, P-11

MIC-03-16-0 0007

The P-11 interlock permits a normal unit cooldown and depressurization without actuation of ECCS, Main Steam Line Isolation, CVCS Isolation, EFW Isolation or Main Feedwater Isolation on High-High SG Water Level.

With two-out-of-four ~~p~~Pressurizer ~~p~~Pressure channels (discussed previously) less than the P-11 setpoint, the operator can manually ~~block~~bypass the Low Pressurizer Pressure and Low Main Steam Line Pressure ECCS Actuation signals, the Low Main Steam Line Pressure ~~m~~Main ~~s~~Steam ~~l~~Line ~~i~~Isolation signal, the CVCS Isolation signal, the EFW Isolation signals, and the High-High SG Water Level Main Feedwater Isolation signal (previously discussed). When the Low Main Steam Line Pressure ~~m~~Main ~~s~~Steam ~~l~~Line ~~i~~Isolation signal is manually ~~blocked, a main steam isolation signal~~bypassed, a Main Steam Line Isolation signal on High Main Steam Line Pressure Negative Rate is enabled. This provides protection for an SLB by closure of the MSIVs.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

With two-out-of-three ~~p~~Pressurizer ~~p~~Pressure channels above the P-11 setpoint, the Low Pressurizer Pressure and Low Main Steam Line Pressure ECCS Actuation signals, the Low Main Steam Line Pressure ~~m~~Main ~~s~~Steam ~~l~~Line ~~i~~Isolation signal, the CVCS Isolation signal, the EFW Isolation signals, and the High-High SG Water Level Main Feedwater Isolation signal are automatically enabled. The operator can also enable these trips by use of the respective manual reset buttons. When the Low Main Steam Line Pressure ~~m~~Main ~~s~~Steam ~~l~~Line ~~i~~Isolation signal is enabled, the ~~m~~Main ~~s~~Steam ~~i~~Isolation on High Main Steam Line Pressure Negative Rate is disabled.

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MIC-03-16-0 0007

The Nominal Trip Setpoint reflects only steady state instrument uncertainties.

This Function must be OPERABLE in MODES 1, 2, and 3 to allow an orderly cooldown and depressurization of the unit without the actuation of ECCS, ~~m~~Main ~~s~~Steam ~~l~~Line ~~i~~Isolation, CVCS Isolation, EFW Isolation or Main Feedwater Isolation on High-High SG Water Level. This Function does not have to be OPERABLE in MODE 4, 5, or 6 because system pressure must already be below the P-11 setpoint for the requirements of the heatup and cooldown curves to be met.

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12.   Containment Purge Isolation

Containment Purge Isolation initiates on Containment High Range Area Radiation, an ~~automatic~~ ECCS Actuation signal, by ~~m~~Manual ~~i~~Initiation of Containment Isolation Phase A, or by ~~m~~Manual ~~i~~Initiation of Containment Spray.

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Containment Purge Isolation components are distributed to PSMS Trains A and D. Two trains are sufficient to provide the safety function. Both are required to be OPERABLE to provide the safety function with a concurrent single failure.

a.   Containment Isolation Phase A - Manual Initiation

Containment Purge Isolation is manually initiated by Containment Isolation Phase A - Manual Initiation. The Containment Purge Isolation requirements for this Function are the same as the requirements for the Containment Isolation Phase A Function. Therefore, the requirements are not repeated in Table 3.3.2-1. Instead, Function 3.a, Containment Isolation Phase A- Manual Initiation, is referenced for all initiating Functions and requirements.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

    b.   <u>Containment Spray - Manual Initiation</u>

Containment Purge Isolation is manually initiated by Containment Spray - Manual Initiation. The Containment Purge Isolation requirements for this Function are the same as the requirements for the Containment Spray Function. Therefore, the requirements are not repeated in Table 3.3.2-1. Instead, Function 2.a, Containment Spray – Manual Initiation, is referenced for all initiating Functions and requirements.

Note that ~~all two~~both Containment Purge Isolation trains are actuated when any two-out-of-four Containment Spray - Manual Initiation signals are actuated.

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    c.   <u>Containment Purge Isolation - Actuation Logic and Actuation Outputs</u>

Actuation Logic and Actuation Outputs consist of the same features and operate in the same manner as described for ESFAS Function 1.b. Containment Purge Isolation valves are distributed to Trains A and D. Both trains must be OPERABLE.

    d.   <u>Containment Purge Isolation - ECCS Actuation</u>

Containment Purge Isolation is also initiated by all Functions that initiate ECCS. The Containment Purge Isolation requirements for these Functions are the same as the requirements for the ECCS function. Therefore, the requirements are not repeated in Table 3.3.2-1. Instead, Function 1, ECCS, is referenced for all initiating Functions and requirements.

Note that ~~all two~~both Containment Purge Isolation trains are actuated when any two- out- of- four ECCS - Automatic or Manual Initiation signals are actuated.

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    e.   <u>Containment Purge Isolation - Containment High Range Area Radiation</u>

Containment High Range Area Radiation has four channels in a two-out-of-four logic configuration. Three OPERABLE channels are sufficient to satisfy protective requirements with two-out-of-three logic.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The Containment Purge Isolation Functions are required OPERABLE in MODES 1, 2, 3, and 4. Under these conditions, the potential exists for an accident that could release significant fission product radioactivity into containment. Therefore, the Containment Purge Isolation instrumentation must be OPERABLE in these MODES.

While in MODES 5 and 6 including fuel handling in progress, the Containment Purge Isolation instrumentation ~~need~~is not required to be OPERABLE ~~since the potential for radioactive releases is minimized and operator action is sufficient to ensure post accident offsite doses are maintained within acceptable limits~~. This is because the doses at the exclusion area boundary, at the low population zone outer boundary, and in the MCR are maintained within acceptable limits for the case where a fuel handling accident occurs without the containment being isolated, as described in FSAR Section 15.7.4 (Ref. 10). | MIC-03-16-0 0007

13.   Main Control Room Isolation

The ~~Main Control Room~~MCR Isolation function provides an enclosed ~~main control room~~MCR environment from which the unit can be operated following an uncontrolled release of radioactivity. MCR Isolation controls the ~~m~~Main ~~c~~Control ~~r~~Room HVAC System (MCRVS) which includes two subsytems: Main Control Room Emergency Filtration System (MCREFS) and Main Control Room Air Temperature Control System (MCRATCS), described in the ~~DCD~~FSAR Chapter 16 Section 3.7.10 | MIC-03-16-0 0007 | MIC-03-16-0 0007 | MIC-03-16-0 0007

There are four ~~Main Control Room~~MCR Isolation trains. Trains A and D of MCR Isolation control two 100% capacity trains of subsystem MCREFS, and all four trains of MCR Isolation control four 50% capacity trains of subsystem MCRATCS. Two trains of MCR Isolation, including A or D, must actuate to properly provide the safety function (i.e., isolate and supply filtered air to the ~~main control room~~MCR) and three trains, including A and D, must be OPERABLE to provide the safety function with a concurrent single failure. | MIC-03-16-0 0007 | MIC-03-16-0 0007

The MCR Isolation actuation instrumentation consists of redundant radiation monitors. A high radiation signal will initiate all four MCR Isolation trains. The ~~main control room~~MCR operator can also initiate MCR Isolation trains by manual switches in the ~~main control room~~MCR. MCR Isolation is also actuated by an ECCS Actuation signal. | MIC-03-16-0 0007

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The ~~main control room~~MCR must be kept habitable for the operators stationed there during accident recovery and post accident operations. The MCR Isolation function acts to terminate the supply of unfiltered outside air to the ~~main control room~~MCR, initiate filtration, and allows pressurization of the ~~main control room~~MCR. These actions are necessary to ensure the ~~main control room~~MCR is kept habitable for the operators stationed there during accident recovery and post accident operations by minimizing the radiation exposure of the ~~main control room~~MCR personnel.

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In MODES 1, 2, 3, and 4, the radiation monitor actuation of MCR Isolation is a backup for the ECCS Actuation. This ensures initiation of the MCR Isolation during a loss of coolant accident or steam generator tube rupture.

The radiation monitor actuation of MCR Isolation during movement of irradiated fuel assemblies are the primary means to ensure ~~main control room~~MCR habitability in the event of a fuel handling accident.

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The MCREFS and MCRATCS components (e.g., fans, dampers) can be manually controlled by the Safety VDUs (S-VDUs) of the corresponding train, and by the non-safety operational VDUs (O-VDUs). MCR Isolation signals, (either automatically or manually initiated) have priority over all manual component control signals, and therefore will block any signals from the O-VDUs, including spurious signals.

The automatic initiation of MCR Isolation is credited to ensure any spurious signals from the non-safety O-VDUs cannot prevent the MCR Isolation safety function. To accommodate various inoperable conditions, MCREFS and/or MCRATCS components are manually placed in the position they would be automatically actuated to by the MCR Isolation signal. For conditions where the automatic initiation function is inoperable, the MCRVS O-VDU Disconnect function is manually activated from the S-VDU for the affected MCREFS and/or MCRATCS train(s). The MCRVS O-VDU Disconnect function blocks signals from the O-VDUs, including spurious signals, in the same manner as the credited automatic initiation signal.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

a. Main Control Room Isolation - Manual Initiation

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~~The LCO requires four trains OPERABLE.~~ The operator can initiate MCR Isolation for all four MCR Isolation trains at any time by using four Manual Initiation switches in the ~~main control room~~MCR. Each push button actuates its own train directly. A signal from each pushbutton is also interfaced to all other trains via internal PSMS communication links. In addition to direct actuation by its own train pushbutton, each train is also actuated by two-out-of-three Manual Initiation signals received from the other trains. The signals from the other trains are not credited in determining when the Manual Initation Function is OPERABLE or in determining the number of required trains. However, these additional signals are considered in the Completion Times for the Required Actions. This action will cause actuation of all components in the same manner as any of the automatic actuation signals.

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~~The LCO for Manual Initiation ensures the proper amount of redundancy is maintained in the manual actuation circuitry to ensure the operator has manual initiation capability.~~The LCO requires three trains, including A and D, to be OPERABLE due to the two train configuration of MCREFS and four train configuration of MCRATCS, as described above.

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0007

Each ~~channel~~train consists of one push button and the interconnecting wiring to the ESFAS cabinet.

b. Main Control Room Isolation - Actuation Logic and Actuation Outputs

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0007

Actuation Logic and Actuation Outputs consist of the same features and operate in the same manner as described for ESFAS Function 1.b., ECCS Actuation. However, for MCR Isolation ~~4~~three trains, including A and D, must be ~~operable~~OPERABLE due to the ~~distribution~~two train configuration of ~~main control room isolation dampers to all~~MCREFS and four train~~s.~~ configuration of MCRATCS, as described above.

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0007

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

    c.   <u>Main Control Room Isolation - Main Control Room Radiation</u>   MIC-03-16-0 0007

There are three kinds of Main Control Room Radiation monitor functions (gas monitor, iodine monitor, and particulate monitor). ~~One monitor~~<u>Each monitoring function</u> includes two   MIC-03-16-0 0007 detectors of train A and D. RPS trains A and D provide separate <u>digital</u> bistable setpoint comparison functions for each   MIC-03-16-0 0007 monitor. These <u>digital</u> bistable output signals are distributed from RPS trains A and D to each of the four ESFAS trains. Within each of the four ESFAS trains the MCR Isolation signal is actuated on a signal from either the A or D train detectors using 1-out-of-2 logic for each type of monitor.

The LCO specifies two required Main Control Room Radiation monitors for each function to ensure that the radiation monitoring instrumentation necessary to initiate the MCR Isolation remains OPERABLE.

For sampling systems, channel OPERABILITY involves more than OPERABILITY of channel electronics. OPERABILITY may also require correct valve lineups, sample pump operation, and filter motor operation, as well as detector OPERABILITY, if these supporting features are necessary for trip to occur under the conditions assumed by the safety analyses.

    d.   <u>Main Control Room Isolation - ECCS ACTUATION</u>   MIC-03-16-0 0007

~~Main Control Room~~<u>MCR</u> Isolation is also initiated by all Functions that initiate ECCS Actuation. The MCR Isolation requirements for these Functions are the same as the requirements for their ECCS Actuation function. Therefore, the requirements are not repeated in Table 3.3.2-1. Instead, Function 1, ECCS Actuation, is referenced for all initiating Functions and requirements. Note that all four MCR Isolation trains are actuated when any two-out-of-four ECCS   MIC-03-16-0 0007 Actuation - Automatic or Manual Initiation signals are actuated.

The MCR Isolation Functions must be OPERABLE in MODES 1, 2, 3, <u>and</u> 4, and during movement of irradiated fuel   MIC-03-16-0 0007 assemblies.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

14.   <u>Block Turbine Bypass and Cooldown Valves</u>

The Block Turbine Bypass and Cooldown Valves function prevents the ~~overcooldown~~<u>overcooling</u> of the reactor coolant system when T_{avg} is decreased abnormally.

MIC-03-16-0 0007

Block turbine bypass and cooldown valves are distributed to Trains A and D. Both trains must be OPERABLE<u> in MODES 1, 2 and 3. In MODES 4, 5, and 6, the average coolant temperature is below the Low-Low T_{avg} Signal setpoint and this function is not required to be OPERABLE</u>.

MIC-03-16-0 0007

a.   <u>Block Turbine Bypass and Cooldown Valves - Manual Initiation</u>

Manual ~~i~~<u>I</u>nitiation of Block Turbine Bypass and Cooldown Valves can be accomplished from the ~~main control room~~<u>MCR</u>. There are two switches in the ~~main control room~~<u>MCR</u>, one for each train. <u> EachTurbine Bypass and Cooldown Valve is blocked from both trains. Therefore, either switch can be initiated to immediately block the opening of all Turbine Bypass and Cooldown Valves.</u> This LCO requires 2 Manual Block Turbine Bypass and Cooldown Valves Actuation switches~~. Operation of either switch will actuate this Function.~~<u> to be OPERABLE.</u>

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b.   <u>Block Turbine Bypass and Cooldown Valves - Actuation Logic and Actuation Outputs</u>

Actuation Logic and Actuation Outputs consist of the same features and operate in the same manner as described for ESFAS Function 1.b. Block ~~t~~<u>T</u>urbine ~~b~~<u>B</u>ypass and ~~c~~<u>C</u>ooldown ~~v~~<u>V</u>alves are distributed to Trains A and D. Both trains must be OPERABLE.

MIC-03-16-0 0007

c.   <u>Block Turbine Bypass and Cooldown Valves - Low-Low T_{avg} Signal</u>

~~This function must be OPERABLE in MODES 1, 2 and 3. In MODES 4, 5, and 6, the average coolant temperature is below the low low Tavg signal setpoint and this function is not~~<u>There are four Low T_{avg} channels (one per loop) in a two-out-of-four configuration. Three channels of T_{avg} are</u> required to be OPERABLE.<u> The T_{avg} channels are combined in a logic such that two out of three channels cause a trip for the Function. The accidents that this Function protects against cause reduction of T_{avg} in the entire primary system. Therefore, the</u>

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

provision of three OPERABLE channels in a two-out-of-four configuration ensures no single random failure disables the Low T_{avg} Function.

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T_{avg} channels provide inputs to both control and protection functions. T_{avg} channels provide control inputs to the Rod Control System, Pressurizer Water Level Control System, and Turbine Bypass Control System. The interface from the safety channels in the PSMS to the PCMS is through the Signal Selection Algorithm (SSA).

When three or more T_{avg} channels are OPERABLE, the SSA ensures an input failure to the control system does not result in erroneous control system action that would require the protection function actuation. Therefore, the protection function requires only two additional channels to provide the protection function actuation (i.e., three channels total). Three channels total must be OPERABLE. When there are less than three OPERABLE T_{avg} channels, the SSA cannot prevent erroneous control system operation due to an input failure. This is reflected in the LCO Completion Times for shared T_{avg} channels.

With the T_{avg} resistance temperature detectors (RTDs) located inside the containment, it is possible for them to experience adverse environmental conditions during an SLB event. Therefore, the Nominal Trip Setpoint reflects both steady state and adverse environmental instrumental uncertainties.

Low-Low T_{avg} Signal - Low-Low T_{avg} Signal is enabled by the Block Turbine Bypass and Cooldown Valves.

15. Manual Control of ESF Components

The Manual Control of ESF Components Function provides credited manual controls for accidents and safe shutdown, as defined for the plant components in LCO 3.4 through 3.7.

a. Manual Control of ESF Components - S-VDU

An S-VDU train consists of a VDU and S-VDU processor. An S-VDU train must be OPERABLE for the same trains and MODES as required for the controlled ESF components. For ESF components with four trains (three required trains), three S-VDU trains must be OPERABLE for the same three trains

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

as the required OPERABLE ESF components. For ESF components with only two required trains, an S-VDU train must be OPERABLE for the same two trains as the required OPERABLE ESF components. However, for Phase B Containment Isolation, there are two-train components assigned to Trains A and D, and two-train components assigned to Trains B and C. Therefore, because all four trains are required for Phase B Containment Isolation, all four trains of S-VDU are required. Since Manual Control of ESF Components is required for some ESF systems in all MODES, S-VDU must be OPERABLE to support ESF components in MODES 1, 2, 3, 4, 5 and 6.

MIC-03-16-0 0007

b.   Manual Control of ESF Components - COM-2

COM-2 combines the manual control signals from non-safety Operational VDUs with the manual control signals from S-VDUs. The combined signal is interfaced to the Actuation Logic in the SLS for manual control of ESF components. Since COM-2 controls ESF components assigned to all four trains as explained above for the S-VDU, some of which are required in all MODES, four COM-2 trains are required in MODES 1, 2, 3, 4, 5 and 6.

c.   Manual Control of ESF Components - Actuation Logic and Actuation Outputs

The Actuation Logic and Actuation Outputs for the Manual Control of ESF Components Function is implemented in the SLS. For ESFAS components, the SLS combines the automatic actuation signals from the ESFAS with the manual control signals from COM-2. For all ESF components the SLS generates Actuation Outputs, based on automatic and/or manual control signals, which control the state of the ESF components. For the Manual Control of ESF Components Function, the Actuation Logic and Actuation Outputs within any SLS controller must be OPERABLE in the same MODES and for the same trains as for the required ESF components. LCO 3.4 through 3.7 provide MODE and train requirements applicable to ESF components.

The ESFAS instrumentation satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii) (Ref. 9).

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 on Table 3.3.2-1. |

In the event a channel's accuracy is found non-conservative with respect to the Allowable Value, or the transmitter, instrument ~~L~~loop, signal processing electronics, or digital bistable is found inoperable, then all affected Functions provided by that channel must be declared inoperable and the LCO Condition(s) entered for the protection Function(s) affected. When the Required Channels in Table 3.3.2-1 are specified (e.g., on a per steam line, per loop, per SG, etc., basis), then the Condition may be entered separately for each steam line, loop, SG, etc., as appropriate. `MIC-03-16-00007`

When the number of channels inoperable ~~channels~~ in a trip function exceeds those specified in one or other related Conditions associated with a trip function, then the unit is outside the safety analysis. Therefore, LCO 3.0.3 should be immediately entered if applicable in the current MODE of operation. `MIC-03-16-00007`

In all cases where the LCO states "Restore channel or train to OPERABLE status", this means restore the required number of channels or trains to OPERABLE status. Therefore, restoration of an alternate channel or train, other than the failed channel or train, is also acceptable. `MIC-03-16-00007`

A.1

Condition A applies to all ESFAS protection functions.

Condition A addresses the situation where one or more required channels or trains for one or more Functions are inoperable at the same time. The Required Action is to refer to Table 3.3.2-1 and to take the Required Actions for the protection functions affected. The Completion Times are those from the referenced Conditions and Required Actions. `MIC-03-16-00007`

B.1, B.2.1, and B.2.2

Condition B applies to ~~m~~Manual ~~i~~Initiation of: `MIC-03-16-00007`

•   ECCS Actuation,

•   Containment Spray, and

•   Containment Phase A Isolation.

BASES

ACTIONS (continued)

This action addresses the train orientation of the PSMS for the functions listed above. If ~~a channel or~~one required train is inoperable, 72 hours ~~is~~are allowed to return it to an OPERABLE status. Note that for ~~c~~Containment ~~s~~Spray and Phase B ~~i~~Isolation, failure of one or both channels in one train renders the train inoperable. Condition B, therefore, encompasses both situations.

The ~~specified~~ Completion Time ~~is reasonable considering that the remaining OPERABLE~~of 72 hours is justified because (1) for ECCS two trains ~~provide protection for each Function, and the low probability of an event occurring during this interval. The completion time also considers that~~are adequate to perform the safety function and there are three required automatic actuation trains and two other required Manual Initiation ~~for all functions can also be actuated from the Safety VDU for each train. Therefore all safety related~~ trains OPERABLE, (2) for Containment Spray three trains are adequate to perform the safety function and there are four automatic actuation trains and three other Manual Initiation ~~functions remain operable. In addition, the~~ trains OPERABLE, or (3) for Containment Phase A Isolation one train is adequate to perform the safety function and there are two automatic actuation trains and one other Manual Initiation ~~function for~~train OPERABLE. The Completion Time also considers that all trains ~~is actuated~~of ECCS can be initiated by the Manual Initiation ~~pushbuttons for~~Function from the two remaining trains, and Containment Spray can be initiated by the Manual Initiation Function from any two out of the three remaining trains.

In addition, the Completion Time considers that each train of all Functions can be manually initiated from the Safety VDU for that train. Therefore, manual initiation through safety related equipment remains functional in all required trains.

The Completion Time of 72 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 11).

If the train cannot be restored to OPERABLE status, the unit must be placed in a MODE in which the LCO does not apply. This is done by placing the unit in at least MODE 3 within an additional 6 hours (78 hours total time) and in MODE 5 within an additional 30 hours (108 hours total time). The allowable 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 unit systems.

~~The initial completion time of 72 hours is justified in the PSMS reliability analysis. For detail information, refer to the US APWR Technical Report MUAP-07030 PRA, Attachment 6B.12. The result of the PSMS reliability analysis is evaluated and confirmed in the US APWR PRA Chapter 19. The PSMS reliability analysis credits the continued compliance to the single~~

MIC-03-16-0 0007

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BASES

ACTIONS (continued)

~~failure criteria, since the ESFAS manual initiation function remains fully operable from the Safety VDUs, even when one ESFAS manual initiation function is inoperable.~~ | MIC-03-16-0 0007

C.1, C.2.1, and C.2.2

Condition C applies to the Actuation Logic and Actuation Outputs for the following ~~f~~Functions: | MIC-03-16-0 0007

• Containment Phase A Isolation, and

• Containment Phase B Isolation.

This action addresses the train orientation of the PSMS. If one train is inoperable, 24 hours are allowed to restore the train to OPERABLE status. ~~The 24 hours allowed for restoring the inoperable train to OPERABLE status is reasonable considering that there are sufficient trains OPERABLE to ensure the capability of the required Function, and the low probability of an event occurring during this interval.~~ | MIC-03-16-0 0007

The Completion Time ~~also~~of 24 hours is justified because the remaining OPERABLE train(s) are adequate to perform the safety function. In addition, the Completion Time considers that the remaining OPERABLE train(s) each have continuous automatic self-testing.

The Completion Time of 24 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 11).

If the train cannot be restored to OPERABLE status, the unit must be placed in a MODE in which the LCO does not apply. This is done by placing the unit in at least MODE 3 within an additional 6 hours (30 hours total time) and in MODE 5 within an additional 30 hours (60 hours total time). The 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 unit systems.

The Required Actions are modified by a Note that allows placing one train ~~to be bypassed~~in bypass for up to 4 hours ~~for~~while performing surveillance testing, provided the other train(s) ~~is~~are OPERABLE. This ~~allowance is~~4 hour bypass time is reasonable based on ~~the reliability analysis assumption~~operating experience that 4 hours is the average time required to perform a train surveillance. | MIC-03-16-0 0007

BASES

ACTIONS (continued)

~~The bypassed condition for up to 4 hours and the initial completion time of 24 hours are~~ The Bypass Time of 4 hours is justified because the remaining OPERABLE train(s) are adequate to perform the safety function. In addition, the Bypass Time considers that the remaining OPERABLE train(s) have continuous automatic self-testing.

The Bypass Time of 4 hours is also justified in the ~~PSMS~~ US-APWR reliability ~~analysis. For detail information, refer to the US-APWR Technical Report MUAP-07030 PRA, Attachment 6B.12. The~~ and risk analyses, the summary and result of ~~the PSMS reliability analysis is evaluated and confirmed~~ which are documented in the ~~US-APWR PRA~~ FSAR Chapter 19 (Ref. 11).

MIC-03-16-0 0007

D.1, D.2.1, and D.2.2

Condition D applies to:

• High Containment Pressure, and

MIC-03-16-0 0007

• ~~Low Pressurizer Pressure,~~

• ~~Low Main Steam Line Pressure,~~

• ~~Low T_avg,~~

• ~~High Pressurizer Water Level,~~

• High-High Containment Pressure~~,~~.

• ~~High Main Steam Line Pressure Negative Rate,~~

• ~~High SG Water Level,~~

• ~~Low SG Water Level,~~

• ~~High High SG Water Level, and~~

• ~~Low low T_avg~~

BASES

ACTIONS (continued)

If one ~~required~~ channel is inoperable, 72 hours are allowed to restore the channel to OPERABLE status or to place it in the trip~~ped~~ condition. ~~Generally this Condition applies to functions that operate on two out of three logic. Therefore, f~~Failure of one channel places the Function in a two-out-of-two configuration~~. One~~, when the failed channel does not result in a trip channel. This configuration provides adequate plant protection, but does not meet the single failure criteria. Therefore, within 72 hours the inoperable channel must be tripped to place the Function in a one-out-of-~~three~~two configuration that satisfies ~~redundancy requirements. The 72 hours allowed to restore the channel to OPERABLE status or to place it in the tripped condition is justified because the remaining two~~the single failure criteria.

The Completion Time of 72 hours is justified because the two remaining OPERABLE channels are adequate to perform the safety function. In addition, the Completion Time considers that the two remaining OPERABLE channels have continuous automatic self-testing ~~(as described for COT),~~ and continuous automatic CHANNEL CHECKS.

The Completion Time of 72 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 11).

Failure to restore the channel inoperable ~~channel~~ to OPERABLE status or place it in the trip~~ped~~ condition within 72 hours requires the unit be placed in MODE 3 within the following 6 hours and MODE 4 within the next 6 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 unit systems. In MODE 4, these Functions are no longer required OPERABLE.

~~The initial completion time of 72 hours is justified in the PSMS reliability analysis, considering that the remaining operable channels have continuous self-testing. For detail information, refer to the US APWR Technical Report MUAP-07030 PRA, Attachment 6B.12. The result of the PSMS reliability analysis is evaluated and confirmed in the US-APWR PRA Chapter 19.~~The Required Actions are modified by a Note that allows placing one required channel in bypass for up to 12 hours while performing surveillance testing, provided the other required channels are OPERABLE, or one required channel is OPERABLE and the other required channel is placed in the trip condition.

~~One channel may be bypassed for up to 12 hours for surveillance testing. The 12 hours bypass limit is justified in the PSMS reliability analysis, considering that the remaining operable channels have continuous self-testing. For detail information, refer to the US APWR Technical Report MUAP-07030 PRA,~~

MIC-03-16-0 0007

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BASES

ACTIONS (continued)

~~Attachment 6B.12. The result of the PSMS reliability analysis is evaluated and confirmed in the US APWR PRA Chapter 19. This bypass is not allowed for the other functions because these channels are also used for control. If a failure were to occur in one of the two remaining control channels, a plant transient could occur that would require a plant trip, but a plant trip would not occur with only one remaining operable channel.~~   MIC-03-16-0 0007

The Bypass Time of 12 hours is justified because the remaining OPERABLE required channels are adequate to perform the safety function. In addition, the Bypass Time considers that the remaining OPERABLE required channels have continuous automatic self-testing and continuous automatic CHANNEL CHECKS.

The Bypass Time of 12 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 11).

E.1, E.2.1, and E.2.2

Condition E applies to:

*   Containment Spray - High-3 Containment Pressure, and

*   Containment Phase B Isolation - High-3 Containment Pressure.

~~This LCO requires three operable channels. None of these signals has input to a control function. Two out of three logic is necessary to meet acceptable protective requirements. However, a two-out-of-three design would require tripping a failed channel. This~~If one required channel is inoperable, 72 hours are allowed to restore the channel to OPERABLE status. Failure of one channel places the Function in a two-out-of-two configuration, when the failed channel does not result in a trip channel. This configuration provides adequate plant protection, but does not meet the single failure criteria. Therefore, within 72 hours the inoperable channel must be restored to OPERABLE status. Tripping a channel, as in Condition D, is undesirable because a single failure would then cause spurious ~~c~~Containment ~~s~~Spray initiation. Spurious spray actuation is undesirable because of the cleanup problems presented.   MIC-03-16-0 0007

~~Restoring the channel to OPERABLE status within 72 hours is sufficient because of the low probability of an event occurring during this interval because the remaining two~~The Completion Time of 72 hours to restore the inoperable channel is justified because the two remaining OPERABLE channels are adequate to perform the safety function. In addition, the Completion Time considers that the two remaining OPERABLE channels have continuous automatic self-testing ~~(as described for COT),~~ and continuous automatic CHANNEL CHECKS.   MIC-03-16-0 0007

BASES

ACTIONS (continued)

The Completion Time of 72 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 11).

MIC-03-16-0 0007

Failure to restore the required number of channels to OPERABLE status within 72 hours, requires the unit be placed in MODE 3 within the following 6 hours and MODE 4 within the next 6 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 unit systems. In MODE 4, these Functions are no longer required OPERABLE.

The initial completion time of 72 hours is justified in the PSMS reliability analysis, considering that the remaining operable channels have continuous self-testing. For detail information, refer to the US-APWR Technical Report MUAP-07030 PRA, Attachment 6B.12. The result of the PSMS reliability analysis is evaluated and confirmed in the US-APWR PRA Chapter 19.

MIC-03-16-0 0007

The Required Actions are modified by a Note that allows placing one required channel in bypass for up to 12 hours while performing surveillance testing, provided the other required channels are OPERABLE. Bypassing with another channel in trip, as in Condition D, is undesirable because a single failure during surveillance testing would then cause spurious Containment Spray initiation. Spurious spray actuation is undesirable because of the cleanup problems presented.

Bypass Time of 12 hour is justified because the remaining OPERABLE channels are adequate to perform the safety function. In addition, the remaining OPERABLE channels have continuous automatic self-testing and continuous automatic CHANNEL CHECKS.

The Bypass Time of 12 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 11).

F.1, F.2.1, and F.2.2

Condition F applies to:

MIC-03-16-0 0007

- Loss of Offsite Power, and.

- P-4 Interlock.

BASES

ACTIONS (continued)

Condition F also applies to the ~~m~~Manual ~~i~~Initiation for: MIC-03-16-0
0007

•   Main Steam Line Isolation,

•   Main Feedwater Isolation,

•   Emergency Feedwater Actuation,

•   Emergency Feedwater Isolation,

•   CVCS Isolation, and

•   Block Turbine Bypass and Cooldown Valves.

For all Functions, this action addresses the train orientation of the PSMS. For the Loss of Offsite Power Function, this action also recognizes the lack of manual trip provision for a failed channel.   MIC-03-16-0
0007

If ~~a train or~~one channel or required train is inoperable, 72 hours ~~is~~are allowed to return it to OPERABLE status. ~~The specified Completion Time is reasonable considering the nature of these Functions, the available redundancy, and the low probability of an event occurring during this interval.~~

For the Loss of Offsite Power Function, the Completion Time of 72 hours is justified because the two remaining OPERABLE undervoltage devices for each train of the Emergency Feedwater Actuation Function are adequate to perform the safety function. Since the undervoltage devices are dedicated for each of the four Class 1E busses, and two undervoltage devices are adequate to perform the safety function of each bus, the Emergency Feedwater Actuation on Loss of Offsite Power continues to meet the single failure criterion (i.e., three trains of the Emergency Feedwater Actuation Function will still actuate if there is an additional undervoltage device failure on one bus).

For Manual Initiation Functions, the Completion Time of 72 hours is justified because (1) for Emergency Feedwater Actuation the remaining two trains are adequate to perform the safety function and there are three automatic actuation trains and two other Manual Initiation trains OPERABLE, or (2) for Main Steam Line Isolation, Main Feedwater Isolation, Emergency Feedwater Isolation, CVCS Isolation, and Block Turbine Bypass and Cooldown Valves the remaining train is adequate to perform the safety function and there are two automatic actuation trains and one other Manual Initiation train OPERABLE. The Completion Time also considers that Emergency Feedwater Actuation for all trains can be initiated by the Manual Initiation Function from the two remaining trains.

BASES

ACTIONS (continued)

In addition, the Completion Time for the Manual Initiation Function considers that each train can be manually initiated from the Safety VDU for that train. Therefore, manual initiation through safety related equipment remains functional in all trains.

For all Functions, the Completion Time of 72 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 11).

MIC-03-16-0 0007

If the Function cannot be returned to OPERABLE status, the unit must be placed in MODE 3 within the next 6 hours and MODE 4 within the following 6 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power in an orderly manner and without challenging unit systems. In MODE 4, the unit does not have any analyzed transients or conditions that require the explicit use of the protection functions noted above.

~~The initial completion of 72 hours is justified in the PSMS reliability analysis. For detail information, refer to the US-APWR Technical Report MUAP-07030 PRA, Attachment 6B.12. The result of the PSMS reliability analysis is evaluated and confirmed in the US-APWR PRA Chapter 19. For the manual initiation functions, the PSMS reliability analysis credits the continued compliance to the single failure criteria, since the ESFAS manual initiation function remains fully operable from the Safety VDUs, even when one ESFAS manual initiation function is inoperable.~~For the Loss of Offsite Power Function a Note is added to allow placing one channel in bypass for up to 4 hours while performing surveillance testing, provided the other channels on the same bus are OPERABLE, or one channel is OPERABLE and the other is placed in the trip condition.

MIC-03-16-0 0007

The Bypass Time of 4 hours is justified because the Function remains fully OPERABLE on every bus. In addition, the Bypass Time considers that each OPERABLE train has continuous automatic self-testing.

The 4 hour bypass time is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 11).

G.1, G.2.1, and G.2.2

Condition G applies to the Actuation Logic and Actuation Outputs for the;

- Emergency Feedwater Isolation,

- CVCS Isolation, and

- Turbine Trip Functions.

BASES

ACTIONS (continued)

The action addresses the train orientation of the PSMS for these ~~f~~Functions. |MIC-03-16-0
If one train is inoperable, 24 hours are allowed to restore the train to 0007
OPERABLE status. ~~The 24 hours allowed for restoring the inoperable train to~~ |MIC-03-16-0
~~OPERABLE status is reasonable considering that the safety function can be~~ 0007
~~performed by the remaining OPERABLE trains, and the low probability of an~~
~~event occurring during this interval.   The Completion Time also~~

The Completion Time of 24 hours is justified because the remaining
OPERABLE train is adequate to perform the safety function. In addition, the
Completion Time considers that the remaining OPERABLE ~~trains each~~
~~have~~train has continuous automatic self-testing.

The Completion Time of 24 hours is also justified in the US-APWR reliability
and risk analyses, the summary and result of which are documented in FSAR
Chapter 19 (Ref. 11).

If the train cannot be returned to OPERABLE status, the unit must be brought
to MODE 3 within the next 6 hours and MODE 4 within the following 6 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 unit systems. Placing the unit in
MODE 4 removes all requirements for OPERABILITY of the protection
channels and actuation functions. In this MODE, the unit does not have
analyzed transients or conditions that require the explicit use of the protection
functions noted above.

The Required Actions are modified by a Note that allows placing one train ~~to~~ |MIC-03-16-0
~~be bypassed~~in bypass for up to 4 hours ~~for~~while performing surveillance 0007
testing. provided the other train~~s are~~ is OPERABLE. ~~This allowance is based~~
~~on the assumption that 4 hours is the average time required to perform~~
~~channel surveillance.~~

~~The bypassed condition for up to 4 hours and the initial completion time of 24~~
~~hours are~~The Bypass Time of 4 hours is justified because the remaining
OPERABLE train is adequate to perform the safety function. In addition, the
Bypass Time considers that the remaining OPERABLE train has continuous
automatic self-testing.

The Bypass Time of 4 hours is also justified in the ~~PSMS~~US-APWR reliability
~~analysis. For detail information, refer to the US APWR Technical Report~~
~~MUAP-07030 PRA, Attachment 6B.12. The~~and risk analyses, the summary
and result of ~~the PSMS reliability analysis is evaluated and confirmed~~which
are documented in ~~the US APWR PRA~~FSAR Chapter 19 (Ref. 11).

BASES

ACTIONS (continued)

H.1 and H.2

Condition H applies to the ~~EFW pump start~~Emergency Feedwater Actuation on ~~t~~Trip of all MFW ~~p~~Pumps. | MIC-03-16-0 0007

This action addresses the train orientation of the PSMS for the auto start function of the EFW System on loss of all MFW pumps. The OPERABILITY of the EFW System must be assured by allowing automatic start of the EFW System pumps. | MIC-03-16-0 0007

If a required channel is inoperable, 48 hours are allowed to return it to an OPERABLE status.

The allowance of 48 hours to return the train to an OPERABLE status is justified because Trip of all Main Feedwater Pumps is an anticipatory function that is not credited in the safety analysis.

If the function cannot be returned to an OPERABLE status, 6 hours are allowed to place the unit in MODE 3. | MIC-03-16-0 0007

The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging unit systems. In MODE 3, the unit does not have any analyzed transients or conditions that require the explicit use of the protection function noted above. ~~The allowance of 48 hours to return the train to an OPERABLE status is justified because trip of all main feedwater pumps is an anticipatory function that is not credited in the safety analysis.~~ | MIC-03-16-0 0007

I.1, I.2.1, and I.2.2

Condition I applies to the P-11 interlock.

With one or more required channels inoperable, the operator must verify that the interlock is in the required state for the existing unit condition. This action manually accomplishes the function of the interlock. Determination must be made within 1 hour. The 1 hour Completion Time is equal to the time allowed by LCO 3.0.3 to initiate shutdown actions in the event of a complete loss of ESFAS function. | MIC-03-16-0 0007

If the interlock is not in the required state (or placed in the required state) for the existing unit condition, the unit must be placed in MODE 3 within the next 6 hours and MODE 4 within the following 6 hours. | MIC-03-16-0 0007

The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in

BASES

ACTIONS (continued)

an orderly manner and without challenging unit systems. Placing the unit in MODE 4 removes all requirements for OPERABILITY of this interlocks.

<u>J.1 and J.2</u>

Condition J applies to the Actuation Logic and Actuation Outputs for the Emergency Feedwater Actuation.

The action addresses the train orientation of the PSMS for ~~these~~this ~~f~~Function~~s~~.　　　　　　　　　　　　　　　MIC-03-16-0
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　0007

If one required train is inoperable, 72 hours are allowed to restore the train to OPERABLE status. ~~The 72 hours allowed for restoring the inoperable train to OPERABLE status is reasonable considering that the safety function can be performed by the remaining OPERABLE trains, and the low probability of an event occurring during this interval. The Completion Time also~~

The Completion Time of 72 hours is justified because the two remaining OPERABLE trains are adequate to perform the safety function. In addition, the Completion Time considers that the two remaining OPERABLE trains each have continuous automatic self-testing.

The Completion Time of 72 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 11).

Required Action J.2 allows the option to apply the requirements of Specification 5.5.18 to determine a Risk Informed Completion Time.

The Required Actions are modified by a Note that allows placing one ~~train to~~ MIC-03-16-0
~~be bypassed~~required train in bypass for up to 4 hours ~~for~~while performing   0007
surveillance testing, provided the other required trains are OPERABLE. ~~This allowance is based on the assumption that 4 hours is the average time required to perform channel surveillance.~~

~~The bypassed condition for up to 4 hours and the initial completion time of 72 hours are~~The Bypass Time of 4 hours is justified because the remaining OPERABLE trains are adequate to perform the safety function. In addition, the Bypass Time considers that the remaining OPERABLE trains have continuous automatic self-testing.

The Bypass Time of 4 hours is also justified in the ~~PSMS~~US-APWR reliability ~~analysis. For detail information, refer to the US APWR Technical Report MUAP-07030 PRA, Attachment 6B.12. The~~and risk analyses, the summary and result of ~~the PSMS reliability analysis is evaluated and confirmed~~which are documented in ~~the US-APWR PRA~~FSAR Chapter 19 (Ref. 11).

BASES

ACTIONS (continued)

K.1

Condition K applies to the failure of one Containment High Range Area Radiation ~~monitor~~ channel. Since the three Containment High Range Area Radiation ~~monitors~~channels measure the same parameter~~s~~, failure of a single channel does not result in loss of the radiation monitoring Function for any event~~s~~.

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If one required channel is inoperable, 72 hours are allowed to restore the channel to OPERABLE status ~~or to place it in the tripped condition. Generally this Condition applies to functions that operate on two out of three logic. Therefore, f~~. Failure of one channel places the Function in a two-out-of-two configuration. ~~One channel must be tripped to place the Function in a one-out-of-three configuration that satisfies redundancy requirements.~~

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The Completion Time of 72 hours ~~allowed~~ to restore the inoperable channel ~~to OPERABLE status or to place it in the tripped condition~~ is justified because the two remaining OPERABLE channels are adequate to perform the safety function. In addition, the Completion Time considers that the two remaining OPERABLE channels have continuous automatic self-testing ~~(as described for COT),~~ and continuous automatic CHANNEL CHECKS.

The Completion Time of 72 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19. (Ref. 11).

~~Failure to restore the inoperable channel to OPERABLE status or place it in the tripped condition within 72 hours requires the unit be placed in MODE 3 within the following 6 hours and MODE 5 within the next 30 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 unit systems. In MODE 5, these Functions are no longer required OPERABLE.~~

~~The initial completion time of 72 hours is justified in the PSMS reliability analysis, considering that the remaining operable channels have continuous self testing. For detail information, refer to the US APWR Technical Report MUAP-07030 PRA, Attachment 6B.12. The result of the PSMS reliability analysis is evaluated and confirmed in the US APWR PRA Chapter 19.~~

BASES

ACTIONS (continued)

L.1

Condition L applies to the Containment Purge Isolation - Actuation Logic and Actuation Outputs Function and addresses the train orientation of the Engineered Safety Features Actuation System (ESFAS). ~~It~~Condition L also addresses the failure of multiple Containment Purge Isolation - Containment High Range Area Radiation ~~Monitoring~~ channels, or the ~~inability to restore a single failed channel to OPERABLE status in the time allowed for Required Action K.1~~Required Action and associated Completion Time of Condition K not met.

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If a~~n~~ train of Actuation Logic and Actuation Outputs ~~train~~ is inoperable, multiple required channels of Containment High Range Area Radiation ~~Monitoring channels~~ are inoperable, or the Required Action and associated Completion Time of Condition K are not met, operation may continue as long as the Required Action for the applicable Conditions of LCO 3.6.3 is met for each valve made inoperable by failure of isolation instrumentation.

M.1 and M.2

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Condition M applies to: ~~the Actuation Logic and Actuation Outputs Function of the MCR Isolation, the Main Control Air monitor Functions, and the Manual Initiation Functions.~~

~~If one Actuation Logic and Actuation Outputs train is inoperable, one Main Control Room Radiation channel is inoperable in one or more Functions, or one Manual Initiation train is inoperable, 7 days are permitted to restore it to OPERABLE status. The 7 day Completion Time is the same as is allowed if one train of the mechanical portion of the system is inoperable. The basis for this Completion Time is the same as provided in LCO 3.7.10. If the channel/train cannot be restored to OPERABLE status, one train of the affected subsystem(s) must be placed in the emergency mode of operation. This accomplishes the actuation instrumentation Function and places the unit in a conservative mode of operation.~~

~~Affected subsystems depend on inoperable train, as follows.~~

• Low Pressurizer Pressure.~~If train A or D is inoperable, MCREFS doesn't satisfy the single failure criterion. Therefore, one train MCREFS is placed on emergency mode. MCRATCS is unaffected, since three required trains remain operable.~~

• Low Main Steam Line Pressure.~~If train B or C is inoperable, MCREFS is unaffected and three required trains of MCRATCS remain operable. Therefore, no action is required.~~

BASES

ACTIONS (continued)

- Low T$_{avg}$,   MIC-03-16-0 0007

- Low-Low T$_{avg}$,

- High Pressurizer Water Level,

- High Main steam Line Pressure Negative Rate,

- High SG Water Level,

- Low SG Water Level, and

- High-High SG Water Level.

N.1.1, N.1.2, and N.2

Condition N applies to the failure of two MCR Isolation Actuation Logic and Actuation Outputs trains, two Main Control Room Radiation channels, or two Manual Initiation trains for one or more Functions. The first Required Action is to place the affected subsystem(s) in the emergency mode of operation immediately. For MCREFS this requires one train, since each is 100% capacity. Two trains of MCRATCS are required since each is 50% capacity. This accomplishes the actuation instrumentation Function that may have been lost and places the unit in a conservative mode of operation. The applicable Conditions and Required Actions of LCO 3.7.10 must also be entered for the MCRVS train made inoperable by the inoperable actuation instrumentation. This ensures appropriate limits are placed upon train inoperability as discussed in the Bases for LCO 3.7.10.

Alternatively, all trains of the affected subsystem(s)may be placed in the emergency mode. This ensures the MCR Isolation function is performed even in the presence of a single failure.

Affected subsystems depend on inoperable train, as follows.

- If trains A and D are inoperable, MCREFS is completely inoperable. Therefore, one train of MCREFS is placed on emergency mode and the required action of MCRVS is appled (to restore in 7 days). Or two trains of MCREFS are placed on emergency mode. And one train of MCRATCS is placed on emergency mode, since MCRATCS does not satisfy the single failure criterion.

BASES

ACTIONS (continued)

- ~~If trains A and B, or A and C, or B and D, or C and D are inoperable, one train of MCREFS and one train of MCRATCS is placed on emergency mode since both subsystems don't satisfy the single failure criterion.~~

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- ~~If trains B and C are inoperable, MCREFS is unaffected. One train of MCRATCS is placed on emergency mode since MCRATCS does not satisfy the single failure criterion.~~

With one required channel inoperable the inoperable channel must be placed in the trip condition within 1 hour and restored to OPERABLE status in 72 hours.

This Condition applies to functions that operate on two-out-of-three logic and have channels that are shared with the control systems. Failure of one channel places the Function in a two-out-of-two configuration, when the failed channel does not result in a trip channel. Normally the SSA can prevent erroneous control system operations. However, when there are less than three OPERABLE channels, the SSA cannot prevent erroneous control system operation due to an input failure. With two OPERABLE channels and one channel in the trip condition, if a channel failure occurs in an OPERABLE channel and results in erroneous control system operation, the remaining OPERABLE channel can provide a plant trip. However, the channel that causes the erroneous control system operation cannot be credited as the single failure; therefore, this configuration does not satisfy the single failure criteria. To satisfy the single failure criteria, three channels must be restored to OPERABLE status within 72 hours.

The Completion Time of 1 hour to place the failed channel in the trip condition is based on operating experience and the minimum amount of time allowed for manual operator actions.

The Completion Time of 72 hours to restore the inoperable channel is justified because the two remaining OPERABLE channels are adequate to perform the safety function. In addition, the Completion Time considers that the two remaining OPERABLE channels have continuous automatic self-testing and continuous automatic CHANNEL CHECKS.

The Completion Time of 72 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19. (Ref.11).

Bypass of a required channel is not allowed because there are only three required channels and these channels are also used for control. If a failure were to occur in one of the two remaining control channels, a plant transient

BASES

ACTIONS (continued)

could occur that would require a plant trip, but a plant transient would not occur with only one remaining OPERABLE channel.

N.1 and N.2

If the Required Action and associated Completion Time of Condition M are not met, the unit must be brought to MODE 3 within the next 6 hours and MODE 4 within the following 6 hours. Placing the unit in MODE 4 removes all requirements for OPERABILITY of the protection channels and actuation functions. In this MODE, the unit does not have analyzed transients or conditions that require the explicit use of the protection functions noted above.

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 unit systems.

O.1 and O.2

~~Condition O applies when the Required Action and associated Completion Time for Condition M or N have not been met and the unit is in MODE 1, 2, 3, or 4. The unit must be brought to a MODE in which the LCO requirements are not applicable. To achieve this status, the unit must be brought to MODE 3 within 6 hours and MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems~~Condition O applies to the S-VDU trains for the Manual Control of ESF Components Function.

If one train is inoperable, 72 hours are allowed to restore the train to OPERABLE status. If the inoperable S-VDU train cannot be restored to OPERABLE status, the applicable Conditions and Required Actions must be entered for ESF components made inoperable by the inoperable S-VDU train. This ensures appropriate limits are placed upon train inoperability. LCO 3.4 through 3.7 provide MODE and train requirements applicable to ESF components.

~~P.1~~

~~Condition P applies when the Required Action and associated Completion Time for Condition M or N have not been met when irradiated fuel assemblies are being moved. Movement of irradiated fuel assemblies must be suspended immediately to reduce the risk of accidents that would require MCR Isolation actuation.~~

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BASES

ACTIONS (continued)

The Required Actions are modified by a Note that allows placing one train in bypass for up to 4 hours while performing surveillance testing, provided the other trains are OPERABLE. This 4 hour Bypass Time is reasonable based on operating experience that 4 hours is the average time required to perform a train surveillance.

The Bypass Time of 4 hours is justified because the remaining OPERABLE trains are adequate to perform the safety function. In addition the Bypass Time considers that the remaining OPERABLE trains have continuous automatic self-testing.

P.1 and P.2

Condition P applies to the COM-2 trains for the Manual Control of ESF Components Function.

If one train is inoperable, 12 hours are allowed to restore the train to OPERABLE status. If the inoperable COM-2 train cannot be restored to OPERABLE status, the applicable Conditions and Required Actions must be entered for the affected train of all ESF components made inoperable by the inoperable COM-2 train. This ensures appropriate limits are placed upon train inoperability. LCO 3.4 through 3.7 provide MODE and train requirements applicable to ESF components.

The Required Actions are modified by a Note that allows placing one train in bypass for up to 4 hours while performing surveillance testing, provided the other trains are OPERABLE. This 4 hour Bypass Time is reasonable based on operating experience that 4 hours is the average time required to perform a train surveillance.

The Bypass Time of 4 hours is justified because the remaining OPERABLE trains are adequate to perform the safety function. In addition, the Bypass Time considers that the remaining OPERABLE trains have continuous automatic self-testing.

Q.1 and Q.2

Condition Q applies to the Actuation Logic and Actuation Outputs for the following functions:

•   ECCS Actuation, and

•   Containment Spray.

This action addresses the train orientation of the PSMS.

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BASES

ACTIONS (continued)

If one required train is inoperable, 24 hours are allowed to restore the train to OPERABLE status. ~~The 24 hours allowed for restoring the inoperable train to OPERABLE status is reasonable considering that there are sufficient trains OPERABLE to ensure the capability of the required Function, and the low probability of an event occurring during this interval.~~

The Completion Time ~~also~~of 24 hours is justified because the remaining OPERABLE trains are adequate to perform the safety function. In addition, the Completion Time considers that the remaining OPERABLE trains each have continuous automatic self-testing.

The Completion Time of 24 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 11).

Required Action Q.2 allows the option to apply the requirements of Specification 5.5.18 to determine a Risk Informed Completion Time. This Required Action is not applicable in MODE 4, because Risk Informed Completion Times are only applicable to MODES 1, 2 and 3.

The Required Actions are modified by a Note that allows placing one ~~train to be bypassed~~required train in bypass for up to 4 hours ~~for~~while performing surveillance testing, provided the other ~~train(s) is~~required trains are OPERABLE. This ~~allowance is~~4 hour Bypass Time is reasonable based on ~~the reliability analysis assumption~~operating experience that 4 hours is the average time required to perform a train surveillance.

~~The bypassed condition for up to 4 hours and the initial completion time of 24 hours are~~The Bypass Time of 4 hours is justified because the remaining OPERABLE trains are adequate to perform the safety function. In addition, the Bypass Time considers that the remaining OPERABLE trains have continuous automatic self-testing.

The Bypass Time of 4 hours is also justified in the ~~PSMS~~US-APWR reliability ~~analysis. For detail information, refer to the US-APWR Technical Report MUAP-07030 PRA, Attachment 6B.12. The~~and risk analyses, the summary and result of ~~the PSMS reliability analysis is evaluated and confirmed~~which are documented in ~~the US-APWR PRA~~FSAR Chapter 19 (Ref. 11).

BASES

ACTIONS (continued)

R.1 and R.2

Condition R applies to the Actuation Logic and Actuation Outputs for the following functions:

•   ECCS Actuation, and

•   Containment Spray,

If the ~~train cannot be restored to OPERABLE status~~Required Action and associated Completion Time of Condition Q are not met, the unit must be placed in a MODE in which the LCO does not apply. This is done by placing the unit in at least MODE 3 within 6 hours and in MODE 5 within an additional 30 hours (36 hours total time). The 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 unit systems.

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S.1 and S.2

Condition S applies to the Actuation Logic and Actuation Outputs for the;

•   Main Steam Line Isolation,

•   Main Feedwater Isolation, and

•   Block Turbine Bypass and Cooldown Valves.

The action addresses the train orientation of the PSMS for these ~~f~~Functions.

MIC-03-16-0 0007

If one train is inoperable, 24 hours are allowed to restore the train to OPERABLE status. ~~The 24 hours allowed for restoring the inoperable train to OPERABLE status is reasonable considering that the safety function can be performed by the remaining OPERABLE trains, and the low probability of an event occurring during this interval.   The Completion Time also~~

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The Completion Time of 24 hours is justified because the remaining OPERABLE train is adequate to perform the safety function. In addition, the Completion Time consider that the remaining OPERABLE train~~s each have~~ has continuous automatic self-testing.

The Completion Time of 24 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 11).

BASES

ACTIONS (continued)

Required Action S.2 allows the option to apply the requirements of Specification 5.5.18 to determine a Risk Informed Completion Time.

The Required Actions are modified by a Note that allows ~~placing~~ one train ~~to be bypassed~~in bypass for up to 4 hours ~~for~~while performing surveillance testing~~.~~ provided the other train~~s are~~ is OPERABLE. ~~This allowance is based on the assumption that 4 hours is the average time required to perform channel surveillance.~~   MIC-03-16-00007

~~The bypassed condition for up to 4 hours and the initial completion time of 24 hours are~~The Bypass Time of 4 hours is justified because the remaining OPERABLE train is adequate to perform the safety function. In addition, the Bypass Time considers that the remaining OPERABLE train has continuous automatic self-testing.

The Bypass Time of 4 hours is also justified in the ~~PSMS~~US-APWR reliability ~~analysis. For detail information, refer to the US APWR Technical Report MUAP-07030 PRA, Attachment 6B.12. The~~and risk analyses, the summary and result of ~~the PSMS reliability analysis is evaluated and confirmed~~which are documented in ~~the US APWR PRA~~FSAR Chapter 19 (Ref. 11).

T.1 and T.2

Condition T applies to the Actuation Logic and Actuation Outputs for the following functions:

• 	Main Steam Line Isolation,

• 	 Main Feedwater Isolation,

• 	Emergency Feedwater Actuation, and

• 	Block Turbine Bypass and Cooldown Valves.

Condition T applies when the Required Action and associated Completion Time for Condition J or S have not been met. If the train cannot be returned to OPERABLE status, the unit must be brought to MODE 3 within the next 6 hours and MODE 4 within the following 6 hours (12 hours total time). ~~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 unit systems.~~ Placing the unit in MODE 4 removes all requirements for OPERABILITY of the protection channels and actuation functions. In this MODE, the unit does not have analyzed transients or conditions that require the explicit use of the protection functions.   MIC-03-16-00007

BASES

ACTIONS (continued)

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 unit systems.

U.1

Condition U applies when one MCR Outside Air Intake Radiation monitoring channel is inoperable in one or more Functions. There are two 100% capacity MCREFS Trains A and D, with two trains required, and four 50% capacity MCRATCS Trains A, B, C and D, with three trains required. There are two channels, A and D, for each of three MCR Outside Air Intake Radiation monitoring Functions, with two channels required for each function. An inoperable MCR Outside Air Intake Radiation monitoring channel affects all MCREFS and MCRATCS trains.

If one channel for any of the MCR Outside Air Intake Radiation monitoring Functions is inoperable, the instrumentation Function of MCREFS and MCRATCS can provide 100% capacity but doesn't satisfy the single failure criterion. Therefore, within 7 days one MCREFS train and two MCRATCS trains are placed in the emergency mode. With these trains in the emergency mode, 100% capacity is provided for MCR Outside Air Intake Radiation monitoring Functions. In addition, with one OPERABLE MCR Outside Air Intake Radiation monitoring channel remaining for all Functions, an additional MCREFS train and MCRATCS train are capable of automatic initiation, therefore all MCR Outside Air Intake Radiation monitoring Functions meet the single failure criterion.

The 7 day Completion Time is the same as is allowed if one train of the mechanical portion of the system is inoperable. The basis for this Completion Time is the same as provided in LCO 3.7.10 for the mechanical systems.

The emergency mode of operation requires components of the specified trains to be manually placed in the position that they would be automatically actuated to by the MCR Isolation signal. In addition, the controlled components must be configured to prevent erroneous component repositioning from spurious signals from Operational VDUs by manually activating the MCRVS O-VDU Disconnect function. This action is needed because the automatic initiation signals are credited to override any spurious Operational VDU signals, but those signals are affected in this Condition. These two actions accomplish the actuation instrumentation Function and place the unit in a conservative mode of operation.

The "emergency mode" for this Condition, is defined as the pressurization mode specified in LCO 3.7.10. Automatic transfer to the isolation mode for protection against smoke ingress is not affected by this condition.

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ACTIONS (continued)

V.1, V.2.1, and V.2.2

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0007

Condition V applies when two MCR Outside Air Intake Radiation monitoring channels are inoperable in one or more Functions. There are two 100% capacity MCREFS trains, A and D, with two trains required, and four 50% capacity MCRATCS trains, A, B, C and D, with three trains required. There are two channels, A and D, for each of three MCR Outside Air Intake Radiation monitoring Functions, with two channels required for each function. Two inoperable MCR Outside Air Intake Radiation monitoring channels affect all MCREFS and MCRATCS trains.

If two MCR Outside Air Intake Radiation monitoring channels for the same Function are inoperable in one or more Functions, the MCREFS and MCRATCS instrumentation Functions are completely inoperable. Therefore, one MCREFS train and two MCRATCS trains are immediately placed in the emergency mode. With these trains in the emergency mode, 100% capacity is provided for all MCR Outside Air Intake Radiation monitoring Functions, but the system does not meet the single failure criterion.

Action must be taken within 7 days to restore compliance to the single failure criteria by either restoring one channel of each MCR Outside Air Intake Radiation monitoring Function to OPERABLE status (V.2.1), or placing two trains of MCREFS and three trains of MCRATCS in the emergency mode (V.2.2).

For V.2.1, with one MCREFS train and two MCRATCS trains in the emergency mode, and one additional train of each Function capable of automatic initiation, the system provides 100% capacity and satisfies the single failure criterion.

For V.2.2, with two trains of MCREFS and three trains of MCRATCS in the emergency mode, the system provides 100% capacity and satisfies the single failure criterion.

The 7 day Completion Time is the same as is allowed if one train of the mechanical portion of the system is inoperable. The basis for this Completion Time is the same as provided in LCO 3.7.10 for the mechanical systems.

The emergency mode of operation requires components of the specified trains to be manually placed in the position that they would be automatically actuated to by the MCR Isolation signal. In addition, the controlled components must be configured to prevent erroneous component repositioning from spurious signals from Operational VDUs by manually activating the MCRVS O-VDU Disconnect function. This action is needed because the automatic initiation signals are credited to override any spurious Operational VDU signals, but those signals are affected in this

BASES

ACTIONS (continued)

Condition. These two actions accomplish the actuation instrumentation Function and place the unit in a conservative mode of operation.

The "emergency mode" for this Condition, is defined as the pressurization mode specified in LCO 3.7.10. Automatic transfer to the isolation mode for protection against smoke ingress is not affected by this condition.

W.1

Condition W applies when one train, A or D, of the MCR Isolation Actuation Logic and Actuation Outputs Function is inoperable, or one train, A or D, of the MCR Isolation Manual Initiation Function is inoperable. There are two 100% capacity MCREFS trains, A and D, with two trains required, and four 50% capacity MCRATCS trains, A, B, C and D, with three trains required. There are four Manual Initiation trains, with three trains required, including Trains A and D.

If Train A or D of the MCR Isolation Actuation Logic and Actuation Outputs Function or the MCR Isolation Manual Initiation Function is inoperable, the instrumentation of MCREFS provides 100% capacity but doesn't satisfy the single failure criterion. Therefore, within 7 days the affected train of MCREFS is placed in the emergency mode. With one train in the emergency mode the system provides 100% capacity, and with the remaining OPERABLE MCREFS train capable of automatic actuation, the system satisfies the single failure criterion for automatic actuation. In addition, with the remaining OPERABLE MCREFS train capable of Manual Initiation, the system satisfies the single failure criterion for Manual Initiation.

The 7 day Completion Time is the same as is allowed if one train of the mechanical portion of the system is inoperable. The basis for this Completion Time is the same as provided in LCO 3.7.10 for the mechanical systems.

Although one instrumentation train of MCRATCS is inoperable due to inoperable Train A or D, there is no Required Action to place any train of MCRATCS in the emergency mode, since three required instrumentation trains of MCRATCS are unaffected and remain OPERABLE.

If Train B or C is inoperable, the instrumentation of MCREFS is unaffected. Although one instrumentation train of MCRATCS is inoperable, there is no Required Action to place any train of MCRATCS in the emergency mode, since three required instrumentation trains of MCRATCS are unaffected and remain OPERABLE.

The emergency mode of operation requires components of the specified train to be manually placed in the position that they would be automatically

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BASES

ACTIONS (continued)

actuated by the MCR Isolation signal. In addition, when the ESFAS is inoperable (which affects automatic actuation and manual initiation), but the SLS remains OPERABLE, the controlled components must be configured to prevent erroneous component repositioning from spurious signals from Operational VDUs by manually activating the MCRVS O-VDU Disconnect function. This action is needed because the automatic actuation signals are credited to override any spurious Operational VDU signals, but those signals are affected in this Condition. These two actions accomplish the actuation instrumentation Function and place the unit in a conservative mode of operation.

The "emergency mode" for this Condition, is defined as the pressurization mode specified in LCO 3.7.10. While operating in the pressurization mode, smoke ingress must be manually monitored and may require prompt manual transfer to the emergency isolation mode. This is because when the MCR Isolation Actuation Logic and Actuation Outputs Function is inoperable, manual transfer from the MCR to the isolation mode for smoke protection and automatic transfer to the isolation mode for smoke protection, are affected.

X.1, X.2.1, X.2.2, X.3.1 and X.3.2

Condition X applies when Trains A and D of the MCR Isolation Actuation Logic and Actuation Outputs Function are inoperable, or Trains A and D of the MCR Isolation Manual Initiation Function are inoperable. There are two 100% capacity MCREFS trains, A and D, with two trains required, and four 50% capacity MCRATCS trains, A, B, C and D, with three trains required. There are four Manual Initiation trains, with three trains required, including Trains A and D. Other inoperable two-train combinations are addressed in Condition Y.

Inoperable Trains A and D affect MCREFS and MCRATCS. The effects and required actions are as follows:

MCREFS

If two Actuation Logic and Actuation Outputs trains (A and D) are inoperable, or two MCR Isolation Manual Initiation trains (A and D) are inoperable, the MCREFS Function is completely inoperable. Therefore, one train of MCREFS is immediately placed in the emergency mode. With one train in the emergency mode MCREFS provides 100% capacity, but does not meet the single failure criterion.

Action must be taken within 7 days to restore compliance to the single failure criteria by either restoring one train of MCREFS instrumentation to OPERABLE status with the other train in the emergency mode (X.2.1), or placing two trains of MCREFS in the emergency mode (X.2.2).

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ACTIONS (continued)

For X.2.1, with one train of MCREFS in the emergency mode and one train capable of automatic actuation and manual initiation, MCREFS provides 100% capacity and satisfies the single failure criterion for automatic actuation and manual initiation.

For X.2.2, with two trains of MCREFS in the emergency mode, the MCREFS provides 100% capacity and satisfies the single failure criterion.

MCRATCS

If two Actuation Logic and Actuation Outputs trains (A and D) are inoperable, or if two MCR Isolation Manual Initiation trains (A and D) are inoperable, the two remaining OPERABLE instrumentation trains (B and C) of MCRATCS provide 100% capacity, but do not meet the single failure criterion.

Action must be taken within 7 days to restore compliance to the single failure criteria by either restoring one affected train of MCRATCS to OPERABLE status (X.3.1), or placing one affected train of MCRATCS in the emergency mode (X.3.2).

For X.3.1, with three trains of MCRATCS capable of automatic actuation and manual initiation, MCRATCS provides 100% capacity and satisfies the single failure criterion for automatic actuation and manual initiation.

For X.3.2 with one train in the emergency mode and two trains capable of automatic actuation and manual initiation, MCRATCS provides 100% capacity and satisfies the single failure criterion for automatic actuation and manual initiation.

The 7 day Completion Time is the same as is allowed if one train of the mechanical portion of the system is inoperable. The basis for this Completion Time is the same as provided in LCO 3.7.10 for the mechanical systems.

The emergency mode of operation requires components of the specified train(s) to be manually placed in the position that they would be automatically actuated to by the MCR Isolation signal. In addition, when the ESFAS is inoperable (which affects automatic and manual initiation), but the SLS remains OPERABLE, the controlled components must be configured to prevent erroneous component repositioning from spurious signals from Operational VDUs by manually activating the MCRVS O-VDU Disconnect function. This action is needed because the automatic actuation signals are credited to override any spurious Operational VDU signals, but those

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0007

BASES

ACTIONS (continued)

signals are affected in this Condition. These two actions accomplish the actuation instrumentation Function and place the unit in a conservative mode of operation.

The "emergency mode" for this Condition, is defined as the pressurization mode specified in LCO 3.7.10. While operating in the pressurization mode, smoke ingress must be manually monitored and may require prompt manual transfer to the emergency isolation mode. This is because when the MCR Isolation Actuation Logic and Actuation Outputs Function is inoperable, manual transfer from the MCR to the isolation mode for smoke protection and automatic transfer to the isolation mode for smoke protection, are affected.

Y.1 and Y.2

Condition Y applies when two MCR Isolation Actuation Logic and Actuation Outputs trains or two MCR Isolation Manual Initiation trains are inoperable, except for inoperable Trains A and D, which are addressed in Condition X. There are two 100% capacity MCREFS trains, A and D, with two trains required, and four 50% capacity MCRATCS trains, A, B, C and D, with three trains required. There are four Manual Initiation trains, with three trains required, including Trains A and D.

The affected Functions and Required Actions depend on the inoperable trains, as follows:

- If Trains A and B, or A and C, or B and D, or C and D are inoperable, the one remaining OPERABLE instrumentation train of MCREFS and the two remaining OPERABLE instrumentation trains of MCRATCS provide 100% capacity, but they don't meet the single failure criterion. Action must be taken within 7 days to restore compliance to the single failure criteria by either restoring the affected instrumentation train of MCREFS and one affected instrumentation train of MCRATCS to OPERABLE status (Y.1), or placing the affected train of MCREFS and one affected train of MCRATCS in the emergency mode (Y.2).

  For Y.1, with two trains of MCREFS and three trains of MCRATCS capable of automatic actuation and manual initiation, MCREFS and MCRATCS provide 100% capacity and satisfy the single failure criterion for automatic actuation and manual initiation.

  For Y.2, with one train of MCREFS in the emergency mode and one train capable of automatic actuation and manual initiation, MCREFS provides 100% capacity and satisfies the single failure criterion for automatic actuation and manual initiation. With one train of MCRATCS in the emergency mode and two trains capable of automatic actuation and manual initiation, MCRATCS provides 100% capacity and satisfies the single failure criterion for automatic actuation and manual initiation.

BASES

ACTIONS (continued)

- If trains B and C are inoperable, the instrumentation of MCREFS is unaffected. The two remaining OPERABLE instrumentation trains of MCRATCS provide 100% capacity, but do not meet the single failure criterion.

  Action must be taken within 7 days to restore compliance to the single failure criteria by either restoring one affected instrumentation train of MCRATCS to OPERABLE status (Y.1) or placing one affected train of MCRATCS in the emergency mode (Y.2).

  For Y.1, with three trains of MCRATCS capable of automatic actuation or manual initiation, MCRATCS provides 100% capacity and satisfies the single failure criterion for automatic actuation and manual initiation.

  For Y.2, with one train of MCRATCS in the emergency mode and two trains capable of automatic actuation and manual initiation, MCRATCS provides 100% capacity and satisfies the single failure criterion for automatic actuation and manual initiation.

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The 7 day Completion Time is the same as is allowed if one train of the mechanical portion of the system is inoperable. The basis for this Completion Time is the same as provided in LCO 3.7.10 for the mechanical systems.

The emergency mode of operation requires components of the specified train(s) to be manually placed in the position that they would be automatically actuated to by the MCR Isolation signal. In addition, when the ESFAS is inoperable (which affects automatic actuation and manual initiation), but the SLS remains OPERABLE, the controlled components must be configured to prevent erroneous component repositioning from spurious signals from Operational VDUs by manually activating the MCRVS O-VDU Disconnect function. This action is needed because the automatic actuation signals are credited to override any spurious Operational VDU signals, but those signals are affected in this Condition. These two actions accomplish the actuation instrumentation Function and place the unit in a conservative mode of operation.

The "emergency mode" for this Condition, is defined as the pressurization mode specified in LCO 3.7.10. While operating in the pressurization mode, smoke ingress must be manually monitored and may require prompt manual transfer to the emergency isolation mode. This is because when the MCR Isolation Actuation Logic and Actuation Outputs Function is inoperable, manual transfer from the MCR to the isolation mode for smoke protection and automatic transfer to the isolation mode for smoke protection, are affected.

BASES

ACTIONS (continued)

Z.1 and Z.2

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Condition Z applies when the Required Action and associated Completion Time for Condition U, V, W, X or Y have not been met and the unit is in MODE 1, 2, 3, or 4. The unit must be brought to a MODE in which the LCO requirements are not applicable. To achieve this status, the unit must be brought to MODE 3 within 6 hours and MODE 5 within 36 hours.

The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

AA.1

Condition AA applies when the Required Action and associated Completion Time for Condition U, V, W, X or Y have not been met when irradiated fuel assemblies are being moved. Movement of irradiated fuel assemblies must be suspended immediately to reduce the risk of accidents that would require MCR Isolation actuation.

BB.1, BB.2.1 and BB.2.2

Condition BB applies to the P-4 Interlock.

This action addresses the train orientation of the PSMS.

If a required train is inoperable, 48 hours are allowed to restore the train to OPERABLE status.

The Completion Time of 48 hours is justified because the two remaining OPERABLE trains are adequate to perform the safety function. In addition, the Completion Time considers that the two remaining OPERABLE trains each have continuous automatic self-testing.

The Completion Time of 48 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 11).

If the train cannot be restored to OPERABLE status, the unit must be placed in MODE 3 within the next 6 hours and MODE 4 within the following 6 hours. In MODE 4, the unit does not have any analyzed transients or conditions that require the explicit use of the interlock function noted above.

The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power in an orderly manner and without challenging unit systems.

BASES

| SURVEILLANCE REQUIREMENTS | The SRs for each ESFAS Function are identified by the SRs column of Table 3.3.2-1. |

A Note has been added to the SR Table to clarify that Table 3.3.2-1 determines which SRs apply to which ESFAS Functions.

Note that each channel of process protection supplies all trains of the ESFAS. However, when testing a channel, it is only necessary to manually verify that the channel is OPERABLE in its respective division. This is because the interface to other divisions is automatically verified through continuous automatic self-testing. ~~Self~~Continuous automatic self-testing is confirmed through periodic ~~COT and ACTUATION LOGIC TEST~~MIC. The CHANNEL CALIBRATION is performed in a manner that is consistent with the methods and assumptions of ~~Section~~Specification 5.5.21, Setpoint Control Program (SCP).

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SR 3.3.2.1

Performance of the CHANNEL CHECK ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between ~~the two~~ instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

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Agreement criteria are determined based on a combination of the channel instrument uncertainties. If a channel is outside the criteria, it may be an indication that the sensor or the signal processing equipment has drifted outside its limit. If the channels are within the criteria, it is an indication that the channels are OPERABLE.

MIC-03-16-0 0007

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

~~A CHANNEL CHECK may be conducted manually or automatically. For the US APWR an automated CHANNEL CHECK is normally conducted continuously. Where the CHANNEL CHECK is conducted automatically, an alarm shall be generated when the agreement criteria is not met.~~

MIC-03-16-0 0007

~~The equipment that performs the automated CHANNEL CHECK, and automatic self-testing described for COT and ACTUATION LOGIC TEST, shall be confirmed OPERABLE including the capability to generate fault alarms.~~

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.2.2

SR 3.3.2.2 is the performance of ~~an ACTUATION LOGIC TEST~~a MIC for the ESFAS Instrumentation. This includes the Safety VDU processors, the RPS, the ESFAS, the SLS, and the COM-2. MIC-03-16-0 0007

The PSMS is self-tested automatically on a continuous basis from the digital side of all input modules to the digital side of all output modules. ~~Self~~Continuous automatic self-testing encompasses all PSMS safety-related functions including digital Nominal Trip Setpoints, Time Constants, Time Delays and actuation logic functions. The continuous automatic self-testing also encompasses all data communications within a PSMS train, between PSMS trains and between the PSMS and PCMS. The continuous automatic self-testing is described in Reference 6 and Reference 7. MIC-03-16-0 0007

The ~~ACTUATION LOGIC TEST~~MIC is a diverse check of the ~~ESFAS~~PSMS software memory integrity, consistent with the Setpoint Control Program (SCP), to ensure there is no change to the internal ~~ESFAS~~PSMS software that would impact its functional operation, including digital Nominal Trip Setpoints, Time Constants, Time Delays, actuation logic functions or the continuous automatic self-testing~~self test function~~. The ~~software memory integrity test~~MIC is described in Reference 6 and Reference 7. ~~The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.~~

The capability to generate continuous automatic self-testing fault alarms shall be confirmed OPERABLE during the MIC.

The complete ~~continuity~~OPERABILITY check from the measurement channel input device to the SLS output device is performed by the combination of the continuous ~~CHANNEL CHECK, and the 24 month CHANNEL CALIBRATION~~automatic self-testing for the ~~non-~~digital ~~side of~~devices (the ~~input module~~RPS, ESFAS, SLS, and data communication interfaces), the continuous ~~self-testing for~~automatic CHANNEL CHECK (SR 3.3.2.1), the ~~digital side~~CHANNEL CALIBRATION (SR 3.3.2.6), the ~~24 month COT, the 24 month ACTUATION LOGIC TEST~~MIC (SR 3.3.2.2), and the ~~24 month ESFAS and SLS~~TADOT ~~for the non-digital side of the output module.~~(SR 3.3.2.3, SR 3.3.2.4, SR 3.3.2.5 and SR 3.3.2.8). The ~~Channel~~CHANNEL CALIBRATION, ~~COT, ACTUATION LOGIC TEST~~the MIC, and the TADOT, which are manual tests, overlap with the ~~CHANNEL CHECK and~~continuous automatic self-testing and confirm the functioning of the continuous automatic self-testing.

BASES

SURVEILLANCE REQUIREMENTS (continued)

~~The ACTUATION LOGIC TEST interval of 24 months with the self test capability is justified in the PSMS reliability analysis. For detail information, refer to the US-APWR Technical Report MUAP-07030 PRA, Attachment 6B.12. The result of the PSMS reliability analysis is evaluated and confirmed in the US-APWR PRA Chapter 19.~~ The complete OPERABILITY check from the Safety VDU (S-VDU) input device to the SLS output device is performed by the combination of the continuous automatic self-testing for the digital devices (Safety VDU processors, COM-2, SLS and data communication interfaces), the SAFETY VDU TEST (SR 3.3.2.9), MIC for the Safety VDU processors, COM-2 and SLS (SR 3.3.2.2) and TADOT for SLS outputs (SR 3.3.2.3). The SAFETY VDU TEST, MIC, and TADOT, which are manual tests, overlap with the automatic self-testing and confirm the functioning of the automatic tests.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

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SR 3.3.2.3

SR 3.3.2.3 is the performance of a ~~COT~~ TADOT for the Actuation Outputs of all ESFAS Functions, and the Actuation Outputs of the Manual Control of ESF Components Function. This surveillance test actuates the outputs of the SLS.~~.~~

MIC-03-16-0 0007

~~The PSMS is self tested on an automatic basis from the digital side of all input modules to the digital side of all output modules. Self testing encompasses all Trip Setpoints and trip functions. The self testing is described in Reference 6 and Reference 7. ESFAS setpoint and bistable functions are implemented within the RPS. Therefore, the COT is a check of the RPS software memory integrity to ensure there is no change to the internal RPS software that would impact its functional operation, including digital Trip Setpoint values or the continuous self-test function. The software memory integrity test is described in Reference 6 and Reference 7~~ Therefore, this test is typically conducted in conjunction with testing the plant process components. Since this test is conducted in conjunction with testing for plant process components, this test may be conducted more frequently, as may be required for the plant process components.~~.~~

~~A COT ensures the entire channel will perform the intended Function.~~

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

BASES

SURVEILLANCE REQUIREMENTS (continued)

~~The complete continuity check from the input device to the output device is performed by the combination of the continuous CHANNEL CHECK, the 24 month CHANNEL CALIBRATION for the non digital side of the input module, the continuous self testing for the digital side, the 24 month COT and the 24 month TADOT for the non digital side of the output module. The Channel CALIBRATION, COT and TADOT, which are manual tests, overlap with the CHANNEL CHECK and self testing and confirm the functioning of the self testing.~~

~~The COT interval of 24 months with the self test capability is justified in the PSMS reliability analysis. For detail information, refer to the US APWR Technical Report MUAP 07030 PRA, Attachment 6B.12. The result of the PSMS reliability analysis is evaluated and confirmed in the US APWR PRA Chapter 19.~~

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SR 3.3.2.4

SR 3.3.2.4 is the performance of a TADOT for the Loss of Offsite Power, Function. The LOP inputs to the ESFAS are tested up to, and including, the signal status readout on a VDU.

Verification of the undervoltage relay Nominal Trip Setpoint is not performed during the TADOT; the undervoltage relay Nominal Trip Setpoint is verified during CHANNEL CALIBRATION.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.3.2.5

SR 3.3.2.5 is the performance of a TADOT for all Manual Initiation Functions and for the EFW Actuation - Trip of all MFW Pumps Function. Each Function is tested up to, and including, the signal status readout on a VDU. These Functions have no associated setpoints.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.2.4   MIC-03-16-0
                                                                                    0007
SR 3.3.2.4 is the performance of a TADOT for the Actuation Outputs of all
ESFAS functions. This function actuates the outputs of the SLS.

Therefore, this test is typically conducted in conjunction with testing the
plant process components. The Actuation Outputs are solid state devices.
The Surveillance Frequency is based on operating experience, equipment
reliability, and plant risk and is controlled under the Surveillance Frequency
Control Program.

SR 3.3.2.5

SR 3.3.2.5 is the performance of a TADOT for the Loss of Offsite Power
Function. The LOP inputs to the ESFAS are tested up to, and including, the
signal status readout on a digital display.

The SR is modified by a Note that excludes verification of setpoints for
relays. Relay setpoints require elaborate bench calibration and are verified
during CHANNEL CALIBRATION. The Surveillance Frequency is based on
operating experience, equipment reliability, and plant risk and is controlled
under the Surveillance Frequency Control Program.

SR 3.3.2.6

SR 3.3.2.6 is the performance of a TADOT for all Manual Initiation   MIC-03-16-0
Functions and EFW pump start on trip of all MFW pumps. Each Manual   0007
Initiation Function is tested up to, and including, the signal status readout
on a digital display. CHANNEL CALIBRATION.

CHANNEL CALIBRATION is a complete check of the instrument loop,
including the sensor. The test must be performed consistent with the
methods and assumptions of Specification 5.5.21, SCP, to verify that the
channel responds to a measured parameter within the necessary range
and accuracy.

The CHANNEL CALIBRATION confirms the accuracy of the channel from
sensor to digital VDU readout, as described in Reference 6.

For analog measurements, the CHANNEL CALIBRATION confirms the
calibration settings are within the Allowable Value at multiple points over
the entire measurement channel span, encompassing all ESF actuation
and interlock Nominal Trip Setpoint values. Digital ESF actuation and
interlock Nominal Trip Setpoint values are confirmed through MIC.

BASES

SURVEILLANCE REQUIREMENTS (continued)

For binary measurements, the CHANNEL CALIBRATION confirms the accuracy of the channel's state change. The state change must occur within the Allowable Value of the Nominal Trip Setpoint.

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0007

The equipment that performs the automated CHANNEL CHECK shall be confirmed OPERABLE, including the capability to generate fault alarms during the CHANNEL CALIBRATION.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program. ~~The SR is modified by a Note that excludes verification of setpoints during the TADOT for manual initiation Functions. The manual initiation Functions have no associated setpoints.~~

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0007

SR 3.3.2.7

~~SR 3.3.2.7 is the performance of a CHANNEL CALIBRATION.~~

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0007

~~CHANNEL CALIBRATION is a complete check of the instrument loop, including the sensor. The test verifies that the channel responds to measured parameter within the necessary range and accuracy, as described in Section 5.5.21, SCP.~~

~~For analog measurements, the CHANNEL CALIBRATION confirms the accuracy of the channel from sensor to VDU as described in Reference 6. CHANNEL CALIBRATION confirms the analog measurement accuracy conforms to the Allowable Value at multiple points over the entire measurement channel span, encompassing all reactor trip and interlock Trip Setpoint values. Digital reactor trip and interlock Trip Setpoint values are confirmed through COT.~~

~~For binary measurements, the CHANNEL CALIBRATION confirms the accuracy of the channel's state change, as described in Reference 6. The state change must occur within the Allowable Value of the Trip Setpoint.~~

~~CHANNEL CALIBRATIONS must be performed consistent with the methods and assumptions in Section 5.5.21, SCP.~~

~~The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.~~

~~This SR is modified by a Note stating that this test should include verification that the time constants are adjusted to the prescribed values where applicable.~~

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.2.8   MIC-03-16-0
0007

This SR ensures the ~~response times for all ESFAS functions are~~ESF
RESPONSE TIME is less than or equal to the maximum value~~s~~ assumed in
the accident analysis. Accident analysis response time values are   MIC-03-16-0
~~defined~~specified in Reference 2. Individual component response times are   0007
not modeled in the analyses.

The analyses model the overall or total elapsed time, from the point at
which the parameter exceeds the ~~Trip Setpoint value at the~~
~~sensor,~~Analytical Limit to the point at which the equipment in ~~all trains~~the   MIC-03-16-0
minimum credited train(s) reaches the required functional state (e.g.,   0007
pumps at rated discharge pressure, valves in full open or closed position).

~~The PSMS dynamic transfer functions employ time constants that are~~   MIC-03-16-0
~~installed as digital values and processed through digital algorithms.~~   0007
~~Therefore, the time response of the dynamic transfer functions has no~~
~~potential for variation due to time or environmental drift or component~~
~~aging. The COT confirms the integrity of the time constants and algorithms~~
~~through the periodic software memory integrity check. The complete PSMS~~
~~response time is determined one time by analysis and confirmed one time~~
~~in the factory test. The response times of analog instruments that provide~~
~~input to the dynamic transfer functions are periodically checked in~~
~~Surveillance 3.3.2.8, because they do have the potential for response time~~
~~variation. Electro-mechanical components in the ESFAS have aging or~~
~~wear out mechanisms that can impact response time. Response time for~~
~~other components may be affected by random failures or calibration~~
~~discrepancies, which are detectable by other testing and calibration~~
~~methods required by other surveillances.~~

Response time may be verified by actual response time tests in any series
of sequential, overlapping or total channel measurements, or by the
summation of allocated sensor, signal processing and actuation logic
response times with actual response time tests on the remainder of the
channel.   MIC-03-16-0
0007

Allocations for sensor~~s~~, signal conditioning and actuation logic response
times may be obtained from: (1) historical records based on acceptable
response time tests (hydraulic, noise, or power interrupt tests), (2) in place,
onsite, or offsite (e.g., vendor) test measurements, or (3) utilizing vendor
engineering specifications.

BASES

SURVEILLANCE REQUIREMENTS (continued)

The PSMS MELTAC controllers employ dynamic transfer functions with Time Constants and actuation logic functions with Time Delays that are installed as digital values and processed through digital algorithms. Therefore, the time response of all digital PSMS functions has no potential for variation due to time, environmental drift or component aging. PSMS Time Constants and Time Delays are set at the nominal values assumed in the safety analysis. The combination of continuous automatic self-testing and MIC confirms the integrity of the dynamic transfer functions, Time Constants, Time Delays and actuation logic functions.

The response time for the digital portion of the PSMS is determined one time by analysis and confirmed one time in the factory test. Therefore, for PSMS digital functions, including Functions with Time Constants and Time Delays, response time tests are not required; instead, a response time allocation may be applied.

Response time for PSMS MELTAC input signal conditioning, can be affected by random failures or degradation, which can be detected by CHANNEL CALIBRATION. Section 4.6 of MUAP-07005, "Safety System Digital Platform -MELTAC-" (Ref. 7) describes the basis for crediting CHANNEL CALIBRATION for detecting PSMS signal conditioning response time degradation. Therefore, for PSMS input signal conditioning, response time tests are not required; instead, a response time allocation may be applied.

MUAP-09021-P, "Response Time of Safety I&C System" (Ref. 8), provides the basis and methodology for using allocated sensor response times in the overall verification of the channel response time for specific sensors identified in the report. Response time verification for other sensor types must be demonstrated by test. MUAP-09021-P also provides the basis and methodology for using allocated signal processing and actuation logic response times in the overall verification of the protection system channel response time. ~~Section 4.4 of MUAP-07005, "Safety System Digital Platform -MELTAC-" describes how response times of each individual MELTAC module are combined to determine the total digital system response time~~In addition, MUAP-09021-P identifies the acceptance criteria for ESFAS components that require response time measurement (such as LOOP undervoltage relays which are known to have aging or wear-out mechanisms that can impact response time), taking into consideration the total ESF RESPONSE TIME requirement and the allocations for other components that do not require testing..

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BASES

SURVEILLANCE REQUIREMENTS (continued)

The allocations for sensor, signal conditioning, and actuation logic response times must be verified prior to placing the component in operational service and re-verified following maintenance that may adversely affect response time. In general, electrical repair work does not impact response time provided the parts used for repair are of the same type and value. One example where response time could be affected is replacing the sensing assembly of a transmitter.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

This SR is modified by a Note that clarifies that the tests for the turbine driven EFW pumps are conducted within 24 hours after reaching 1000 psig in the SGs.

SR 3.3.2.~~9~~8   MIC-03-16-0
                                                                                              0007

SR 3.3.2.~~9~~8 is the performance of a TADOT for the P-4 ~~Reactor Trip~~ Interlock~~, and the~~. The Surveillance Frequency is once per RTB cycle, as required by SR 3.3.1.4. Each RTB status contact is tested up to, and including, the signal status readout on a digital ~~display~~VDU. This Surveillance Frequency is based on operating experience demonstrating that undetected failure of the P-4 interlock sometimes occurs when the RTB is cycled.

~~The SR is modified by a Note that excludes verification of setpoints during~~   MIC-03-16-0
~~the TADOT.~~ The ~~Function tested~~P-4 Interlock has no associated setpoint.   0007

SR 3.3.2.9

SR 3.3.2.9 is the performance of a SAFETY VDU TEST for the Safety VDUs in the MCR. The SAFETY VDU TEST is explained in Reference 6.

This SR confirms the Safety VDU is capable of providing all display and control functions for the MCR. This SR overlaps with the MIC (SR 3.3.2.2), to ensure the S-VDU is OPERABLE.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

BASES

REFERENCES

1. NUREG-0737, "Clarification of TMI Action Plan Requirements."

2. FSAR Section 7.3.~~1.~~   MIC-03-16-0 0007

3. FSAR Chapter 15.

4. IEEE-603-1991.

5. 10 CFR 50.49.

6. MUAP-07004-P ~~(Proprietary) and MUAP-07004-NP (Non-Proprietary)~~. Revision 7, "Safety I&C System Description and Design Process."   MIC-03-16-0 0007

7. MUAP-07005-P ~~(Proprietary) and MUAP-07005-NP (Non-Proprietary)~~. Revision 8, "Safety System Digital Platform – -MELTAC-."   MIC-03-16-0 0007

8. ~~FSAR Section 8.3.1.~~MUAP-09021-P, Revision 2, "Response Time of Safety I&C System."

9. 10 CFR 50.36.

10. FSAR Section 15.7.4.   MIC-03-16-0 0007

11. FSAR Chapter 19.

12. MUAP-09022-P, Revision 2, "US-APWR Instrument Setpoint Methodology."

13. Regulatory Guide 1.105, Revision 3, "Setpoints for Safety Related Instrumentation."

14. FSAR Chapter 9.4.1.2.2.

B 3.3 INSTRUMENTATION

B 3.3.3 Post Accident Monitoring (PAM) Instrumentation

BASES

BACKGROUND   The purpose of displaying PAM parameters is to assist Main Control Room | MIC-03-16-0
(MCR) personnel in evaluating the safety status of the plant. PAM   0007
parameters are direct measurements or derived variables representative of
the safety status of the plant. The primary function of the PAM parameters
is to aid the operator in the rapid detection of abnormal operating
conditions. As an operator aid, the PAM variables represent a minimum set
of plant parameters from which the plant safety status can be assessed.

The OPERABILITY of the accident monitoring instrumentation ensures that
there is sufficient information available on selected unit parameters to
monitor and to assess unit status and behavior following an accident.

The availability of accident monitoring instrumentation is important so that
responses to corrective actions can be observed and the need for, and
magnitude of, further actions can be determined. These essential
instruments are identified by FSAR ChapterSection 7.5 (Ref. 4) addressing | MIC-03-16-0
the recommendations of Regulatory Guide 1.97 (Ref. 1) as required by   0007
Supplement 1 to NUREG-0737 (Ref. 2).

The instrument channels required to be OPERABLE by this LCO include
parameters based on IEEE 497-2002 (Ref. 5), which is endorsed by
Regulatory Guide 1.97 (Ref. 1), identified as Type A, B and C variables.

FSAR Section 7.5 (Ref. 4) describes the PAM Instrumentation, and in | MIC-03-16-0
particular, the process that was used for determining the bounding list of   0007
PAM variables in Table 3.3.3-1.

Type A, B, and C variables are the key variables deemed risk significant
because they are needed to:

Type A

        Take planned manually controlled actions for accomplishment of
        safety-related functions for which there is no automatic control.

Type B

        Assess the process of accomplishing or maintaining plant critical
        safety functions.

Type C

        Indicate potential for a breach of fission product barriers.

BASES

BACKGROUND (continued)

Indicate an actual breach of fission product barriers.

The specific instrument Functions listed in Table 3.3.3-1 are discussed in the LCO section.

APPLICABLE
SAFETY
ANALYSES

The PAM ~~i~~Instrumentation ensures the operability of Type A, B and C variables so that the control room operating staff can: | MIC-03-16-0 0007

• Perform the diagnosis specified in the emergency operating procedures (these variables are restricted to preplanned actions for the primary success path of ~~PAs~~Postulated Accidents), e.g., loss of coolant accident (LOCA), | MIC-03-16-0 0007

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

• Determine whether systems important to safety are performing their intended functions,

• Determine the likelihood of a gross breach of the barriers to radioactivity release,

• Determine if a gross breach of a barrier has occurred, and

• Initiate action necessary to protect the public and to estimate the magnitude of any impending threat.

The PAM Instrumentation is interfaced to the Protection and Safety Monitoring System (PSMS) through the Reactor Protection System (RPS), with the exception of Containment Isolation Valve (CIV) position, which is interfaced via the Safety Logic System (SLS). The RPS, including Nuclear Instrumentation System (NIS), and SLS provide signal conditioning, analog to digital conversion, and digital signals for display of the PAM Instrumentation measurements on MCR VDUs. | MIC-03-16-0 0007

The PAM Instrumentation is displayed in the MCR via Safety VDUs and non-safety Operational VDUs. Only the Safety VDUs are credited for the PAM Display Function. The S-VDU in each train consists of a VDU and S-VDU processor.

To meet the single failure criteria and accommodate on-line maintenance, four trains of S-VDU, RPS and SLS are provided, each performing the same functions. If one train is taken out of service for maintenance or test purposes, the remaining trains will provide PAM displays for the unit.

BASES

APPLICABLE SAFETY ANALYSES (continued)

The S-VDU, RPS and SLS for each train are packaged in their own cabinet for physical and electrical separation to satisfy separation and independence requirements.

The S-VDU, RPS and SLS have continuous automatic self-testing while in service. When any one train is taken out of service for manual testing, the remaining trains are capable of providing unit monitoring and protection until the testing has been completed.

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LCO   The LCO requires all instrumentation performing the PAM Instrumentation Function, listed in Table 3.3.3-1 in the accompanying LCO, to be OPERABLE. A channel is OPERABLE provided the "as-found" value, measured during surveillance testing, does not exceed its associated Allowable Value, and provided the "as-left" value is within the specified calibration tolerance at the completion of each CHANNEL CALIBRATION.

The PAM ~i~Instrumentation LCO provides OPERABILITY requirements for Type A variables, which provide information required by the control room operators to perform certain manual actions specified in the unit Emergency Operating Procedures. These manual actions ensure that a system can accomplish its safety function, and are credited in the safety analyses. Additionally, this LCO addresses instruments that have been designated Type B and C.

The OPERABILITY of the PAM ~i~Instrumentation ensures there is sufficient information available on selected unit parameters to monitor and assess unit status following an accident.

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~LCO 3.3.3 requires two OPERABLE~The number of channels available for ~most~PAM Instrumentation Functions. ~ Two~ is shown in FSAR Chapter 7 Table 7.5-3. For PAM Instrumentation Functions with two channels, the channels are assigned to Trains A and D; both channels are required. For PAM Instrumentation Functions with four channels, the channels are assigned to Trains A, B, C and D; the required number of which is two, three, or four depending on the variable.

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LCO 3.3.3 requires two, three or four OPERABLE channels. The specified number of OPERABLE channels ensure no single failure prevents operators from getting the information necessary for them to determine the safety status of the unit, and to bring the unit to and maintain it in a safe condition following an accident.

BASES

LCO (continued)

Furthermore, OPERABILITY of at least two channels allows a CHANNEL CHECK during the post accident phase to confirm the validity of displayed information.

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The exception to the minimum two channel requirement is Penetration Flow Path Containment Isolation Valve (CIV) Position. In this case, the important information is the status of the containment penetrations. The LCO requires one position indication for each active CIV. This is sufficient to redundantly verify the isolation status of each isolable penetration either via indicated status of the active valve and prior knowledge of a passive valve, or via system boundary status. If a normally active CIV is known to be closed and deactivated, position indication is not needed to determine status. Therefore, the position indication for valves in this state is not required to be OPERABLE.

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Due to redundant components within the PSMS, such as controllers, communication links and power supplies, an inoperable component may or may not result in an inoperable channel. Where an inoperable component results in an inoperable required channel, LCOs are entered. For inoperable components that do not result in inoperable channels, LCOs are not entered.

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Table 3.3.3-1 provides a list of the PAM variables.

Type A, B, C and DC variables are required to meet requirements defined in IEEE 497-2002 (Ref. 5) for seismic and environmental qualification, and testability. Type A, B and C variables must also meet requirements for single failure criterion, separation and independence, quality, utilization of emergency standby power, information ambiguity and recording of display. In addition, Type A and B variables require continuously visible displays. These design features are described in FSAR Chapter 7 (Ref. 4).

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Listed below are discussions of the specified instrument Functions listed in Table 3.3.3-1. These discussions are intended as examples of what should be provided for each Function when the unit specific list is prepared.

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1.   Wide Range Neutron Flux

Wide Range Neutron Flux indication is provided to verify reactor shutdown. TheA single wide range instrument for each channel covers the full range of flux that may occur post accident.

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Neutron flux is used for accident diagnosis, verification of subcriticality, and diagnosis of positive reactivity insertion.

BASES

LCO (continued)

2,3.   Reactor Coolant System (RCS) Hot and Cold Leg Temperatures, (Wide Range)   MIC-03-16-00007

~~RCS Hot and Cold Leg Temperatures are provided for verification of core cooling and long term surveillance.~~ Verification of core cooling can be determined by RCS Hot or Cold Leg Temperature in any one RCS loop. The Emergency Operating Procedure (EOP) operator action threshold points, for events such as steam generator tube rupture, can only be determined by RCS Hot Leg Temperature in any one RCS loop.

~~In addition, RCS cold leg temperature is used in conjunction with RCS hot leg temperature to verify the unit conditions necessary to establish natural circulation in the RCS.~~

~~The PAM function~~ There is one channel each of RCS Hot Leg ~~and Cold Leg~~ Temperature (Wide Range ~~is to monitor the core cooling condition. There will be little temperature deviation between the Hot Leg~~) and ~~Cold Leg after an accident and reactor shutdown. Thus, Hot Leg and Cold Leg Temperature can be defined as equivalent parameters to monitor the trend of core cooling. Thus, Hot Leg and~~ RCS Cold Leg Temperature ~~of the same~~ (Wide Range) per loop ~~are pair PAM functions credited for compliance with the single failure criteria. Therefore, only one of each channel of Hot Leg Temperature and Cold Leg Temperature~~ and a minimum of any three loops are required ~~in~~ for each ~~loop, since with a failure of either channel adequate core cooling can still be monitored.~~ parameter. Therefore, in any one loop both instruments may be OPERABLE (i.e., RCS Hot Leg and Cold Leg Temperature) or only one instrument may be OPERABLE (i.e., RCS Hot Leg or Cold Leg Temperature).

Only three channels are required for each parameter because if the break is in one of the instrumented loops, the instrumentation in either remaining instrumented loop (i.e., RCS Hot Leg Temperature or RCS Cold Leg Temperature) provides sufficient indication of core cooling, and the EOP operator action threshold points can be confirmed by the RCS Hot Leg Temperature instrumentation in either remaining instrumented loop. Therefore, with only 3 required channels for each parameter (each monitoring any three loops), a single failure affecting one or both instruments (i.e., RCS Hot leg Temperature/RCS Cold Leg Temperature) in any intact loop can be accommodated.

BASES

LCO (continued)

4. Reactor Coolant System Pressure (Wide Range)

RCS ~~wide range pressure~~Pressure (Wide Range) is provided for verification of core cooling and RCS integrity long term surveillance.

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5. Reactor Vessel Water Level

Reactor Vessel Water Level is provided for verification and long term surveillance of core cooling. It is also used for accident diagnosis and to determine reactor coolant inventory adequacy. There are two channels and two channels are required. A channel consists of three sections with two sensors per section. A channel is OPERABLE if at least one sensor is OPERABLE in all three sections.

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6. Containment Pressure

Containment Pressure is provided for verification of RCS and containment OPERABILITY and is used to verify closure of main steam isolation valves (MSIVs)~~,~~ and ~~containment spray~~ Phase B ~~isolation~~Containment Isolation when High-3 ~~c~~Containment ~~p~~Pressure is reached. Additionally, Containment Pressure is provided for indication of maintaining RCS integrity and containment integrity.

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7. Containment Isolation Valve Position

Penetration Flow Path CIV Position is provided for verification of Containment OPERABILITY, and Phase A and Phase B ~~i~~Isolation.

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When used to verify Phase A and Phase B ~~i~~Isolation, the important information is the isolation status of the containment penetrations. The LCO requires one channel of valve position indication in the control room to be OPERABLE for each active CIV in a containment penetration flow path, i.e. two total channels of CIV position indication for a penetration flow path with two active valves.

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For containment penetrations with only one active CIV having control room indication, Note (b) in Table 3.3.3-1 requires a single channel of valve position indication to be OPERABLE. This is sufficient to redundantly verify the isolation status of each isolable penetration either via indicated status of the active valve, as applicable, and prior knowledge of a passive valve, or via system boundary status. If a normally active CIV is known to be closed and deactivated, position indication is not needed to determine status. Therefore, the position indication for valves in this state is not required to be OPERABLE.

BASES

LCO (continued)

Note (a) ~~to the Required Channels~~in Table 3.3.3-1 states that the Function is 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.

Each penetration is treated separately and each penetration flow path is considered a separate function. Therefore, separate Condition entry is allowed for each inoperable penetration flow path.

8.   Containment High Range Area Radiation

Containment Area Radiation is provided to monitor for the potential of significant radiation releases and to provide release assessment for use by operators in determining the need to invoke site emergency plans. Containment radiation level is used to determine if a high energy line break (HELB) has occurred, and whether the event is inside or outside of containment.

9.   Pressurizer Water Level

Pressurizer Water Level is used to determine whether to terminate ~~SI~~ECCS Actuation, if still in progress, or to reinitiate ~~SI~~ECCS Actuation if it has been stopped. ~~Knowledge of pressurizer water level~~Pressurizer Water Level is also used to verify the unit conditions necessary to establish natural circulation in the RCS and to verify that the unit is maintained in a safe shutdown condition.

10,11.   Steam Generator Water Level (Wide Range and Narrow Range)

SG Water Level is provided to monitor operation of decay heat removal via the SGs. ~~The indication of SG level is the extended startup range level instrumentation. The extended startup range level covers a span above the lower tubesheet.~~

SG Water Level (~~Wide~~Narrow Range) is used to:

•   identify the faulted SG following a tube rupture,

•   verify that the intact SGs are an adequate heat sink for decay heat removal from the reactor,

•   determine the nature of the accident in progress (e.g., verify an SGTR), and

•   verify unit conditions for termination of ~~SI~~ECCS Actuation during secondary unit HELBs outside containment.

BASES

LCO (continued)

Operator action is based on the control room indication of SG level. The RCS response during a design basis small break LOCA depends on the break size. For a certain range of break sizes~~, the boiler condenser mode of heat transfer is~~ SGs are necessary to remove decay heat. ~~Extended startup range level is a Type A variable because the operator must manually raise and control SG level to establish boiler condenser heat transfer. Operator action is initiated on a loss of subcooled margin. Feedwater flow is increased until the indicated extended startup range level reaches the boiler condenser setpoint. This function is an alternate mean with EFW Flow.~~SG Water Level (Narrow Range) can be used to manually control SG level to remove decay heat via the SGs.

~~The PAM function of Steam Generator Water Level Wide Range and Emergency Feedwater Flow is to monitor heat removal capability of the Steam Generators. Since during accident or shutdown condition, SG water level is directly attributed to emergency feedwater flow, either provides an indication of SG heat removal capability. Thus the SG Water Level Wide Range and EFW Flow can be defined as equivalent parameters to monitor the heat removal capability of the secondary. Thus, the~~SG Water Level (Wide Range), which covers the span above the lower tubesheet, is used to verify that the intact SGs are an adequate heat sink for decay heat removal from the reactor.

There is one SG Water Level ~~and EFW Flow of same loop are pair PAM functions credited for compliance with the single failure criteria. Therefore, only one set of each~~(Wide Range) channel ~~of SG Water Level and EFW Flow are required in each loop, since with a failure of either channel adequate heat removal capability can still be monitored.~~per loop. All four loops are required because if the break is in one of the instrumented SGs and there is a single failure affecting the instrumentation in another SG, the instrumentation in the remaining two SGs provide sufficient indication of heat sink availability; two SGs are required for sensible heat removal.

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BASES

LCO (continued)

12, 13, 14, 15.   <u>Core Exit Temperature</u>

Core Exit Temperature is provided for verification and long term surveillance of core cooling.

~~Twenty~~For Post Accident Monitoring, twenty six core exit thermocouple~~s~~ channels are provided for measuring core cooling ~~as the post accident monitors. These thermocouples~~. The thermocouple channels are arranged in two safety trains, A and ~~a~~D, with each train ~~consists~~consisting of thirteen ~~thermocouples. These thermocouples in each train are distributed at the exit of the core nearly uniformly and a minimum of 2 thermocouples are provided for each core quadrant. These distributed thermocouples provide adequate information of temperature distribution of core exit fluid.~~thermocouple channels. A minimum of 2 thermocouple channels from each of two trains (4 total) are required for each core quadrant. For each train and each core quadrant, one thermocouple channel is required near the center of the core and one thermocouple channel is required near the core perimeter. The two thermocouple channels indicate the radial temperature gradient across their core quadrant. The uniform ~~distributions of two train thermocouples ensure the~~distribution of thermocouple channels from both trains ensures adequate information of radial temperature distribution ~~in~~even with a single train failure condition.

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16.   <u>Emergency Feedwater Flow</u>

Emergency Feedwater (EFW) Flow is provided to monitor operation of decay heat removal via the SGs.

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EFW flow is used three ways:

- to verify delivery of EFW flow to the SGs,

- to determine whether to terminate ~~SI~~ECCS Actuation if still in progress, in conjunction with SG ~~w~~Water ~~l~~Level (~~n~~Narrow ~~r~~Range), and

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- ~~to regulate EFW flow so that the SG tubes remain covered.~~to verify that the intact SGs are an adequate heat sink for decay heat removal from the reactor.

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~~This function is an alternate mean with SG Water Level.~~

BASES

LCO (continued)

There is one channel of EFW Flow per loop. All four loops are required, because if the break is in one of the instrumented SGs and there is a single failure affecting the instrumentation in another SG, the instrumentation in the remaining two SGs provide sufficient indication of heat sink availability; two SGs are required for sensible heat removal.

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17.   Degrees of Subcooling

~~The~~ Degrees of Subcooling is provided for verification of core cooling. Degrees of Subcooling utilizes sensors for RCS ~~c~~Cold and ~~h~~Hot ~~l~~Leg ~~t~~Temperatures, ~~c~~Core ~~e~~Exit ~~t~~Temperature and RCS ~~p~~Pressure. The saturation temperature is calculated from ~~minimum temperature~~the pressure input. The temperature subcooled ~~or superheated~~ margin is the difference between the calculated saturation temperature and the sensor temperature input. Two temperature~~s~~ subcooled ~~or superheated~~ margin presentation~~s~~ are available as follows:

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•   RCS saturation margin – ~~t~~The temperature saturation margin is based on the difference between the saturation temperature and the maximum temperature from the RTDs in the hot and cold legs.

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•   Upper head saturation margin – The temperature saturation margin is based on the difference between the saturation temperature and the ~~c~~Core ~~e~~Exit ~~t~~Temperature.

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18.   Main Steam Line Pressure

Steam Generator Pressure is provided to monitor ~~operation of~~ decay heat removal via the SGs.

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19.   Emergency Feedwater Pit Level

EFW Pit Level is provided to ensure water supply for ~~e~~Emergency ~~f~~Feedwater (EFW). The EFW Pits provide the ensured safety grade water supply for the EFW System. There are two identical EFW Pits, each of which supplies one motor driven and one turbine driven EFW pump. Redundant level indication for each EFW Pit is displayed in the ~~m~~Main ~~c~~Control ~~r~~Room.

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~~The PAs that required EFW are the loss of electric power, steam line break (SLB), and small break LOCA.~~

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BASES

LCO (continued)

20, 21. Refueling Water Storage Pit (RWSP) Level (Wide Range, Narrow Range)

RWSP Level is provided for verification and long term surveillance of RCS integrity and is used to determine:

- RWSP level accident diagnosis, and

- Whether to terminate ~~SI~~ECCS Actuation, if still in progress.

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PAM Display Function

The PAM Display Function is provided by four trains of Safety VDUs (S-VDU). A Safety VDU train consists of a VDU and S-VDU processor. An S-VDU train must be OPERABLE for the corresponding channels of the required PAM Instrumentation Functions, and in the same MODES. For PAM Instrumentation Functions with four channels (two or three required channels), two or three corresponding S-VDU trains must be OPERABLE. For PAM Instrumentation Functions with only two required channels, two corresponding S-VDU trains must be OPERABLE. For CIV position, there are two-train components assigned to Trains A and D, and two-train components assigned to Trains B and C. Therefore, because all four trains are required for CIV position, all four trains of S-VDU are required to be OPERABLE.

| APPLICABILITY | The PAM ~~i~~Instrumentation LCO is applicable in MODES 1, 2, and 3. These variables are related to the diagnosis and pre-planned actions required to mitigate PAs. The applicable PAs are assumed to occur in MODES 1, 2, and 3. In MODES 4, 5, and 6, unit conditions are such that the likelihood of an event that would require PAM ~~i~~Instrumentation is low; therefore, the PAM ~~i~~Instrumentation is not required to be OPERABLE in these MODES. |

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| ACTIONS | The ACTIONS Table has been modified by ~~two Notes~~a Note~~.~~ |

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~~The first Note excludes the MODE change restriction of LCO 3.0.4. This exception allows entry into an applicable MODE while relying on the ACTIONS even though the ACTIONS may eventually require a plant shutdown. This exception is acceptable due to the passive function of the instruments, the operator's ability to respond to an accident using alternate instruments and methods, and low probability of an event requiring these instruments.~~

~~The second 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 on Table 3.3.3-1 and the PAM Display Function. The Completion Time(s) of the inoperable channel(s) of a Function will be tracked separately for each Function starting from the time the Condition was entered for that Function.

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BASES

ACTIONS (Continued)

In all cases where the LCO states "Restore channel or train to OPERABLE status", this means restore the required number of channels or trains to OPERABLE status. Therefore, restoration of an alternate channel or train, other than the failed channel or train, is also acceptable.

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A.1

Condition A applies when one or more PAM Instrumentation Functions have one required channel ~~that~~ inoperable, or one train of the PAM Display Function is inoperable.

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Required Action A.1 requires restoring the inoperable channel or train to OPERABLE status within 30 days. The 30 day Completion Time is based on operating experience and takes into account the remaining OPERABLE channel(s) or trains (or in the case of a Function that has only one required channel, other non-Regulatory Guide 1.97 instrument channels to monitor the Function), the passive nature of the instrument (operability for automatic actions that may occur from these instruments is covered by LCOs in other sections), and the low probability of an event requiring PAM ~~i~~Instrumentation during this interval.

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B.1

Condition B applies when the Required Action and associated Completion Time for Condition A are not met. This Required Action specifies initiation of actions in Specification 5.6.5, which requires a written report to be submitted to the NRC immediately. This report discusses the results of the root cause evaluation of the inoperability and identifies proposed restorative actions. This action is appropriate in lieu of a shutdown requirement since alternative actions are identified before loss of functional capability, and given the likelihood of unit conditions that would require information provided by this instrumentation.

C.1 and C.2

Condition C applies when one or more PAM Instrumentation Functions have two ~~inoperable~~ required channels ~~(i.e.~~ inoperable, or two ~~channels~~ trains of the PAM Display Function are inoperable ~~in the same Function)~~.

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Required Action C.1 requires restoring one channel in the Function(s) to OPERABLE status within 7 days. The Completion Time of 7 days is based on the relatively low probability of an event requiring PAM instrument

BASES

ACTIONS (Continued)

operation and the availability of alternate means to obtain the required information. Continuous operation with two ~~trains or two~~ required channels inoperable in a Function is not acceptable because the alternate indications may not fully meet all performance qualification requirements applied to the PAM ~~i~~Instrumentation. Therefore, requiring restoration of one inoperable channel or train of the Function limits the risk that the PAM Function will be in a degraded condition should an accident occur.

Required Action C.2 allows the option to apply the requirements of Specification 5.5.18 to determine a Risk Informed Completion Time.

Required Action C.2 is modified by a Note that indicates C.2 ~~is~~may only ~~required to~~ be performed when the Emergency Feedwater Pit Level is inoperable.

D.1 and D.2

~~Condition D applies when the Required Action and associated Completion Time of Condition C is not met. Required Action D.1 requires entering the appropriate Condition referenced in Table 3.3.3-1 for the channel immediately. The applicable Condition referenced in the Table is Function dependent. Each time an inoperable channel has not met the Required Action of Condition C, and the associated Completion Time has expired, Condition D is entered for that channel and provides for transfer to the appropriate subsequent Condition.~~

~~E.1 and E.2~~

If the Required Action and associated Completion Time of Condition C ~~is~~are not met ~~and Table 3.3.3-1 directs entry into Condition E~~, the unit must be brought to a MODE where the requirements of this LCO do not apply. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours and MODE 4 within 12 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 unit systems.

BASES

ACTIONS (Continued)

F.1

~~At this unit, alternate means of monitoring Reactor Vessel Water Level and Containment High Area Radiation have been developed and tested. These alternate means may be temporarily installed if the normal PAM channel cannot be restored to OPERABLE status within the allotted time. If these alternate means are used, the Required Action is not to shut down the unit but rather to follow the directions of Specification 5.6.5, in the Administrative Control section of the TS. The report provided to the NRC should discuss the alternate means used, describe the degree to which the alternate means are equivalent to the installed PAM channels, justify the areas in which they are not equivalent, and provide a schedule for restoring the normal PAM channels.~~

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SURVEILLANCE REQUIREMENTS

A Note has been added to the SR Table to clarify that SR 3.3.3.1 and SR 3.3.3.2 apply to each PAM iInstrumentation Function in Table 3.3.3-1.

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SR 3.3.3.1

Performance of the CHANNEL CHECK ensures that a gross instrumentation failure has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between ~~the two~~ instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION. The high radiation instrumentation should be compared to similar unit instruments located throughout the unit.

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Agreement criteria are determined based on a combination of the channel instrument uncertainties. If a channel is outside the criteria, it may be an indication that the sensor or the signal processing equipment has drifted outside its limit. If the channels are within the criteria, it is an indication that the channels are OPERABLE.

~~As specified in the SR, a CHANNEL CHECK is only required for those channels that are normally energized.~~

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~~The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.~~

BASES

SURVEILLANCE REQUIREMENTS (continued)

~~A CHANNEL CHECK may be conducted manually or automatically. For the US-APWR an automated CHANNEL CHECK is normally conducted continuously. Where the CHANNEL CHECK is conducted automatically, an alarm shall be generated when the agreement criteria is not met.~~

~~The equipment that performs the automated CHANNEL CHECK shall be confirmed OPERABLE including the capability to generate fault alarms.~~ The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

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SR 3.3.3.2

CHANNEL CALIBRATION is a complete check of the instrument loop, ~~from sensor to VDU as described in Reference 3. The test verifies~~ including the sensor. The test must be performed consistent with the methods and assumptions of MUAP-09022, "US-APWR Instrument Setpoint Methodology" (Ref. 6), to verify that the channel responds to a measured parameter with the necessary range and accuracy.

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The CHANNEL CALIBRATION confirms the accuracy of the channel from sensor to digital VDU read out as described in Reference 3.

For analog measurements, except Core Exit Temperature Channels, CHANNEL CALIBRATION confirms the channel accuracy at five calibration settings corresponding to 0%, 25%, 50%, 75% and 100% of the instrument range.

For binary measurements, the CHANNEL CALIBRATION confirms the accuracy of the channel's state change at the required setpoint.

This SR includes the RCS Hot Leg and Cold Leg Temperature channels. The CHANNEL CALIBRATION of the RCS Hot Leg and Cold Leg Temperature channels is accomplished by a cross calibration that compares the signals from the installed channels to a channel with a reference RTD, in accordance with FSAR Section 7.1.3.14 (Ref. 8).

This SR includes the Core Exit Temperature channels. The CHANNEL CALIBRATION of the Core Exit Temperature channels is accomplished by a cross calibration that compares the signals from the installed channels to the signals from the RCS Hot Leg and Cold Leg Temperature channels, after they have been calibrated as described above.

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BASES

SURVEILLANCE REQUIREMENTS

This SR is modified by a Note that excludes the neutron detectors from the CHANNEL CALIBRATION for the Wide Range Neutron Flux channels; the remaining channel devices are included. The calibration method for neutron detectors is specified in the Bases for SR 3.3.1.9 of LCO 3.3.1, "Reactor Trip System (RTS) Instrumentation." ~~Whenever a sensing element is replaced, the next required CHANNEL CALIBRATION of the Core Exit thermocouple sensors is accomplished by an in situ cross calibration that compares the other sensing elements with the recently installed sensing element.~~

The equipment that performs the automated CHANNEL CHECK shall be confirmed OPERABLE, including the capability to generate fault alarms during the CHANNEL CALIBRATION.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.3.3.3

SR 3.3.3.3 is the performance of a MEMORY INTEGRITY CHECK (MIC) for the PAM Instrumentation. This includes the Safety VDU processors, RPS and SLS.

The PSMS is self-tested automatically on a continuous basis from the digital side of all input modules to the digital side of all visual display units. Continuous automatic self-testing encompasses all PSMS safety-related functions. The continuous automatic self-testing also encompasses all data communications within a PSMS train, between PSMS trains and between the PSMS and PCMS. The continuous automatic self-testing is described in Reference 3 and Reference 7.

The MIC is a diverse check of the PSMS software memory integrity to ensure there is no change to the internal PSMS software that would impact its functional operation, including the continuous automatic self-testing. The MIC is described in Reference 3 and Reference 7.

The capability to generate continuous automatic self-testing fault alarms shall be confirmed OPERABLE during the MIC.

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BASES

SURVEILLANCE REQUIREMENTS (continued)

The complete OPERABILITY check from the measurement channel input device to the Safety VDU is performed by the combination of the continuous automatic self-testing for the digital devices (the Safety VDU processors, RPS, SLS and data communication interfaces), the continuous automatic CHANNEL CHECK (SR 3.3.3.1), the CHANNEL CALIBRATION (SR 3.3.3.2) and the MIC (SR 3.3.3.3). The CHANNEL CALIBRATION, the MIC, and the TADOT, which are manual tests, overlap with the continuous automatic self-testing and confirm the functioning of the continuous automatic self-testing.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.3.3.4

SR 3.3.3.4 is the performance of a SAFETY VDU TEST for the Safety VDUs in the MCR. The SAFETY VDU TEST is explained in Reference 3.

This SR confirms the Safety VDU is capable of providing all display functions for the MCR. This test overlaps with the MIC (SR 3.3.3.3), to ensure the S-VDU is OPERABLE.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

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BASES

REFERENCES 1. Regulatory Guide 1.97, Rev. 4.

2. NUREG-0737, "Clarification of TMI Action Plan Requirements."

3. MUAP-07004-P ~~(Proprietary) and MUAP-07004-NP (Non-Proprietary)~~, Revision 7, "Safety I&C System Description and Design Process."

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4. FSAR Section 7.5.

5. IEEE 497-2002.

6. MUAP-09022-P, Revision 2, "US-APWR Instrument Setpoint Methodology."

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7. MUAP-07005-P, Revision 8, "Safety System Digital Platform -MELTAC-."

8. FSAR Section 7.1.3.14.

B 3.3 INSTRUMENTATION

B 3.3.4 Remote Shutdown Console (RSC)

BASES

BACKGROUND

The RSC provides sufficient displays and controls for the ~~control room~~Main Control Room (MCR) operator to place and maintain the unit in a ~~safe shutdown~~hot standby condition (MODE 3), to place and maintain the unit in a hot shutdown condition (MODE 4), and to place and maintain the unit in a cold shutdown condition (MODE 5), from a location outside the ~~Main Control Room~~MCR if the ~~control room~~MCR becomes inaccessible. In accordance with Section 7.4 (Ref. 4), MODES 3, 4 or 5 are referred to as safe shutdown.

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With the unit in MODE 3, the Emergency Feedwater (EFW) System and the steam generator (SG) safety valves or the main steam depressurization valves (MSDVs) can be used to remove core decay heat and meet all safety requirements. The long term supply of water for the EFW System and the ability to borate the Reactor Coolant System (RCS) from outside the ~~control room~~MCR allows extended operation in MODE 3.

MIC-03-16-0 0007

If the ~~control room~~MCR becomes inaccessible, the operators can establish control at the RSC, and place and maintain the unit in MODE 3 for an extended period of time. The RSC also provides the capability to transition and maintain the unit in MODE 5, using the Residual Heat Removal System.

MIC-03-16-0 0007

APPLICABLE SAFETY ANALYSES

The RSC is located outside the ~~control room~~MCR with ~~a~~the capability to promptly shutdown, cooldown and maintain the unit in a safe condition in MODE 3, and the capability to transition and maintain the unit in a safe condition in MODE 4 or 5, in accordance with the design described in FSAR Section 7.4 (Ref. 4).

MIC-03-16-0 0007

The criteria governing the design and specific system requirements for remote shutdown are located in 10 CFR 50, Appendix A, GDC 19 (Ref. 1). These criteria are applied to the RSC of the US-APWR.

The RSC satisfies Criterion 4 of 10 CFR 50.36(c)(2)(ii) (Ref. 2).

The RSC LCO provides the OPERABILITY requirements for the RSC, which includes the displays and controls necessary to place and maintain the unit in MODE 3, with the capability to transition to MODES 4 or 5 and the ability to transfer control from the MCR to the RSC.

MIC-03-16-0 0007

LCO

Due to redundant components within the PSMS, such as controllers, communication links and power supplies, an inoperable component may or may not result in an inoperable channel or train. Where an inoperable component results in an inoperable required channel or train, LCOs are entered. For inoperable components that do not result in inoperable channels or trains, LCOs are not entered. The instrumentation required are listed in Table B 3.3.4-1.

MIC-03-16-0 0007

BASES

LCO (continued)

Display and Control Function | MIC-03-16-0 0007

The displays and controls at the RSC are functionally the same as the displays and controls used by the operator to achieve and maintain MODE 3, 4 or 5 from the ~~main control room~~MCR. These displays and controls are provided by four trains of Safety VDUs, and non-safety Operational VDUs. MODE 3, 4 or 5 can be achieved and maintained using only safety related plant equipment which is controlled and monitored from Safety VDUs or Operational VDUs. | MIC-03-16-0 0007 MIC-03-16-0 0007

The Display and Control Function of the RSC encompasses the measurement channels and component controls required for safe shutdown, and the subsystems of the PSMS that support that equipment. The measurement channels and component controls available to achieve normal and safe shutdown are identified in Table 7.4-1 and Table 7.4-2 of FSAR Section 7.4 (Ref. 4). | MIC-03-16-0 0007

The measurement channels for safe shutdown, that are required to be OPERABLE for this LCO, are listed in Table B 3.3.4-1, including the required number of channels. These measurement channels are interfaced to the Reactor Protection System (RPS) and then provided to the RSC. Each item listed in Table B 3.3.4-1 is referred to as an RSC Instrumentation Function.

The component controls for safe shutdown, that are required to be OPERABLE for this LCO, are listed in Table B 3.3.4-2, including the required number of trains. The Safety Logic System (SLS) provides the Actuation Logic and Actuation Outputs for these components. Safe shutdown can be achieved by only one train of plant equipment for two train ESF systems and by two trains of plant equipment for four train ESF systems. One additional train is required to meet the single failure criteria. Each item listed in Table B 3.3.4-2 is referred to as an RSC Control Function.

The Display and Control Function also encompasses the Safety VDUs (S-VDU) and Communication Subsystem (COM-2). The S-VDU is required for the display of safe shutdown measurement channels. The S-VDU and COM-2 are required for manual control of safe shutdown components. Since for all required safe shutdown systems, the required OPERABLE safety plant components may be distributed to all four trains, all four trains of Safety VDUs and COM-2 are required. The Safety VDU in each train consists of a VDU and Safety VDU processor.

~~Non~~All plant equipment, including non-safety plant equipment is controlled and monitored from the Operational VDUs at the RSC. This equipment is provided for convenience and is not necessary to achieve or maintain MODE 3, 4 or 5. Therefore the Operational VDUs are not covered by this LCO. | MIC-03-16-0 0007

BASES

LCO (continued)

~~Transfer of Control~~

MIC-03-16-0
0007

~~The controls in the MCR are normally enabled, while the controls at the RSC are normally disabled. Actuation of Transfer Switches disables the controls in the MCR and enables the controls at the RSC. There are two Transfer Switches for each safety train of the PSMS and two transfer switches for the PCMS. Activating both transfer switches for a train, transfers the controls for that train.~~

The RSC equipment covered by this LCO does not need to be continuously energized to be considered OPERABLE. However, it is necessary to energize this equipment for surveillance testing.

Transfer of Control Function

MIC-03-16-0
0007

The controls in the MCR are normally enabled, while the controls at the RSC are normally disabled. Actuation of Transfer Switches disables the controls in the MCR and enables the controls at the RSC. There are two Transfer Switches for each safety train of the Protection and Safety Monitoring System (PSMS) (8 switches) and two Transfer Switches for the Plant Control and Monitoring System (PCMS) (which has only one train). Activating both Transfer Switches for a train, transfers the controls for that train. Transferring control also blocks signals from the disabled location that could otherwise interfere with safe shutdown operations. Since all trains must be capable of control transfer and signal blocking, both Transfer Switches for all four PSMS trains and the PCMS are required to be OPERABLE.

The Transfer of Control Function also encompasses the COM-2. The COM-2 is required for transfer of control from the MCR to the RSC. Since for all required safe shutdown systems, the required OPERABLE safety plant components may be distributed to all four trains, all four trains of COM-2 are required.

APPLICABILITY

The RSC LCO is applicable in MODES 1, 2 and 3. This applicability recognizes the need for being able to place and maintain the unit in a safe shutdown condition (MODE 3, with the capability to transition to MODES 4 or 5) from a location outside the ~~main control room~~MCR if the MCR becomes inaccessible while the RCS contains a large amount of energy.

MIC-03-16-0
0007

This LCO is not applicable in MODE 4, 5, or 6. In these MODES, the facility is already subcritical and in a condition of reduced RCS energy. Under these conditions, considerable time is available to restore necessary instrument control functions if ~~control room~~MCR instruments or controls become unavailable.

MIC-03-16-0
0007

BASES

| ACTIONS | In all cases where the LCO states "Restore channel or train to OPERABLE status", this means restore the required number of channels or trains to OPERABLE status. Therefore, restoration of an alternate channel or train, other than the failed channel or train, is also acceptable. | MIC-03-16-0 0007 |

A.1

Condition A addresses the situation where ~~the Remote Shutdown Console is inoperable. This includes~~one required channel or train for the Display and Control Function ~~and~~is inoperable, or one train for the Transfer of Control Function~~.~~ is inoperable

The Required Action is to restore the ~~required Function~~channel or train to OPERABLE status within 30 days. The Completion Time is based on operating experience and the low probability of an event that would require evacuation of the ~~control room~~MCR.

B.1 and B.2

Condition B applies when the Required Action and associated Completion Time of Condition A are not met. In this condition, 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 4 within 12 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 unit systems.

| SURVEILLANCE REQUIREMENTS | SR 3.3.4.1 | |

SR 3.3.4.1 is the performance of a TADOT for the Transfer of Control Function from the ~~main control room~~MCR to the RSC, which verifies the RSC Transfer Switches perform their required functions for each PSMS train and the PCMS. Each Transfer Switch is tested up to, and including, the signal status readout on a digital display.

This ~~Surveillance~~SR verifies that the controls and interfaces for the Transfer of Control Function are OPERABLE.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.4.2

SR 3.3.4.2 is the performance of ~~an ACTUATION LOGIC~~a SAFETY VDU TEST for all Safety VDUs on the RSC. The ~~PSMS are self tested on a continuous basis from the digital side of all input modules to the digital side of all output modules. Self testing also encompasses all data communications within a PSMS train, between PSMS trains. The self testing is described~~SAFETY VDU Test is explained in Reference 3 ~~and 5. The ACTUATION LOGIC TEST is a check of the PSMS software memory integrity to ensure there is no change to the internal software that would impact its functional operation or the continuous self test function. The software memory integrity test is described in Reference 3 and 5~~.

~~This Surveillance verifies that all logic and communications with the PSMS for the Transfer of Control Function is OPERABLE. It also verifies that all logic functions within the PSMS associated with controls and indications at the RSC are OPERABLE.~~This SR confirms the Safety VDU is capable of providing all Display and Control Functions for the RSC. This test overlaps with the MEMORY INTEGRITY CHECK (MIC) for the Safety VDU processor (SR 3.3.4.5), to ensure the Display and Control Function is OPERABLE.

MIC-03-16-0 0007

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.3.4.3

SR 3.3.4.3 is the performance of a CHANNEL CHECK for each RSC Instrumentation Function in Table 3.3.4-1.~~Safety VDU test for all Safety VDUs on the RSC. The Safety VDU Test is explained in Reference 3.~~

~~This Surveillance confirms the Safety VDU is capable of providing all display and control functions for the RSC. This test overlaps with the Actuation Logic Test of SR 3.3.4.2 to ensure the Display and Control Function is OPERABLE.~~

MIC-03-16-0 0007

BASES

SURVEILLANCE REQUIREMENTS (continued)

Performance of the CHANNEL CHECK ensures that a gross instrumentation failure has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION. Agreement criteria are determined based on a combination of the channel instrument uncertainties. If a channel is outside the criteria, it may be an indication that the sensor or the signal processing equipment has drifted outside its limit. If the channels are within the criteria, it is an indication that the channels are OPERABLE.

MIC-03-16-0 0007

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.3.4.4

MIC-03-16-0 0007

SR 3.3.4.4 is the performance of a CHANNEL CALIBRATION for each RSC Instrumentation Function in Table B 3.3.4-1.

The CHANNEL CALIBRATION confirms the accuracy of the channel from sensor to digital VDU readout, as described in Reference 3.

CHANNEL CALIBRATION is a complete check of the instrument loop, including the sensor. The test must be performed consistent with the methods and assumptions of MUAP-09022, "US-APWR Instrument Setpoint Methodology" (Ref. 6), to verify that the channel responds to a measured parameter with the necessary range and accuracy.

For analog measurements, CHANNEL CALIBRATION confirms the channel accuracy at five calibration settings corresponding to 0%, 25%, 50%, 75% and 100% of the instrument range. For binary measurements, the CHANNEL CALIBRATION confirms the accuracy of the channel's state change at the required setpoint.

BASES

SURVEILLANCE REQUIREMENTS (continued)

This SR is applicable to all channels, including the Wide Range Neutron Flux channels. However, this SR is modified by a Note that excludes neutron detectors. The calibration method for neutron detectors is specified in the Bases for SR 3.3.1.9 of LCO 3.3.1, "Reactor Trip System (RTS) Instrumentation."

MIC-03-16-0 0007

This SR includes the RCS Hot Leg and Cold Leg Temperature channels. The calibration of the channels is accomplished by a cross calibration that compares the signals from the installed channels to a channel with a reference RTD, in accordance with FSAR Section 7.1.3.14 (Ref. 7).

The equipment that performs the automated CHANNEL CHECK shall be confirmed OPERABLE, including the capability to generate fault alarms during the CHANNEL CALIBRATION.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.3.4.5

SR 3.3.4.5 is the performance of a MIC for the RSC. This includes the Safety VDU processors, RPS, SLS and COM-2.

The PSMS is self-tested automatically on a continuous basis from the digital side of all input modules to the digital side of all output modules. Continuous automatic self-testing encompasses all PSMS safety-related functions including actuation logic functions. The continuous automatic self-testing also encompasses all data communications within a PSMS train, between PSMS trains and between the PSMS and PCMS. The continuous automatic self-testing is described in Reference 3 and Reference 5.

The MIC is a diverse check of the PSMS software memory integrity to ensure there is no change to the internal PSMS software that would impact its functional operation, including actuation logic functions or the continuous automatic self-testing. The MIC is described in Reference 3 and Reference 5.

The capability to generate continuous automatic self-testing fault alarms shall be confirmed OPERABLE during the MIC.

BASES

SURVEILLANCE REQUIREMENTS (continued)

The complete operability check from the Safety VDUs (S-VDU) input device to the Safety Logic System (SLS) output device is performed by the combination of the continuous automatic self-testing for the digital devices (Safety VDU processors, COM-2, SLS and digital communication interfaces), the SAFETY VDU TEST (SR 3.3.4.2), MIC for the Safety VDU processors, COM-2 and SLS (SR 3.3.4.5) and TADOT for SLS outputs (SR 3.3.4.6). The SAFETY VDU TEST, MIC, and TADOT, which are manual tests, overlap with the continuous automatic self-testing and confirm the functioning of the continuous automatic self-testing.

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The complete operability check from the measurement channel sensing device to the S-VDU is performed by the combination of the continuous automatic self-testing for the digital devices (Safety VDU processors and RPS, and digital communication interfaces), the SAFETY VDU TEST (SR 3.3.4.2), MIC for the Safety VDU processors and RPS (SR 3.3.4.5), the continuous automatic CHANNEL CHECK (SR 3.3.4.3) and the CHANNEL CALIBRATION (SR 3.3.4.4). The CHANNEL CALIBRATION, MIC and Safety VDU TEST, which are manual tests, overlap with the continuous automatic self-testing and confirm the functioning of the continuous automatic self-testing.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.3.4.6

SR 3.3.4.6 is the performance of a TADOT for the Actuation Outputs of each required train for each RSC Control Function. This test actuates the outputs of the SLS for all components required to achieve and maintain safe shutdown. Therefore, this test is typically conducted in conjunction with testing the plant process components. Since this test is conducted in conjunction with testing for plant process components, this test may be conducted more frequently, as may be required for the plant process components.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

BASES

REFERENCES

1.   10 CFR 50, Appendix A, GDC 19.

2.   10 CFR 50.36.

3.   MUAP-07004-P ~~(Proprietary) and MUAP-07004-NP (Non-Proprietary)~~. Revision 7, "Safety I&C System Description and Design Process."   MIC-03-16-0 0007

4.   FSAR Section 7.4.~~1.~~   MIC-03-16-0 0007

5.   MUAP-07005-P ~~(Proprietary) and MUAP-07005-NP (Non-Proprietary)~~. Revision 8, "Safety System Digital Platform – MELTAC."

6.   MUAP-09022-P, Revision 2, "US-APWR Instrument Setpoint Methodology."   MIC-03-16-0 0007

7.   FSAR Section 7.1.3.14.

Table B 3.3.4-1 (Sheet 1 of 2)
Remote Shutdown Console Instrumentation

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FUNCTION	REQUIRED NUMBER OF CHANNELS
1. Reactor Coolant System	
a. Pressurizer Water Level	2
b. Pressurizer Pressure	2
c. Reactor Coolant Hot Leg Temperature (Wide Range)	3
d. Reactor Coolant Cold Leg Temperature (Wide Range)	3
e. Reactor Coolant Pressure	2
2. Safety Injection System	
a. Safety Injection Pump Discharge Flow	1 per Required Pump
b. Safety Injection Pump Minimum Flow	1 per Required Pump
c. Safety Injection Pump Discharge Pressure	1 per Required Pump
d. Safety Injection Pump Suction Pressure	1 per Required Pump
e. Accumulator Pressure	1 per Tank
3. Residual Heat Removal System	
a. CS/RHR Hx Outlet Temperature	1 per Required Pump
b. CS/RHR Pump Discharge Flow	1 per Required Pump
c. CS/RHR Pump Minimum Flow	1 per Required Pump
d. CS/RHR Pump Discharge Pressure	1 per Required Pump
e. CS/RHR Pump Suction Pressure	1 per Required Pump
4. EFW Pit Water Level	
a. EFW Pit Water Level	2 per Pit
b. EFW Flow	1 per SG
c. EFW Pump Discharge Pressure	1 per Required Pump
5. Condensate and Feedwater System	
SG Water Level (Wide Range)	1 per SG

Table B 3.3.4-1 (Sheet 2 of 2)
Remote Shutdown Console Instrumentation

FUNCTION	REQUIRED NUMBER OF CHANNELS
6. Main Steam Supply System	
a. Main Steam Line Pressure	2 per Line
7. Component Cooling Water System	
a. CCW Surge Tank Water Level	1 per Required Tank Compartment
b. CCW Header Pressure	1 per Required Pump
c. CCW Header Flow	1 per Required Pump
d. CCW Supply Temperature	1 per Required Pump
8. Essential Service Water System	
a. CCW Hx ESW Flow	1 per Required Pump
b. ESW Header Pressure	1 per Required Pump
9. Refueling Water Storage System	
a. RWSP Water Level (Wide Range)	2
10. Nuclear Instrumentation	
a. Source Range Neutron Flux	2
11. UHS Instrumentation	
a. UHS Basin Water level	2 per Basin
b. UHS Basin Temperature	1 per Basin

Table B 3.3.4-2 (Sheet 1 of 3)
Remote Shutdown Console Control

FUNCTION	REQUIRED NUMBER OF TRAINS
1. Reactor Trip System	
a. Reactor Trip Breaker	3 (2 Breakers per Train)
2. Reactor Coolant System	
a. Safety Depressurization Valve	2
b. Safety Depressurization Valve Block Valve	2
c. Pressurizer Heater Backup Group	3
d. Reactor Vessel (RV) Vent Valve	2 per Line
3. Chemical Volume Control System	
a. Seal Water Return Line Isolation Valve	2 per Line
4. Safety Injection System	
a. Safety Injection Pump (SIP)	3
b. SIPs Suction Isolation Valve	1 per Required Pump
c. SIPs Discharge Containment Isolation Valve	1 per Required Pump
d. Direct Vessel Safety Injection Line Valve	1 per Required Pump
e. Emergency Letdown Line Isolation Valve	2 per Line
f. Accumulator Discharge Valve	1 per Tank
g. ACC Nitrogen Supply Line Isolation Valve	1 per Tank
h. ACC Nitrogen Discharge Valve	2 per Tank
5. Residual Heat Removal System	
a. CS/RHR Pump	3
b. CS/RHR Pump Hot Leg Isolation Valve	1 per Required Pump (2 Valves per train)
c. CS/RHR Pumps RWSP Suction Isolation Valve	1 per Required Pump
d. RHR Discharge Line Containment Isolation Valve	1 per Required Pump
e. RHR Flow Control Valve	1 per Required Pump
f. CS/RHR Pump Full-Flow Test Line Stop Valve	1 per Required Pump

Table B 3.3.4-2 (Sheet 2 of 3)
Remote Shutdown Console Control

FUNCTION	REQUIRED NUMBER OF TRAINS
6. Emergency Feedwater System	
a. EFW Pump (Motor-Driven or Turbine Driven)	3
b. EFW Control Valve	1 per SG
c. EFW Isolation Valve	1 per SG
d. T/D-EFW Pump MS Line Steam Isolation Valve	1 per Required Pump
e. T/D-EFW Pump Actuation Valve	1 per Required Pump
7. Main Steam Supply System	
a. Main Steam Depressurization Valve	1 per SG
b. Main Steam Relief Valve Block Valve	1 per SG
c. Main Steam Isolation Valve	1 per SG
d. Main Steam Bypass Isolation Valve	1 per SG
8. Component Cooling Water System	
a. CCW Pump	3
b. CS/RHR Hx CCW Outlet Valve	1 per Required Pump
9. Essential Service Water System	
a. ESW Pump	3
b. ESW Pump Discharge Valve	1 per Required Pump
10. Steam Generator Blowdown System	
a. SGBD Line Containment Isolation Valve	1 per SG
b. SGBD Line Isolation Valve	1 per SG
c. SGBD Sampling Line Containment Isolation Valve	1 per SG
11. Heating, Ventilation, and Air Conditioning	
a. MCR Air Handling Unit & Damper	3
b. Class 1E Electrical Room Air Handling Unit & Damper	3
c. Class 1E Electrical Room Return Air Fan	3

Table B 3.3.4-2 (Sheet 3 of 3)
Remote Shutdown Console Control

FUNCTION	REQUIRED NUMBER OF TRAINS
d. Class 1E Battery Room Exhaust Fan & Damper	3
e. Class 1E Electrical Room In-duct heater	3
f. CCW Pump Area Air Handling Unit	3
g. Essential Chiller Unit Area Air Handling Unit	3
h. EFW Pump Area Air Handling Unit	3
i. Essential Chiller Unit	3
j. Essential Chilled Water Pump & Valves	3
12. UHS Components	
a. UHS Cooling Tower Fans	1 per Required ESW Pump
b. UHS Transfer Pump	3
c. UHS Transfer Pump Discharge Valve	1 per Required UHS Transfer Pump
d. UHS Transfer Line Basin Inlet Valve	1 per Required ESW Pump
e. UHS Basin Blowdown Control Valve	1 per Required ESW Pump
f. ESW Pump Discharge Strainer Backwash Isolation Valve to ESWS blowdown main header	1 per Required ESW Pump
g. ESWS Blowdown Main Header Isolation Valve to CWS blowdown main header	1
h. ESW Pump Room Exhaust Fan	1 per Required ESW Pump
i. UHS Transfer Pump Room Exhaust Fan	1 per Required UHS Transfer Pump
j. ESW Pump Room Unit Heater	1 per Required Fan
k. UHS Transfer Pump Room Unit Heater	1 per Required Fan

B 3.3 INSTRUMENTATION

B 3.3.5 Loss of Power (LOP) Class 1E Gas Turbine Generator (GTG) Start Instrumentation

BASES

BACKGROUND
The Class 1E GTGs provide a source of emergency power when offsite power is either unavailable or is insufficiently stable to allow safe unit operation. Undervoltage protection will generate an LOP start if a loss of voltage or degraded voltage condition occurs in the switchyard. There are four LOP start signals, one for each 6.9 kV Class 1E bus.

MIC-03-16-0 0007

Field Sensors

MIC-03-16-0 0007

Three undervoltage relays with inverse time characteristics are provided on each 6.9 kV Class 1E bus for detecting a sustained degraded voltage condition or a loss of bus voltage. ~~The~~Signals from the undervoltage relays are interfaced to ESFAS.

MIC-03-16-0 0007

ESFAS and SLS

Signals from the undervoltage relays are combined in a two-out-of-three actuation logic within the ESFAS to generate an LOP signal when the voltage is dropped before reaching the loss of voltage limit for a short time or before reaching the degraded voltage limit for a long time. The LOP signal is interfaced from the ESFAS via internal digital data communication to the SLS controllers of the PSMS, which provide the GTG actuation logic, GTG control system and GTG control output. The GTG actuation logic combines manual and automatic start demands, with other GTG control interlocks; the GTG control system provides continuous closed loop control of the GTG via the GTG control output. The LOP start actuation is described in Reference 1.

MIC-03-16-0 0007

~~The Allowable Value in conjunction with the Trip Setpoint and LCO establishes the threshold for Engineered Safety Features Actuation System (ESFAS) action to prevent exceeding acceptable limits such that the consequences of Postulated Accidents (PAs) will be acceptable. The Allowable Value is considered a limiting value such that a channel is OPERABLE if the setpoint is found not to exceed the Allowable Value during the CHANNEL CALIBRATION. Note that although a channel is OPERABLE under these circumstances, the setpoint must be left adjusted to within the established calibration tolerance band of the setpoint in accordance with Section 5.5.21, SCP.~~

MIC-03-16-0 0007

Allowable Values and LOP Class 1E GTG Start Instrumentation Setpoints

The Nominal Trip Setpoint and Allowable Value are recorded and maintained in a document established by the Setpoint Control Program (SCP).

MIC-03-16-0 0007

BASES

BACKGROUND (Continued)

The Allowable Value in conjunction with the Nominal Trip Setpoint and LCO establishes the threshold for Engineered Safety Features Actuation System (ESFAS) action to prevent exceeding acceptable limits such that the consequences of Postulated Accidents (PAs) will be acceptable. The Allowable Value is considered a limiting value such that a channel is OPERABLE if the setpoint is found not to exceed the Allowable Value during the CHANNEL CALIBRATION (Ref. 7). Note that although a channel is OPERABLE under these circumstances, the setpoint shall be left adjusted to within the established Calibration Tolerance band of the setpoint in accordance with uncertainty assumptions stated in the referenced setpoint methodology (as-left-criteria), and confirmed to be operating within the statistical allowances of the uncertainty terms assigned. The Calibration Tolerance is recorded and maintained in a document established by the SCP.

If the as-found value of the device is found to have exceeded the Allowable Value, or the as-left value of the device cannot be adjusted to the value within the Calibration Tolerance, the device would be considered inoperable from a Technical Specification perspective. This requires corrective action including those actions required by 10 CFR 50.36 when automatic protective devices do not function as required.

Setpoints adjusted consistent with the requirements of ~~Section~~Specification 5.5.21, SCP ensure that the consequences of accidents will be acceptable, ~~providing~~provided the unit is operated from within the LCOs at the onset of the accident and that the equipment functions as designed. The time ~~delay of~~required to start the Class 1E GTG ~~starting~~, which is initiated by ~~LOOP~~the LOP signal~~,~~. is considered ~~as mitigation system time delay~~ in the analysis presented in FSAR Chapter 15 (Ref. 6).

~~The trip setpoints are selected to ensure that the setpoint measured by the surveillance procedure does not exceed the Allowable Value if the relay is performing as required.~~The Nominal Trip Setpoint entered into the LOP binary sensor is more conservative than that specified by the Analytical Limit. The Nominal Trip Setpoint accounts for measurement errors detectable by the CHANNEL CALIBRATION and other unmeasurable errors (such as the effects of anticipated environmental conditions), which are both considered in the Allowable Value for the LOP Nominal Trip Setpoint, which is checked during CHANNEL CALIBRATION. If the ~~measured~~as-found value of the LOP setpoint does not exceed the Allowable Value, the ~~relay~~channel is considered OPERABLE. Operation with a trip setpoint less conservative than the ~~n~~Nominal Trip Setpoint, but within the Allowable Value, is acceptable provided that operation and testing is consistent with the assumptions of the unit specific setpoint calculation.

MIC-03-16-0 0007

MIC-03-16-0 0007

BASES

BACKGROUND (Continued)

Within the Protection and Safety Monitoring System (PSMS), LOP Time Delays are digital settings maintained in non-volatile software memory within each ESFAS train. Digital settings have no potential for variation due to time, environmental drift or component aging; therefore, these digital settings have no surveillance tolerance. Each train of the process control equipment has continuous automatic self-testing, which verifies that the digital Time Delay settings are correct. Time Delays are also verified periodically through a diverse software MEMORY INTEGRITY CHECK (MIC).

MIC-03-16-0 0007

| APPLICABLE SAFETY ANALYSES | The LOP Class 1E GTG start instrumentation is required for the Engineered Safety Features (ESF) Systems to function in any accident with a loss of offsite power. Its design basis is that of the ESF Actuation System (ESFAS) Accident analyses credit the loading of the Class 1E GTG based on the loss of offsite power during a loss of coolant accident (LOCA). The actual Class 1E GTG start has historically been associated with the ESFAS actuation. The Class 1E GTG loading has been included in the delay time associated with each safety system component requiring Class 1E GTG supplied power following a loss of offsite power. The analyses assume a non-mechanistic Class 1E GTG loading, which does not explicitly account for each individual component of loss of power detection and subsequent actions. |

The required channels of LOP Class 1E GTG start instrumentation, in conjunction with the ESF systems powered from the Class 1E GTGs, provide unit protection in the event of any of the analyzed accidents discussed in FSAR Chapter 15, in which a loss of offsite power is assumed.

The delay times assumed in the safety analysis for the ESF equipment include the ~~100 second~~ Class 1E GTG start delay, and the appropriate sequencing delay, if applicable. The response times for ESFAS actuated equipment in LCO 3.3.2, "Engineered Safety Features Actuation System (ESFAS) Instrumentation," include the appropriate Class 1E GTG loading and sequencing delay.

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The LOP Class 1E GTG start instrumentation channels satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii) (Ref. 4).

BASES

LCO	The Loss of Power (LOP) Class 1E Gas Turbine Generator (GTG) Start Instrumentation shall be OPERABLE for each bus that is required to be OPERABLE.	MIC-03-16-0 0007

The LCO for LOP Class 1E GTG start instrumentation requires ~~that~~ three OPERABLE channels per required bus of both the loss of voltage and degraded voltage Functions ~~shall be OPERABLE~~ in MODES 1, 2, 3, and 4~~, as well as whenever the associated GTG is required to be OPERABLE by LCO 3.8.2, "AC Sources – Shutdown." A Class 1E GTG is not required to be OPERABLE if its associated Class 1E 6.9 kV bus is not powering any required ESF loads. Therefore the associated Class 1E 6.9 kV bus is not required~~.

For MODES 5 and 6, three channels per required bus of both the loss of voltage and degraded voltage Functions shall be OPERABLE whenever the associated GTG is required to be OPERABLE by LCO 3.8.2, "AC Sources - Shutdown" to ensure that the automatic start of the GTG is available when needed.

In addition, for each required bus, the LCO for LOP Class 1E GTG Start Instrumentation requires the ESFAS actuation logic, GTG actuation logic, GTG control system and GTG control output in the associated train of the ESFAS and SLS to be OPERABLE. These logic, control and output functions are collectively referred to as the LOP Actuation Function. There are four trains for the LOP Actuation Function, one train for each bus and its associated GTG.

Loss of the LOP Class 1E GTG Start Instrumentation Function could result in the delay of safety systems initiation when required. This could lead to unacceptable consequences during accidents. During the loss of offsite power the Class 1E GTG powers the motor driven Emergency Feedwater Pumps. Failure of these pumps to start would leave two turbine driven pumps, as well as an increased potential for a loss of decay heat removal through the secondary system.

APPLICABILITY	~~The LOP Class 1E GTG Start Instrumentation Functions are required in MODES 1, 2, 3, and 4, as well as whenever the associated Class 1E GTG is required to be OPERABLE by LCO 3.8.2, "AC Sources – Shutdown.". A Class 1E GTG is not required to be OPERABLE if its associated Class 1E 6.9 kV bus is not powering any required ESF loads. Therefore the associated Class 1E 6.9 kV bus is not required.~~Due to redundant components within the PSMS, such as controllers, communication links and power supplies, an inoperable component may or may not result in an inoperable channel or train. Where an inoperable component results in an inoperable required channel or train, LCOs are entered. For inoperable components that do not result in inoperable channels or trains, LCOs are not entered.	MIC-03-16-0 0007

BASES

APPLICABILITY (continued)

The LOP GTG Start Instrumentation Functions are required in MODES 1, 2, 3, and 4 because ESF Functions are designed to provide protection in these MODES. This Function is also required in MODE 5 or 6 whenever the required GTG must be OPERABLE so that it can perform its function on an LOP or degraded power to its associated bus.

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ACTIONS

In the event a channel Nominal Trip Setpoint is found non-conservative with respect to the Allowable Value, or the channel or train is found inoperable, then the function that channel or train provides must be declared inoperable and the LCO Condition entered for the particular protection function affected.

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Because the required channels are specified on a per bus basis, the Condition may be entered separately for each bus as appropriate.

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 the LCO. The Completion Time(s) of the inoperable channel(s) of a Function will be tracked separately for each Function starting from the time the Condition was entered for that Function.

In all cases where the LCO states "Restore channel or train to OPERABLE status", this means restore the required number of channels or trains to OPERABLE status. Therefore, restoration of an alternate channel or train, other than the failed channel or train, is also acceptable.

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A.1

Condition A applies to the LOP Class 1E GTG ~~start~~Start Instrumentation Functions with one loss of voltage or one degraded voltage channel per required Class 1E 6.9 kV bus inoperable.

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If one channel is inoperable, Required Action A.1 requires that channel to be placed in trip within 6 hours. With a channel in trip, the LOP Class 1E GTG start instrumentation channels are configured to provide a one-out-of-two logic to initiate a trip of the incoming offsite power.

~~A Note is added to allow bypassing an inoperable channel for up to 4 hours for surveillance testing of other channels. This allowance is made where bypassing the channel does not cause an actuation and where at least two other channels are monitoring that parameter.~~

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~~The specified Completion Time and time allowed for bypassing one channel are reasonable considering the Function remains fully OPERABLE on every bus and the low probability of an event occurring during these intervals.~~

BASES

ACTIONS (Continued)

The Completion Time of 6 hours is justified because the two remaining OPERABLE undervoltage devices for each bus are adequate to perform the safety function. Since the undervoltage devices are dedicated for each of the four Class 1E busses, and two undervoltage devices are adequate to perform the safety function of each bus, the LOP Class 1E GTG Start Instrumentation Function continues to meet the single failure criterion (i.e., three GTGs will still actuate if there is an additional undervoltage device failure on one bus).

The Completion Time of 6 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 5).

A Note is added to allow placing one channel in bypass for up to 4 hours while performing surveillance testing, provided the other channels on the same bus are OPERABLE, or one channel is OPERABLE and the other is placed in the trip condition.

The Bypass Time of 4 hours is justified because the remaining OPERABLE channels are adequate to perform the safety function. In addition, the Bypass Time considers that the remaining OPERABLE channels have continuous automatic self-testing.

The 4 hour Bypass Time is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 5).

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B.1

Condition B applies when two or more loss of voltage or two or more degraded voltage channels per required Class 1E 6.9 kV bus are inoperable.

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Required Action B.1 requires restoring all but one channel per required Class 1E 6.9 kV bus to OPERABLE status. The 1 hour Completion Time should allow ample time to repair most failures and takes into account the low probability of an event requiring an LOP start occurring during this interval.

C.1

Condition C applies to eachwhen one train of the LOP Class 1E GTG start FunctionsActuation Function is inoperable for a required bus, or when the Required Action and associated Completion Time for Condition A or B are not met.

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BASES

ACTIONS (Continued)

In these circumstances the Condition(s) specified in LCO 3.8.1, "AC Sources - Operating," or LCO 3.8.2, "AC Sources - Shutdown," for the Class 1E GTG made inoperable by failure of the LOP Class 1E GTG sStart iInstrumentation are required to be entered immediately. The actions of those LCOs provide for adequate compensatory actions to assure unit safety.

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SURVEILLANCE REQUIREMENTS

SR 3.3.5.1

Performance of the CHANNEL CHECK ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the two instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria are determined based on a combination of the channel instrument uncertainties. If a channel is outside the criteria, it may be an indication that the sensor or the signal processing equipment has drifted outside its limit.

A CHANNEL CHECK may be conducted manually or automatically. For the US APWR an automated CHANNEL CHECK is normally conducted continuously. Where the CHANNEL CHECK is conducted automatically, an alarm shall be generated when the agreement criteria is not met. SR 3.3.5.1 is the performance of a TADOT for the LOP undervoltage relays and their interface to the ESFAS. For these tests, the undervoltage relays are confirmed to actuate with reasonable proximity to the Nominal Trip Setpoints. Undervoltage trip setpoint Allowable Values are verified during CHANNEL CALIBRATION (SR 3.3.5.2). Undervoltage Time Delays, which are implemented in the ESFAS, are verified during MIC (SR 3.3.5.3) for the ESFAS.

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The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.5.2

SR 3.3.5.2 is the performance of a ~~TADOT for the LOP undervoltage relays and their interface to the PSMS. For these tests, the undervoltage relay is confirmed to actuate with reasonable proximity to the Nominal Trip Setpoints. Undervoltage trip setpoints Allowable Values and time delays are verified during~~ CHANNEL CALIBRATION~~, SR 3.3.5.3~~.

~~The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.~~

~~SR 3.3.5.3~~

~~SR 3.3.5.3 is the performance of a CHANNEL CALIBRATION.~~

~~The setpoints, as well as the response to a loss of voltage and a degraded voltage test, shall include a single point verification that the trip occurs within the required time delay.~~

CHANNEL CALIBRATION for a binary ~~process~~ measurement is a complete check of the instrument loop, including the sensor and interface to the PSMS, as described in Reference 2. The test verifies that the channel responds to measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION confirms the accuracy of the channel from sensor to digital Visual Display Unit (VDU) readout, as described in Reference 2. The CHANNEL CALIBRATION confirms the accuracy of the channel's state change at the required setpoint.

CHANNEL CALIBRATIONS must be performed consistent with the methods and assumptions in ~~Section~~Specification 5.5.21 SCP. For binary measurements, the CHANNEL CALIBRATION confirms the accuracy of the channel's state change. The state change must occur within the Allowable Value of the Nominal Trip Setpoint. Time Delays associated with Loss of Voltage and Degraded Voltage are recorded and maintained in a document established by the Setpoint Control Program (SCP) and confirmed through MIC.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

The equipment that performs the automated CHANNEL CHECK shall be confirmed OPERABLE, including the capability to generate fault alarms during the CHANNEL CALIBRATION.

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BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.5.3

SR 3.3.5.3 is the performance of a MIC for the LOP Class 1E GTG Start Instrumentation. This includes the ESFAS and the SLS.

The PSMS is self-tested automatically on a continuous basis from the digital side of all input modules to the digital side of all output modules. Continuous automatic self-testing encompasses all PSMS safety-related functions including Time Delays, actuation logic functions and continuous control functions. The continuous automatic self-testing also encompasses all data communications within a PSMS train, between PSMS trains and between the PSMS and PCMS. The continuous automatic self-testing is described in Reference 2 and Reference 3.

The MIC is a diverse check of the PSMS software memory integrity, consistent with the Setpoint Control Program (SCP), to ensure there is no change to the internal PSMS software that would impact its functional operation, including digital Time Delays, actuation logic functions, continuous control functions or the continuous automatic self-testing. The MIC is described in Reference 2 and Reference 3.

The capability to generate continuous automatic self-testing fault alarms shall be confirmed OPERABLE during the MIC.

The complete OPERABILITY check from the measurement channel input device to the Safety Logic System (SLS) output device is performed by the combination of the continuous automatic self-testing for the digital devices (the ESFAS, SLS and data communication interfaces), the TADOT (SR 3.3.5.1) and CHANNEL CALIBRATION (SR 3.3.5.2) for the LOP undervoltage relays, the MIC (SR 3.3.5.3) and the TADOT for the GTG control output of the SLS (SR 3.3.5.4). The CHANNEL CALIBRATION, MIC, and TADOTs, which are manual tests, overlap with the continuous automatic self-testing and confirm the functioning of the automatic tests. The MIC is described in Reference 2 and Reference 3.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

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BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.5.4

SR 3.3.5.4 is the performance of a TADOT for the GTG control outputs of the SLS. an ACTUATION LOGIC TEST. The Class 1E GTG start logic within the PSMS is self tested on a continuous basis from the digital side of all input modules to the digital side of all output modules. Self testing also encompasses all data communications within a PSMS train, between PSMS trains and between the PSMS and PCMS. The self testing is described in Reference 2 and 3. The ACTUATION LOGIC TEST is a check of the PSMS software memory integrity to ensure there is no change to the internal PSMS software that would impact its functional operation or the continuous self test function. The software memory integrity test is described in Reference 2 and 3. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

The complete continuity check from the input device to the output device is performed by the combination of the continuous CHANNEL CHECK, the CHANNEL CALIBRATION for the non digital side of the input module, the continuous self testing for the digital side, the ACTUATION LOGIC TEST, and the ESFAS and SLS TADOT for the non digital side of the output module. The CHANNEL CALIBRATION, ACTUATION LOGIC TEST and TADOT, which are manual tests, overlap with the CHANNEL CHECK and self testing and confirm the functioning of the self testing.

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BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.5.5   MIC-03-16-0
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SR 3.3.5.5 is the performance of a TADOT for the Actuation Outputs to start the Class 1E GTGs. This function actuates the outputs of the SLS. Therefore, The scope of this TADOT is limited to the GTG control outputs of the SLS, including the interface of those outputs to the GTG. However, this test is typically conducted in conjunction with testing the Class 1E complete GTG. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program. The Actuation Outputs are solid state devices. including the fuel system and other GTG engine components, in accordance with LCO 3.8.1. Since this test is conducted in conjunction with testing for the Class 1E GTG components, this test may be conducted more frequently, as may be required for the Class 1E GTG components.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

REFERENCES

1.   FSAR Section 8.3.1.

2.   MUAP-07004-P (Proprietary) and MUAP-07004-NP (Non-Proprietary), Revision 7, "Safety I&C System Description and Design Process."   MIC-03-16-0
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3.   MUAP-07005-P (Proprietary) and MUAP-07005-NP (Non-Proprietary), Revision 8, "Safety System Digital Platform—MELTAC-."   MIC-03-16-0
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4.   10 CFR 50.36.

5.   FSAR Chapter 19.   MIC-03-16-0
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6.   FSAR Chapter 15.

7.   MUAP-09022-P, Revision 2, "US-APWR Instrument Setpoint Methodology."

B 3.3 INSTRUMENTATION

B 3.3.6 Diverse Actuation System (DAS) Instrumentation

BASES

BACKGROUND   The Diverse Actuation System (DAS) provides non-Class 1E backup
controls in case of beyond design basis common-cause failure (CCF) of the
digital I&C systems. CCF is a condition that concurrently affects all safety
and non-safety systems that contain the same digital software. CCF is
considered for the Protection and Safety Monitoring System (PSMS) and
the Plant Control and Monitoring System (PCMS). The DAS is not credited
for mitigating accidents in the FSAR Chapter 15 (Ref. 6) analyses.   MIC-03-16-0 0007

To initiate rReactor tTrip, the DAS uses equipment that is diverse from the
PSMS equipment (hardware and software) that is used to initiate a
rReactor tTrip. This diversity does not include the analog input sensors or
analog signal distribution devices.

To initiate ESF functions including tTurbine tTrip, the DAS uses equipment   MIC-03-16-0 0007
that is diverse from the PSMS software. This diversity does not include the
analog input sensors or analog signal distribution devices, or the final solid
state Actuation Outputs in the PSMS, which are referred to as Power
Interface (PIF) modules.   MIC-03-16-0 0007

The DAS includes manual and automatic initiation capability.

FSAR Chapter 7Defense-in-Depth and Diversity (Ref. 1) and FSAR Section   MIC-03-16-0 0007
7.8 (Ref. 3) provides a description of the DAS.

The DAS iInstrumentation is segmented into threefour distinct but
interconnected modules as described in FSAR Chapterthe
Defense-in-Depth and Diversity report (Ref. 1) and FSAR Section 7.8 (Ref.
3), and as identified below:

1.   Field transmitters or process sensors: provide a measurable
        electronic signal based upon the physical characteristics of the
        parameter being measured. The DAS shares field transmitters and
        process sensors, and signal distribution devices with the PSMS.

2.   The Diverse Automatic Actuation Cabinet (DAAC): provides signal
        conditioning, analog bistables for setpoint comparison, process   MIC-03-16-0 0007
        algorithm actuation, compatible electrical signal output to actuation
        devices, and control room indications. DAAC outputs provide the
        means to actuate the Rod Drive Motor-Generator Set Trip Devices   MIC-03-16-0 0007
        which interrupt power tofrom the Rod Drive Motor-Generator sets
        for rReactor tTrip. and DAAC outputs also provide the means to
        actuate tTurbine tTrip and other ESF functions, through the Power
        Interface modules of the PSMS. There are four DAACs. Each is
        referred to as a DAAC subsystem.

BASES

BACKGROUND (continued)

3.   Diverse Human System Interface Panel (DHP): provides indications, alarms and Manual Initiation controls for DAS.

4.   The Rod Drive Motor-Generator Set Trip Devices are actuated by output signals from the DAACs to interrupt power from the Rod Drive Motor-Generator Sets for Reactor Trip.   MIC-03-16-0 0007

Field Transmitters or Sensors

To meet the design demands for redundancy and reliability, four field transmitters or sensors are used to measure each unit parameter. To account for the calibration tolerances and instrument drift, which are assumed to occur between calibrations, statistical allowances are provided in the Nominal tTrip sSetpoint and Allowable Values. The OPERABILITY of each channel from the transmitter or sensor through the signal distribution device is determined by either "as-found" and "as-left" calibration data evaluated during the CHANNEL CALIBRATION or, and by qualitative assessment of field transmitter or sensor as related to the channel behavior observed during performance of the CHANNEL CHECK. Since all DAS measurement channels are shared with the PSMS, the PSMS CHANNEL CALIBRATION and CHANNEL CHECK also confirm OPERABILITY of the DAS instrumentation from the transmitter or sensor through the signal distribution device.   MIC-03-16-0 0007

DAAC Signal ProcessingProcess Control Equipment

For each DAS automatic actuation function, generally, four channels of process control equipment are used in each DASDAAC subsystem for the signal processing of unit parameters measured by the field instruments. The process control equipment provides signal conditioning, comparable output signals for instruments located on the DHP, and analog comparison of measured input signals with setpoints established by the D3 Coping Analysis (Ref. 2). These analog setpoints are recorded and maintained in a document established by the Setpoint Control Program (SCP). If the measured value of a unit parameter exceeds the predetermined setpoint, an binary output from a DAAC analog bistable is forwarded to the DAAC voting logic for decision evaluation. Channels are isolated in the PSMS prior to their interface to the DAAC subsystems.   MIC-03-16-0 0007 / MIC-03-16-0 0007 / MIC-03-16-0 0007

In each DAAC subsystem Threefour channels with a two-out-of-threefour logic are sufficient to provide the required reliability and redundancyprovided for each parameter. If one channel fails in a direction that would not result in a partial Function trip, the Function is still OPERABLE with a two-out-of-twothree logic. If one channel fails, such that a partial Function trip occurs, a spurious trip will not occur and the Function   MIC-03-16-0 0007 / MIC-03-16-0 0007

BASES

BACKGROUND (continued)

is still OPERABLE with a one-out-of-~~two~~three logic. Two channels are necessary to generate a trip or ESF actuation, and since the DAS needs to function with a concurrent fire or flood in any PSMS I&C equipment room, which is where these signals originate, three channels are required. A channel of process control equipment consists of the signal path from field transmitter or sensor through the analog bistable in each DAAC.

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The DAAC includes provisions to bypass a failed channel to prevent spurious trip~~/~~ or actuation conditions.

~~Two measurement channels are required to ensure no single random failure of a DAAC measurement channel will result in spurious reactor trip, turbine trip or ESF actuation.~~ The measurement channels are designed such that testing may be accomplished while the reactor is at power and without causing trip~~/~~ or actuation. ~~Three~~Four measurement channels are provided for each function ~~to allow~~, which allows one channel to be taken out of service with no operational restrictions.

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The OPERABILITY of the DAAC process control equipment is determined by a CHANNEL OPERATIONAL TEST (COT) and by an ACTUATION LOGIC TEST. The COT overlaps with the CHANNEL CALIBRATION and the ACTUATION LOGIC TEST overlaps with the COT. OPERABILITY of the interface from each DAAC to the PSMS PIF modules and to the Rod Drive Motor-Generator Set Trip Devices is determined by a TRIP ACTUATING DEVICE OPERATIONAL TEST (TADOT), which overlaps with the ACTUATION LOGIC TEST.

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Allowable Values and DAS Setpoints

The CHANNEL CALIBRATION verifies the accuracy of the measurement channels at five calibration settings corresponding to 0%, 25%, 50%, 75% and 100% of the instrument range. If the as-found value of the device is found to have exceeded the Allowable Value, or the as-left value of the device cannot be adjusted to a value within the Calibration Tolerance, the device would be considered inoperable from a technical specification perspective. This requires corrective action including those actions required by 10 CFR 50.36 when automatic protective devices do not function as required. Since DAS measurement channels are shared with the PSMS, the PSMS Reactor Trip or ESFAS Functions establish the accuracy requirements for the channel, including the Allowable Value and Calibration Tolerance for CHANNEL CALIBRATION.

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BASES

BACKGROUND (continued)

The trip setpoints Regulatory guidance (Ref. 8) allows best estimate methods for analysis that demonstrate adequate coping for Anticipated Operational Occurrences (AOOs) and Postulated Accidents (PA) with concurrent CCF. Therefore, the Nominal Trip Setpoints used in the DAAC analog bistables are based on the analytical limits stated specified in the D3 Coping Analysis. These setpoints (Ref. 2), with no channel uncertainty and no safety margin, in accordance with the setpoint methodology (Ref. 7). This results in analog setpoints that are generally less conservative than the corresponding digital setpoints in the PSMS to allow ensure the PSMS to actuate actuates first. If the PSMS actuates, DAS actuation is blocked. For plant operators, DAS actuation is indicative of an accident with a concurrent CCF in the PSMS, which prompts the use of special emergency procedures for beyond design basis plant conditions. Therefore, avoiding unnecessary DAS actuation is an important design basis consideration.

The selection of these the DAS analytical limits and corresponding trip setpoints is such that adequate protection is provided when all sensor and processing time delays are taken into account. To allow for calibration tolerances, instrumentation uncertainties, instrument drift, and severe environment errors for those DAS channels that must function in harsh environments as defined by 10 CFR 50.49 (Ref. 4), the Allowable Values recorded and maintained in a document established by the SCP in the accompanying LCO are conservative with respect to the analytical limits. A detailed description of the methodology used to calculate the Allowable Values and trip setpoints, incorporates the known uncertainties applicable to each channel. The magnitudes of these uncertainties are factored into the determination of each trip setpoint and corresponding Allowable Value. The trip setpoint entered into the bistable is more conservative than that specified by the Allowable Value to account for measurement errors detectable by the COT analog. The Allowable Value for the Nominal Trip Setpoint serves as the Technical Specification OPERABILITY limit for the purpose of the COT analog. Since the Nominal Trip Setpoints for DAS are set at the analytical limits in the D3 Coping Analysis (Ref. 2), the Allowable Value is established only to identify unexpected measurement error. One example of such a change in measurement error is drift during the surveillance interval. If the measured setpoint as-found value does not exceed the Allowable Value, the analog bistable is considered OPERABLE.

The Nominal t Trip s Setpoint is the value at which the analog bistable is set and is the expected value to be achieved during calibration COT. The Nominal t Trip s Setpoint value ensures the D3 Coping Analysis (Ref. 2) limits are met for surveillance interval selected when a channel is adjusted based on stated channel uncertainties. Any bistable is considered to be properly adjusted when the "as left" setpoint value is within the band for CHANNEL CALIBRATION uncertainty allowance (i.e., ± rack calibration + comparator setting uncertainties). The trip setpoint value is therefore

BASES

BACKGROUND (continued)

considered a "nominal" value (i.e., expressed as a value without inequalities) for the purposes of COT analog and CHANNEL CALIBRATION. A DAS analog bistable is considered to be properly adjusted when the "as-left" value is within the specified calibration tolerance around the Nominal Trip Setpoint.

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OPERABLE channels, with calibration settings and Nominal Trip sSetpoints consistent with the requirements of the Allowable Value ensure that the consequences of AOOs and PAs will be acceptable, providingprovided the unit is operated from within the LCOs at the onset of the AOO or PA and the equipment functions as designed. The calibration setting Allowable Values, and the Nominal Trip Setpoints and corresponding Allowable Values, are recorded and maintained in a document established by the SCP. The setpoint methodology identified in the SCP (Ref. 7), is used to calculate the Allowable Values and Nominal Trip Setpoints.

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The "expected as-found value" shall be as specified in the plant-specific setpoint analysis. The expected as-found value reflects the expected normal drift of actual plant equipment, so that a degraded device can be identified before the Allowable Value limit is reached. The expected as-found value is also referred to as the Performance Test Acceptance Criteria (PTAC). The PTAC, recorded and maintained in a document established by the SCP, is applicable to DAS automatic trip and actuation Functions.

Each channel of the process control equipment can be tested on linewhile in service to verify that the measurement channel signal or analog bistable setpoint accuracy is within the specified allowance requirements. Once a designated channel is taken out of service for testing, the field transmitter or sensor is stimulated or a simulated signal is injected in place of the field instrument signal. The process equipment for the channel in test is then tested, verified, and calibrated. SRs for the channels are specified in the SRs section.

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DAAC Actuation Logic and Actuation Outputs

There are four DAAC subsystems. Each DAAC subsystem processes each of the four measurement channels from the PSMS through separate analog bistables. The DAAC provides the decision logic processing of outputs from the signal processing equipment bistables. The DAAC Actuation Logic processes the outputs from the DAAC analog bistables through two-out-of-four voting logic. The outputs from the voting logic for one or more parameters are combined to generate the DAAC outputs for Reactor Trip, Turbine Trip and ESF actuation.

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The DAAC subsystems also process the signals and generate the Actuation Outputs for the Manual Initiation and Manual Control Functions. For Functions that have both automatic and manual signals, the signals are

BASES

BACKGROUND (continued)

combined in each DAAC subsystem to generate a common Actuation Output.

To prevent spurious actuation, two and loss of the functions due to one DAAC subsystem failure, the output signals from four DAAC subsystems of DAAC, each performing the same functions, are providedcombined in a two-out-of-two voting logic after taking one-out-of-two voting logic twice. If the same Function outputs are generated from a selective two DAAC subsystems (i.e., DAAC1 or DAAC3, concurrent with DAAC2 or DAAC4), a Reactor Trip, Turbine Trip and/or ESF actuation will result.

The DAS needs to function with a concurrent fire or flood in any PSMS I&C equipment room, which is were these subsystems are located. All four DAAC subsystems are required because the outputs of the DAAC subsystems are configured in a selective two-out-of-four configuration, not a full two-out-of-four configuration.

The subsystems are designed such that testing may be accomplished while the reactor is at power and without causing trip/Reactor Trip, Turbine Trip or ESF actuation. If one subsystem is actuated for maintenance or test purposes, there will be no reactor trip, turbine trip or ESF actuationDAS Functions for Reactor Trip, Turbine Trip or ESF actuation are maintained for the unit. If both subsystems are actuated, a reactor trip, turbine trip and/or ESF actuation will result. Each DAAC subsystem is packaged in its own cabinet forto satisfy physical and electrical separation to satisfy separation and independence requirements. The system has been designed to not trip/ or actuate in the event of a loss of power, to prevent spurious actuation.

The DAAC performs the decision logic for actuating a rReactor tTrip, tTurbine tTrip or ESF actuation, generates the electrical output signal that will initiate the required trip or actuation, and provides the status, permissive, and annunciator output signals to the mMain cControl rRoom (MCR) of the unit.

Within each DAAC subsystem, the bistable outputs from the signal processing equipment are combined into logic matrices that represent combinations indicative of various unit upset and accident transients. If a required logic matrix combination is completed, the system will send actuation signals, to those components whose aggregate Function best serves to alleviate the condition and restore the unit to a safe condition, via PSMS Power Interface modules, if necessary. Examples are given in the Applicable Safety Analyses, LCO, and Applicability sections of this Bases. Output signals from each DAAC Subsystem are combined in a two-out-of-two logic within Rod Drive Motor-Generator set trip devices or the Power Interface module for each plant component. When each DAAC subsystem is tested, the interface to the Power Interface is tested. When plant components

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BASES

BACKGROUND (continued)

The OPERABILITY of the DAAC Actuation Logic Function is determined by an ACTUATION LOGIC TEST. The ACTUATION LOGIC TEST overlaps with the COT.

The OPERABILITY of DAAC Actuation Outputs for ESF functions and Turbine Trip, which interface from each DAAC to the PIF modules in the PSMS, is determined by a TADOT (SR 3.3.6.5) which overlaps with the ACTUATION LOGIC TEST. When PIF modules are actuated ~~from the PSMS,~~ either during the ESFAS Instrumentation TADOT (SR 3.3.2.3) or for testing or control of ESF plant components, the ~~PSMS~~Safety Logic System (SLS) output signals overlap with the DAAC output signals within the ~~Power Interface. This overlap completes the DAS Function testing. Testing of PSMS components is per LCO 3.3.2.~~PIF modules.

The OPERABILITY of DAAC Actuation Outputs for Reactor Trip, which interface from each DAAC to the Rod Drive Motor-Generator Set Trip Devices, and the OPERABILITY of the Rod Drive Motor-Generator Set Trip Devices themselves, is determined by a TADOT (SR 3.3.6.6) which overlaps with the ACTUATION LOGIC TEST.

Rod Drive Motor-Generator ~~sets~~Set Trip Devices

The Rod Drive Motor-Generator sets are the electrical power supply for the control rod drive mechanisms (CRDMs). ~~Tripping~~Actuating the Rod Drive Motor-Generator ~~sets trip devices~~Set Trip Devices interrupts power to the CRDMs, which allows the control rod shutdown banks and control banks to fall into the core by gravity. There are two Rod Drive Motor-Generator ~~s~~Sets operating in parallel~~.~~ to power all rods. Each has its own Rod Drive Motor-Generator Set Trip Device. The DAS trips both Rod Drive Motor-Generator ~~sets trip devices~~Set Trip Devices.

The DAS interface~~s~~ to the Rod Drive Motor-Generator ~~sets is~~Set Trip Devices are via hardwired circuit~~. This interface may be tested, with no reactor trip, as described in subsection 7.8.2.4. Actual tripping of the Rod Drive Motor-Generator set may be tested from the DAS. Rod Drive Motor-Generator sets may be tripped one at a time for testing~~s. Actual tripping of each Motor-Generator Set and the associated DAS interface may be tested one at a time, with no Reactor Trip. Actual tripping of each Rod Drive Motor-Generator Set may be tested from the DAS.

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BASES

BACKGROUND (continued)

Diverse Human System Interface Panel (DHP)

The DHP provides Manual Initiation switches for all DAS automatic actuation functions and for additional functions that are required, per the D3 Coping Analysis (Ref. 2), to control all critical safety functions. Manual Initiation and Control switches are not redundant. To prevent spurious actuation due to a failure of any of the above switches, a separate manual actuation pPermissive sSwitch is provided. This is referred to as the "Permissive Switch for DAS HSI." | MIC-03-16-0 0007

| MIC-03-16-0 0007

The Manual Initiation and Manual Control switches interface to DAAC subsystems 1 and 3, and the Permissive Switch for DAS HSI interface to DAAC subsystems 2 and 4. Manual Initiation/Control signals and Permissive signals are combined with automatic actuation signals to generate the same DAS outputs. Therefore, as for automatic signals, if the same Manual Initiation/Control Function outputs are generated from a selective two DAAC subsystems (i.e., DAAC1 or DAAC3, concurrent with DAAC2 or DAAC4), a Reactor Trip, Turbine Trip and/or ESF actuation will result. | MIC-03-16-0 0007

The OPERABILITY of the DHP Manual Initiation/Control and Permissive switches, including the interface to the DAAC subsystems and the interface from the DAAC subsystems to the PSMS PIF modules, is determined by a TADOT (SR 3.3.6.5). The OPERABILITY of the DHP Manual Initiation/Control and Permissive switches, including the interface to the DAAC subsystems and the interface from the DAAC subsystems to the Rod Drive Motor-Generator Set Trip Devices, is determined by a TADOT (SR 3.3.6.6). These TADOTs overlap with the ACTUATION LOGIC TEST.

The DHP also provides indications, per and alarms to support the manual actions credited in the D3 Coping Analysis, (Ref. 2), and to monitor alland control critical safety functions.

The DHP also provides indications, per the D3 Coping Analysis, to monitor RCS Leakage.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY	The DAS is required to provide a diverse capability to trip the reactor and actuate the specified safety-related equipment. The DAS is not credited for mitigating accidents in the FSAR Chapter 15 safety analyses. The DAS satisfies Criterion 4 of 10 CFR 50.36(c)(2)(ii) (Ref. 5).

The DAS LCO provides the requirements for the OPERABILITY of the DAS necessary to place the reactor in a shutdown condition and to remove decay heat in the event that required PSMS components do not function due to CCF.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

A DAS measurement channel consists of the measurement device, its interface to each of the four DAAC subsystems, and the associated bistable within each of the four DAAC subsystems. A DAS measurement channel is OPERABLE provided the "as-found" values of the calibration settings checked during CHANNEL CALIBRATION do not exceed their associated Allowable Values, and the "as-found" value of the analog bistable trip setpoint checked during COT does not exceed its associated Allowable Value. A Nominal Trip Setpoint may be set more conservative than the Limiting Trip Setpoint as necessary in response to plant conditions. Failure of any instrument renders the affected channel(s) inoperable and reduces the reliability of the affected Functions.

MIC-03-16-0 0007

Due to redundant components within the DAS, such as analog bistables, voting logic, time delays and power supplies, an inoperable component may or may not result in an inoperable channel/subsystem. Where an inoperable component results in an inoperable required channel/subsystem, LCOs are entered. For inoperable components that do not result in inoperable channels/subsystems, LCOs are not entered.

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The DAS is required to be OPERABLE in the MODES specified in Table 3.3.6-1. All functions of the DAS are required to be OPERABLE in MODES 1, 2 and 3 with the pPressurizer pPressure > P-11.

MIC-03-16-0 0007

DAS functions are as follows:

1.   Reactor Trip, Turbine Trip and Main Feedwater Isolation

      a.   Manual Initiation

The LCO requires 1one channel to be OPERABLE. ThisThe channel consists of the Reactor Trip, Turbine Trip and Main Feedwater Isolation - Manual Initiation switch. This function requires operation of and its interface to DAAC 1 and 3, and the Permissive Switch for DAS HSI and its interface to DAAC 2 and 4. The Permissive Switch for DAS HSI is common for all DAS Manual Initiation/Control Functions. The operator can initiate this functiona specific DAS Function at any time by operation of both of these switches in the control room. This action will cause actuation of all components in the same manner as any of the automatic actuation signals.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY   (continued)

b.   ~~Automatic~~ Actuation Logic and Actuation Outputs

This LCO requires ~~two channels~~four DAAC subsystems to be OPERABLE. Actuation ~~l~~Logic and Actuation Outputs consists of all circuitry housed within the DAAC, up to the Rod Drive Motor-Generator Set Trip Devices or the Power Interface modules ~~responsible~~ for ~~actuating~~ the ESF equipment.

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c.   Low Pressurizer Pressure

There are four Low Pressurizer Pressure channels ~~in~~with two-out-of-four voting logic in each DAAC subsystem. This automatic function is automatically blocked when status signals (P-4) are received indicating that the minimum combination of the RTBs have actuated for the RT function. The LCO requires ~~2~~3 Low Pressurizer Pressure channels for each DAAC subsystem to be OPERABLE.

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d.   High Pressurizer Pressure

There are four High Pressurizer Pressure channels ~~in~~with two-out-of-four voting logic in each DAAC subsystem. This automatic function is automatically blocked when status signals (P-4) are received indicating that the minimum combination (2-out-of-4) of the RTBs have actuated for the RT function. The LCO requires ~~2~~3 High Pressurizer Pressure channels for each DAAC subsytem to be OPERABLE.

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e.   Low Steam Generator Water Level

There is one Low SG Water Level channel for each SG (four total). The LCO requires 1 Low SG Water Level channel for each DAAC subsystem to be OPERABLE on any ~~2~~3 Steam Generators. These signals from each SG are processed ~~through~~with two-out-of-four voting logic in each DAAC subsystem. The D3 Coping Analysis (Ref. 2) demonstrates that the two-out-of-four voting logic is adequate for all secondary events including loss of feedwater and SG rupture. This automatic function is automatically blocked when status signals (P-4) are received indicating that the minimum combination (2-out-of-4) of the RTBs have actuated for the RT function.

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

f.   Rod Drive Motor-Generator Set Trip Device   MIC-03-16-0
                                                          0007

This LCO requires two Rod Drive Motor-Generator ~~s~~Set

~~This LCO requires two channels~~ Trip Device subsystems,
one for each Motor-Generator set, to be OPERABLE. ~~Each
channel~~This is because each subsystem trips one
Motor-Generator set. ~~Both~~and both Motor-Generator sets
must be tripped for this Reactor Trip Function. The DAS
cannot initiate a Reactor Trip with a failure of a Rod Drive
Motor-Generator Set Trip Device.

2.   Emergency Feedwater Actuation

a.   Manual Initiation

Manual Initiation consists of the same features and operates
in the same manner as described for DAS Function 1.a. One   MIC-03-16-0
channel is required to be OPERABLE.   0007

b.   ~~Automatic~~ Actuation Logic and Actuation Outputs

~~Automatic a~~Actuation ~~l~~Logic and ~~a~~Actuation ~~o~~Outputs
consist of the same features and operate in the same
manner as described for DAS Function 1.b. Four   MIC-03-16-0
subsystems are required to be OPERABLE.   0007

c.   Low Steam Generator Water Level

The Low Steam Generator Water Level channels consist of
the same features and operate in the same manner as
described for DAS Function 1.e. ~~This~~One Low SG Water   MIC-03-16-0
Level channel for each DAAC subsystem is required to be   0007
OPERABLE on any 3 Steam Generators.

The DAS Emergency Feedwater (EFW) Actuation automatic
function is automatically blocked when status signals are
received indicating that the PSMS ESFAS EFW function has   MIC-03-16-0
actuated correctly. Correct actuation is indicated when   0007
~~2 out of 4~~ status signals are received from limit switch   MIC-03-16-0
contacts on the steam inlet valves to the turbine driven EFW   0007
pumps ~~and~~or from auxiliary contacts on the motor starters   MIC-03-16-0
controlling the motor driven EFW pumps.   0007

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

3.   ECCS Actuation

a.   Manual Initiation

Manual Initiation consists of the same features and operates in the same manner as described for DAS Function 1.a. One channel is required to be OPERABLE.

MIC-03-16-0 0007

b.   Actuation Logic and Actuation Outputs

Actuation Logic and Actuation Outputs consist of the same features and operate in the same manner as described for DAS Function 1.b. Four subsystems are required to be OPERABLE.

c.   ECCS Actuation – Low-Low Pressurizer Pressure

There are four Low-Low Pressurizer Pressure channels with two-out-of-four voting logic in each DAAC subsystem. This automatic function is automatically blocked when status signals are received from auxiliary contacts on the motor starters controlling the Safety Injection (SI) pumps, indicating that 2-out-of-4 pumps have actuated. The LCO requires 3 Low-Low Pressurizer Pressure channels for each DAAC subsystem to be OPERABLE.

4.   Containment Isolation

a.   Manual Initiation

There are two valves for each containment penetration. Only one of the two valves is controlled by the DAS. Manual Initiation consists of the same features and operates in the same manner as described for DAS Function 1.a. One channel is required to be OPERABLE.

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b.   Actuation Logic and Actuation Outputs

Actuation Logic and Actuation Outputs consist of the same features and operate in the same manner as described for DAS Function 1.b. Four subsystems are required to be OPERABLE.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

5.   EFW Isolation Valves

a.   Manual Control

There are separate EFW Isolation Valves Control ~~switches~~channels for each Steam Generator. Manual Control consists of the same features and operates in the same manner as described for DAS Function 1.a. The LCO requires ~~1~~one channel to be OPERABLE for each of the four Steam Generators. ~~This consists of the EFW Isolation Valves - Manual Control switch, and the Permissive Switch for DAS HSI. The Permissive Switch for DAS HSI is common for all DAS Manual Initiation/Control Functions.~~ The operator can initiate this ~~function~~Function for any single Steam Generator at any time by operation of both of these switches in the control room.

MIC-03-16-00007

b.   Actuation Logic and Actuation Outputs

Actuation Logic and Actuation Outputs consist of the same features and operate in the same manner as described for DAS Function 1.b. Four subsystems are required to be OPERABLE.

MIC-03-16-00007

6.   Pressurizer Safety Depressurization Valves

a.   Manual Control

There are four Pressurizer Safety Depressurization Valves. Only one of the four valves is controlled by the DAS. The LCO requires one channel to be OPERABLE. The channel consists of the Pressurizer Safety Depressurization Valves - Manual Control switch, and the Permissive Switch for DAS HSI. The Permissive Switch for DAS HSI is common for all DAS Manual Initiation ~~consists~~/Control Functions. The operator can initiate this function at any time by operation of both of these switches in the control room.

MIC-03-16-00007

b.   Actuation Logic and Actuation Outputs

Actuation Logic and Actuation Outputs consist of the same features and operate~~s~~ in the same manner as described for DAS Function 1.~~a~~b. Four subsystems are required to be OPERABLE.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

    7.   <u>Main Steam Depressurization Valves</u>

        a.   <u>Manual Control</u>

There are separate Main Steam Depressurization Valve ~~switches~~Control channels for each Steam Generator. The LCO requires ~~1~~one channel to be OPERABLE for each of the four Steam Generators. ~~This~~A channel consists of the Main Steam Depressurization Valves - Manual Control switch, and the Permissive Switch for DAS HSI. The Permissive Switch for DAS HSI is common for all DAS Manual Initiation/Control Functions. The operator can initiate ~~Main Steam Depressurization Valves~~this Function for any single Steam Generator at any time by operation of both of these switches in the control room.

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<div style="text-align:right">MIC-03-16-0 0007</div>

    8.   <u>Main Steam Line Isolation</u>

        a.   <u>Manual Initiation</u>

Manual Initiation consists of the same features and operates in the same manner as described for DAS Function 1.a. One channel is required to be OPERABLE.

        b.   <u>Actuation Logic and Actuation Outputs</u>

Actuation Logic and Actuation Outputs consist of the same features and operate in the same manner as described for DAS Function 1.b. Four subsystems are required to be OPERABLE.

ACTIONS

In all cases where the LCO states "Restore channel or subsystem to OPERABLE status", this means restore the required number of channels or subsystems to OPERABLE status. Therefore, restoration of an alternate channel or subsystem, other than the failed channel or subsystem, is also acceptable.

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<u>A.1</u>~~, A.2.1, and A.2.2~~

Condition A applies when one or more subsystems or required ~~DAS Functions~~channels are inoperable~~.~~

~~If~~ in one or more ~~required DAS functions are~~Functions. With one subsystem or required channel inoperable, 30 days are allowed to restore the ~~Function~~channel or subsystem to OPERABLE status.

BASES

ACTIONS (continued)

The Completion Time of 30 days is ~~reasonable~~justified because the DAS is a separate and diverse non-safety backup system. ~~The 30 days Completion Time allows sufficient time to repair an inoperable DAS and ensures the control is repaired to provide backup protection~~In addition, the Completion Time considers that the remaining OPERABLE channels and Actuation Logic and Actuation Outputs subsystems are adequate to perform the DAS Function.~~.~~

~~Failure to restore the inoperable channel to OPERABLE status or place it in the tripped condition within 30 days, requires the unit be placed in MODE 3 within the following 6 hours and MODE 4 within the next 6 hours.~~The Required Actions are modified by two Notes. Note 1 allows placing the Actuation Logic of one subsystem or one required channel in bypass for up to 4 hours while performing surveillance testing, provided the Actuation Logic in the other subsystems or the other required channels are OPERABLE. This Note does not allow a bypass with one channel or subsystem in the tripped condition, as for the RTS and ESFAS, to avoid a spurious DAS actuation.

The Bypass Time of 4 hours for Actuation Logic and channels is justified because the remaining OPERABLE channels or subsystems are adequate to perform the safety function.

Note 2 allows placing the Actuation Outputs of two subsystems in bypass for up to 4 hours while performing surveillance testing of the Actuation Outputs from the other subsystems, or surveillance testing of the Rod Drive Motor-Generator Set Trip Devices. This bypass avoids spurious DAS actuation, because the Actuation Outputs and Rod Drive Motor-Generator Set Trip Devices must be actuated for these tests and they do not have bypass test capability.

When the Actuation Outputs of DAAC 1 or DAAC 3 are tested, this Note allows bypassing the Actuation Outputs of DAAC 2 and DAAC 4, to prevent spurious signals that would result in a spurious reactor trip or ESF actuation. When the Actuation Outputs of DAAC 2 or DAAC 4 are tested, this Note allows bypassing the Actuation Outputs of DAAC 1 and DAAC 3, to prevent spurious signals that would result in a spurious reactor trip or ESF actuation.

When Rod Drive Motor-Generator Set Trip Device 1 is tested, this Note allows bypassing the Actuation Outputs of DAAC 2 and DAAC 4, to prevent spurious signals that would trip Rod Drive Motor-Generator Set Trip Device 2 and cause a spurious reactor trip. When Rod Drive Motor-Generator Set Trip Device 2 is tested, this Note allows bypassing the Actuation Outputs of DAAC 1 and DAAC 3, to prevent spurious signals that would trip Rod Drive Motor-Generator Set Trip Device 1 and cause a spurious reactor trip.

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BASES

ACTIONS (continued)

The Bypass Time of 4 hours for Actuation Outputs is justified because the DAS is a separate and diverse non-safety backup system.   MIC-03-16-0 0007

The 4 hour Bypass Time for all Functions is reasonable, based on operating experience that 4 hours is the average time required to perform a channel, Actuation Logic, Actuation Output or Rod Drive Motor-Generator Set Trip Device surveillance.

B.1 and B.2

Condition B applies when the Required Action and associated Completion Time of Condition A are not met. In this condition, 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 4 within 12 hours. The allowed Completion Times for Required Actions A.2 and A.3 are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems. In MODE 4, these Functions are no longer required OPERABLE.   MIC-03-16-0 0007

SURVEILLANCE REQUIREMENTS

SR 3.3.6.1

SR 3.3.6.1 is performance of CHANNEL CHECK. Performance of the CHANNEL CHECK ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the two instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION.   MIC-03-16-0 0007

Agreement criteria are determined by the unit staff based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the criteria, it may be an indication that the sensor or the signal processing equipment has drifted outside its limit.   MIC-03-16-0 0007

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.6.2

A COT ~~analog~~ is performed on each required channel to ensure the ~~entire channel~~DAAC process control equipment (including analog bistable modules) and DHP indications and alarms will perform ~~the~~their intended Function. The COT for DAS is performed by injecting simulated process measurement signals at a point that overlaps with the CHANNEL CALIBRATION. The signal distribution module for sensors shared between PSMS and DAS shall be checked by either CHANNEL CALIBRATION or COT.

MIC-03-16-0 0007

A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of single contact of the relay. This clarifies what is an acceptable COT of a relay. This is acceptable because all of the other required contacts of relay are verified by Technical Specifications and Non-Technical Specifications test at least once per refueling interval with applicable extensions.

~~Setpoints~~The COT confirms the accuracy of the channel's trip setting (i.e., the channel's analog bistable state change). The state change must ~~be~~occur within the Allowable Value ~~administered~~of the Nominal Trip Setpoint. The Nominal Trip Setpoints and Allowable Values are recorded and maintained in a document established by the SCP.

MIC-03-16-0 0007

The analog setpoint shall be left set consistent with the Calibration Tolerance recorded and maintained in a document established by the SCP~~the assumptions of the current unit specific setpoint methodology~~.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.3.6.3

CHANNEL CALIBRATION is a complete check of the instrument loop, including the sensor. The test ~~verifies~~must be performed consistent with the methods and assumptions of Specification 5.5.21, SCP, to verify that the channel responds to a measured parameter within the necessary range and accuracy. Since all DAS channels are shared with the PSMS, a Note has been added that allows the CHANNEL CALIBRATION conducted for the PSMS in LCO 3.3.1 or 3.3.2 to be credited for DAS.

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MIC-03-16-0 0007

~~CHANNEL CALIBRATION must be performed consistent with the methods and assumptions in Section 5.5.21 SCP.~~

BASES

SURVEILLANCE REQUIREMENTS (continued)

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.3.6.4

An ACTUATION LOGIC TEST is performed on each of the ~~DAAC (~~four Diverse Automatic Actuation Cabinet~~) using the semiautomatic tester. The channel being tested is placed in the bypass condition, thus preventing inadvertent actuation. Through the semiautomatic tester, all~~ subsystems. All possible logic combinations are tested for each protection function. Verification of ~~Bistable module,~~each Logic module, and Output module is included in this test.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.3.6.5

A TADOT is performed for the Manual Initiation/Control and Actuation Outputs of all DAS functions. This test actuates the outputs to the PSMS Power Interface modules. Through overlap with the ACTUATION LOGIC TEST, the TADOT confirms these outputs can be generated from the Manual Initiation/Control switches and from the Automatic Actuation Logic.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program. ~~The Actuation Outputs are solid state devices.~~

SR 3.3.6.6

A TADOT for the Rod Drive Motor-Generator set trip devices is performed by actuating the Manual Initiation switch from the control room and by verifying actuation of the Rod Drive Motor-Generator set trip device. Through overlap with the ACTUATION LOGIC TEST, the TADOT confirms the Rod Drive Motor-Generator set trip devices can be actuated from the Manual Initiation/Control switches and from the Automatic Actuation Logic.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

BASES

REFERENCES   1.   MUAP-07006-P ~~(Proprietary) and MUAP-07006-NP (Non-Proprietary)~~ A, Revision 2, "Defense-in-Depth and Diversity."   MIC-03-16-00007

     2.   MUAP-07014-P ~~(Proprietary) and MUAP-07014-NP (Non-Proprietary)~~. Revision 4, "Defense-in-Depth and Diversity Coping Analysis."

     3.   FSAR Section 7.8.

     4.   10 CFR 50.49.

     5.   10 CFR 50.36.

     6.   FSAR Chapter 15.   MIC-03-16-00007

     7.   MUAP-09022-P, Revision 2, "US-APWR Instrument Setpoint Methodology."

     8.   U.S. Nuclear Regulatory Commission, Standard Review Plan, Branch Technical Position 7-19, "Guidance for Evaluation of Diversity and Defense-in-Depth in Digital Computer-Based Instrumentation and Control Systems."

BASES

| ACTIONS | A.1 |

RCS pressure and RCS average temperature are controllable and measurable parameters. With one or both of these parameters not within LCO limits, action must be taken to restore parameter(s).

RCS total flow rate is not a controllable parameter and is not expected to vary during steady state operation. If the indicated RCS total flow rate is below the LCO limit, power must be reduced, as required by Required Action B.1, to restore DNB margin and eliminate the potential for violation of the accident analysis bounds.

The 2 hour Completion Time for restoration of the parameters provides sufficient time to adjust plant parameters, to determine the cause for the off normal condition, and to restore the readings within limits, and is based on plant operating experience.

B.1

If Required Action A.1 is not met within the associated Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 2 within 6 hours. In MODE 2, the reduced power condition eliminates the potential for violation of the accident analysis bounds. The Completion Time of 6 hours is reasonable to reach the required plant conditions in an orderly manner.

SURVEILLANCE REQUIREMENTS

SR 3.4.1.1

Periodic Surveillance for pressurizer pressure is performed to ensure the pressure can be restored to a normal operation, steady state condition following load changes and other expected transient operations.   DCD_16-304

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.4.1.2

Periodic Surveillance for RCS average temperature is performed to ensure the temperature can be restored to a normal operation, steady state condition following load changes and other expected transient operations.   DCD_16-304

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.1.3

Surveillance for RCS total flow rate is performed using the installed flow instrumentation.   DCD_16-304

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.4.1.4

Measurement of RCS total flow rate by performance of a precision calorimetric heat balance allows the installed RCS flow instrumentation to be calibrated and verifies the actual RCS flow rate is greater than or equal to the minimum required RCS flow rate.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

This SR is modified by a Note that allows entry into MODE 1, without having performed the SR, and placement of the unit in the best condition for performing the SR. The Note states that the SR is not required to be performed until 24 hours after ≥ 90% RTP. This exception is appropriate since the heat balance requires the plant to be at a minimum of 90% RTP to obtain the stated RCS flow accuracies. The Surveillance shall be performed within 24 hours after reaching 90% RTP.

| REFERENCES | 1. | FSAR Chapter 15. |

BASES

LCO	The two elements of this LCO are:

    a.   The limit curves for heatup, cooldown, and ISLH testing and criticality; and

    b.   Limits on the rate of change of temperature.

The LCO limits apply to all components of the RCS, except the pressurizer. These limits define allowable operating regions and permit a large number of operating cycles while providing a wide margin to nonductile failure.

The limits for the rate of change of temperature control the thermal gradient through the vessel wall and are used as inputs for calculating the heatup, cooldown, and ISLH testing P/T limit curves. Thus, the LCO for the rate of change of temperature restricts stresses caused by thermal gradients and also ensures the validity of the P/T limit curves.

Violating the LCO limits places the reactor vessel outside of the bounds of the stress analyses and can increase stresses in other RCPB components. The consequences depend on several factors, as follow:

    a.   The severity of the departure from the allowable operating P/T regime or the severity of the rate of change of temperature,

    b.   The length of time the limits were violated (longer violations allow the temperature gradient in the thick vessel walls to become more pronounced), and

    c.   The existences, sizes, and orientations of flaws in the vessel material.   CTS-01471

APPLICABILITY	The RCS P/T limits LCO provides a definition of acceptable operation for prevention of nonductile (brittle) failure in accordance with 10 CFR 50, Appendix G (Ref. 1). Although the P/T limits were developed to provide guidance for operation during heatup or cooldown (MODES 3, 4, and 5) or ISLH testing, they are applicable at all times in keeping with the concern for nonductile failure. The limits do not apply to the pressurizer.

During MODES 1 and 2, other Technical Specifications provide limits for operation that can be more restrictive than or can supplement these P/T limits. LCO 3.4.1, "RCS Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits," LCO 3.4.2, "RCS Minimum Temperature for Criticality," and Safety Limit 2.1, "Safety Limits," also provide operational restrictions for pressure and temperature and

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.6 RCS Loops - MODE 4

BASES

BACKGROUND	In MODE 4, the primary function of the reactor coolant is the removal of decay heat and the transfer of this heat to either the steam generator (SG) secondary side coolant or the component cooling water via the residual heat removal (CS/RHR) heat exchangers. The secondary function of the reactor coolant is to act as a carrier for soluble neutron poison, boric acid.

The reactor coolant is circulated through four RCS loops connected in parallel to the reactor vessel, each loop containing an SG, a reactor coolant pump (RCP), and appropriate flow, pressure, level, and temperature instrumentation for control, protection, and indication. The RCPs circulate the coolant through the reactor vessel and SGs at a sufficient rate to ensure proper heat transfer and to prevent boric acid stratification.

In MODE 4, either RCPs or RHR loops can be used to provide forced circulation. The intent of this LCO is to provide forced flow from at least one RCP or two RHR loop for decay heat removal and transport. The flow provided by one RCP loop or RHR loop is adequate for decay heat removal. The other intent of this LCO is to require that additional paths be available to provide redundancy for decay heat removal.

Additionally, forced coolant circulation provided by at least one RCP ensures that the concentration of soluble boron in the reactor coolant is homogeneous. However, when no RCPs are operating, all isolation valves for reactor makeup water sources containing unborated water that are connected to the Reactor Coolant System (RCS) must be secured closed to prevent unplanned boron dilution of the reactor coolant. This will ensure that an inadvertent boron dilution event does not occur under reduced flow conditions where unborated water could stratify in the RCS.   DCD_15.4.6-6

APPLICABLE SAFETY ANALYSES	In MODE 4, RCS circulation is considered in the determination of the time available for mitigation of the accidental boron dilution event. The prevention of an accidental boron dilution event is ensured by requiring that all sources of unborated water be isolated from the RCS when RCS circulation is not provided by at least one operating RCPRCS and RHR loops provide this circulation. DCD_15.4.6-6

RCS Loops - MODE 4 satisfies Criterion 4 of 10 CFR 50.36(c)(2)(ii).

BASES

LCO (continued)

The purpose of this LCO is to require that at least two RCS loops or three RHR loops are OPERABLE in MODE 4 and that one of the RCS loops or two of the RHR loops are in operation. Any one RCS loop or two RHR loops in operation provides enough flow to remove the decay heat from the core with forced circulation. An additional loop is required to be OPERABLE to provide redundancy for heat removal. However, consistency with the Chapter 15.4.6 Safety Analysis (Reference 1) assumptions requires that unborated water sources be isolated from the RCS when only RHR pumps are used to provide forced circulation.

DCD_15.4.6-6

Note 1 permits all RCPs or CS/RHR pumps to be removed from operation for ≤ 1 hour per 8 hour period. The purpose of the Note is to permit tests that are designed to validate various accident analyses values. One of the tests performed during the startup testing program is the validation of rod drop times during cold conditions, both with and without flow. The no flow test may be performed in MODE 3, 4, or 5 and requires that the pumps be stopped for a short period of time. The Note permits the stopping of the pumps in order to perform this test and validate the assumed analysis values. If changes are made to the RCS that would cause a change to the flow characteristics of the RCS, the input values must be revalidated by conducting the test again. The 1 hour time period is adequate to perform the test, and operating experience has shown that boron stratification is not a problem during this short period with no forced flow.

Utilization of Note 1 is permitted provided the following conditions are met along with any other conditions imposed by initial startup test procedures:

a.   No operations are permitted that would dilute the RCS boron concentration with coolant with boron concentrations less than required to meet SDM of LCO 3.1.1, therefore maintaining the margin to criticality. Boron reduction with coolant at boron concentrations less than required to assure SDM is maintained is prohibited because a uniform concentration distribution throughout the RCS cannot be ensured when in natural circulation and

b.   Core outlet temperature is maintained at least 10°F below saturation temperature, so that no vapor bubble may form and possibly cause a natural circulation flow obstruction.

Note 2 requires that the secondary side water temperature of each SG be ≤ 50°F above each of the RCS cold leg temperatures before the start of an RCP with any RCS cold leg temperature ≤ Low Temperature Overpressure Protection (LTOP) arming temperature specified in the PTLR. This restraint is to prevent a low temperature overpressure event due to a thermal transient when an RCP is started.

BASES

LCO (continued)

An OPERABLE RCS loop comprises an OPERABLE RCP and an OPERABLE SG, which has the minimum water level specified in SR 3.4.6.2.

Similarly for the RHR System, an OPERABLE RHR loop comprises an OPERABLE CS/RHR pump capable of providing forced flow to an OPERABLE CS/RHR heat exchanger. RCPs and CS/RHR pumps are OPERABLE if they are capable of being powered and are able to provide forced flow if required.

APPLICABILITY

In MODE 4, this LCO ensures forced circulation of the reactor coolant to remove decay heat from the core and to provide proper boron mixing. One loop of RCS or two loops of RHR provides sufficient circulation for ~~these purposes~~the removal of decay heat from the core. However, two loops of RHR do not provide sufficient circulation to provide proper boron mixing. Therefore, the LCO requires that the valves used to isolate unborated water sources be secured in the closed position when no RCPs are running. ~~a~~Additional loops consisting of RCS and RHR loops are required to be OPERABLE to meet single failure considerations.

DCD_15.4.6-6

Operation in other MODES is covered by:

LCO 3.4.4,   "RCS Loops - MODES 1 and 2,"

LCO 3.4.5,   "RCS Loops - MODE 3,"

LCO 3.4.7,   "RCS Loops - MODE 5, Loops Filled,"

LCO 3.4.8,   "RCS Loops - MODE 5, Loops Not Filled,"

LCO 3.9.5,   "Residual Heat Removal (RHR) and Coolant Circulation - High Water Level" (MODE 6), and

CTS-01472

LCO 3.9.6,   "Residual Heat Removal (RHR) and Coolant Circulation - Low Water Level" (MODE 6).

BASES

ACTIONS (continued)

B.1 and B.2

If two or more required loops are inoperable or a required loop(s) are not in operation, except during conditions permitted by Note 1 in the LCO section, all operations involving introduction of coolant into the RCS with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 must be suspended and action to restore one RCS or RHR loop to OPERABLE status and operation must be initiated. The required margin to criticality must not be reduced in this type of operation. Suspending the introduction of coolant into the RCS of coolant with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 is required to assure continued safe operation. With coolant added without forced circulation, unmixed coolant could be introduced to the core, however coolant added with boron concentration meeting the minimum SDM maintains acceptable margin to subcritical operations. The immediate Completion Times reflect the importance of maintaining operation for decay heat removal. The action to restore must be continued until the required loop(s) are restored to OPERABLE status and operation.

C.1   DCD_15.4.6-
                                                                                            6
ACTION C has been modified by two Notes. The first Note allows separate Condition entry for each unborated water source isolation valve. The second Note requires that Required Action C.2 be completed whenever Condition C is entered.

Preventing inadvertent dilution of the reactor coolant boron concentration when there is insufficient RCS mixing is dependent on maintaining the unborated water isolation valves secured closed when there are no RCPs operating. Securing the valves in the closed position ensures that the valves cannot be inadvertently opened. Planned dilution and makeup operations are sometimes required to compensate for transient conditions which result in a continuous change in the RCS mass. This ACTION allows exception to the requirement to isolate all sources of unborated water for the purpose of performing these planned and procedurally controlled operations, but requires that the isolation status be quickly restored (within 15 minutes) following the planned activity. The Completion Time of immediately requires an operator to initiate actions to close an open valve and secure the isolation valve in the closed position in a timely manner. Once actions are initiated, they must be continued until the valves are secured in the closed position.

BASES

ACTIONS (continued)

C.2   DCD_15.4.6-
6

Due to the potential of having diluted the boron concentration of the reactor coolant, SR 3.1.1.1 (verification of boron concentration) must be performed whenever Condition C is entered to demonstrate that the required boron concentration exists. The Completion Time of 4 hours is sufficient to obtain and analyze a reactor coolant sample for boron concentration.

SURVEILLANCE   SR 3.4.6.1
REQUIREMENTS

This SR requires verification that the required RCS or RHR loop is in operation. Verification includes flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal. In   DCD_15.4.6-
the event that no RCPs are operating to provide sufficient mixing conditions   6
to satisfv the Chapter 15 Safety Analysis assumption the operator is instructed to perform SR 3.4.6.4 to isolate all sources of unborated water to prevent an inadvertent dilution. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.4.6.2

SR 3.4.6.2 requires verification of SG OPERABILITY. SG OPERABILITY is verified by ensuring that the secondary side narrow range water level is ≥ 13%. If the SG secondary side narrow range water level is < 13%, the tubes may become uncovered and the associated loop may not be capable of providing the heat sink necessary for removal of decay heat. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.6.3

Verification that each required pump is OPERABLE ensures that an additional RCS or CS/RHR pump can be placed in operation, if needed, to maintain decay heat removal and reactor coolant circulation. Verification is performed by verifying proper breaker alignment and power available to each required pump. Alternatively, verification that a pump is in operation also verifies proper breaker alignment and power availability. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

This SR is modified by a Note that states the SR is not required to be performed until 24 hours after a required pump is not in operation.

SR 3.4.6.4   DCD_15.4.6-6

Verify that unborated water sources are isolated from the RCS when operating with RHR loops in service and no RCPs running ensures that an inadvertent boron dilution cannot occur under plant conditions that do not provide adequate boron mixing. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

This SR is modified by a Note that state that the SR is not required to be performed if any RCP is in operation.

| REFERENCES | ~~None.~~1.   Subsection 15.4.6 | DCD_15.4.6-6 |

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.7 RCS Loops - MODE 5, Loops Filled

BASES

BACKGROUND   In MODE 5 with the RCS loops filled, the primary function of the reactor coolant is the removal of decay heat and transfer this heat either to the steam generator (SG) secondary side coolant via natural circulation (Ref. 1) or the component cooling water via the residual heat removal (CS/RHR) heat exchangers. While the principal means for decay heat removal is via the RHR System, the SGs via natural circulation (Ref. 1) are specified as a backup means for redundancy. Even though the SGs cannot produce steam in this MODE, they are capable of being a heat sink due to their large contained volume of secondary water. As long as the SG secondary side water is at a lower temperature than the reactor coolant, heat transfer will occur. The rate of heat transfer is directly proportional to the temperature difference. The secondary function of the reactor coolant is to act as a carrier for soluble neutron poison, boric acid.

In MODE 5 with RCS loops filled, the reactor coolant is circulated by means of four RHR loops connected to the RCS, each loop containing a CS/RHR heat exchanger, a CS/RHR pump, and appropriate flow and temperature instrumentation for control, protection, and indication. ~~Two CS/RHR pumps circulate the water through the RCS at a sufficient rate to prevent boric acid stratification.~~   DCD_15.4.6-6

The number of loops in operation can vary to suit the operational needs. The intent of this LCO is to provide forced flow from at least two RHR loops for decay heat removal and transport. The flow provided by two RHR loops is adequate for decay heat removal. The other intent of this LCO is to require that a third path be available to provide redundancy for heat removal.

The LCO provides for redundant paths of decay heat removal capability. The first two paths can be RHR loops that must be OPERABLE and in operation. The third path can be another OPERABLE RHR loop or maintaining two SGs with secondary side water levels ≥ 13% to provide an alternate method for decay heat removal via natural circulation (Ref. 1).

The RHR pumps do not provide sufficient circulation of water through the RCS to ensure that the concentration of soluble boron in the reactor coolant is homogeneous. Therefore, all isolation valves for reactor makeup water sources containing unborated water that are connected to the RCS must be secured closed to prevent unplanned boron dilution of the reactor coolant.   DCD_15.4.6-6

BASES

APPLICABLE SAFETY ANALYSES	In MODE 5, RCS circulation is considered in the determination of the time available for mitigation of the accidental boron dilution event. The ~~RHR loops provide this circulation.~~ prevention of an accidental boron dilution event is ensured by requiring that all sources of unborated water be isolated from the RCS when RCS circulation is only provided by the RHR pumps.

RCS Loops - MODE 5 (Loops Filled) satisfies Criterion 4 of 10 CFR 50.36(c)(2)(ii).

DCD_15.4.6-6

LCO	The purpose of this LCO is to require that at least two of the RHR loops be OPERABLE and in operation with an additional RHR loop OPERABLE or two SGs with secondary side water level ≥ 13%. Two RHR loops provide sufficient forced circulation to perform the safety functions of the reactor coolant under these conditions. An additional RHR loop is required to be OPERABLE to meet single failure considerations. However, if the standby RHR loop is not OPERABLE, an acceptable alternate method is two SGs with their secondary side water levels ≥ 13%. Should one of the operating RHR loops fail, the SGs could be used to remove the decay heat via natural circulation.

Additionally, this LCO requires that all sources of unborated water be isolated from the RCS to prevent an inadvertent boron dilution event in MODE 5. However, planned dilution and makeup operations are sometimes required during MODE 5 to compensate for transient conditions which result in a continuous change in the RCS mass. This LCO allows exception to the requirement to isolate all sources of unborated water for the purpose of performing these planned and procedurally controlled operations, but requires that the isolation status be immediately restored following the planned actions.

DCD_15.4.6-6

Note 1 permits all CS/RHR pumps to be removed from operation ≤ 1 hour per 8 hour period. The purpose of the Note is to permit tests designed to validate various accident analyses values. One of the tests performed during the startup testing program is the validation of rod drop times during cold conditions, both with and without flow. The no flow test may be performed in MODE 3, 4, or 5 and requires that the pumps be stopped for a short period of time. The Note permits stopping of the pumps in order to perform this test and validate the assumed analysis values. If changes are made to the RCS that would cause a change to the flow characteristics of the RCS, the input values must be revalidated by conducting the test again. The 1 hour time period is adequate to perform the test, and operating experience has shown that boron stratification is not likely during this short period with no forced flow.

Utilization of Note 1 is permitted provided the following conditions are met, along with any other conditions imposed by initial startup test procedures:

BASES

LCO a. No operations are permitted that would dilute the RCS boron concentration with coolant with boron concentrations less than required to meet SDM of LCO 3.1.1, therefore maintaining the margin to criticality. Boron reduction with coolant at boron concentrations less than required to assure SDM is maintained is prohibited because a uniform concentration distribution throughout the RCS cannot be ensured when in natural circulation and

 b. Core outlet temperature is maintained at least 10°F below saturation temperature, so that no vapor bubble may form and possibly cause a natural circulation flow obstruction.

Note 2 allows one RHR loop to be inoperable for a period of up to 2 hours, provided that the other RHR loop is OPERABLE and in operation. This permits periodic surveillance tests to be performed on the inoperable loop during the only time when such testing is safe and possible.

Note 3 requires that the secondary side water temperature of each SG be ≤ 50°F above each of the RCS cold leg temperatures before the start of a reactor coolant pump (RCP) with an RCS cold leg temperature ≤ Low Temperature Overpressure Protection (LTOP) arming temperature specified in the PTLR. This restriction is to prevent a low temperature overpressure event due to a thermal transient when an RCP is started.

Note 4 provides for an orderly transition from MODE 5 to MODE 4 during a planned heatup by permitting removal of RHR loops from operation when at least one RCS loop is in operation. This Note provides for the transition to MODE 4 where an RCS loop is permitted to be in operation and replaces the RCS circulation function provided by the RHR loops. The requirement for isolation of the unborated water sources is removed as soon as one RCP is in operation. DCD_15.4.6-6

CS/RHR pumps are OPERABLE if they are capable of being powered and are able to provide flow if required. A SG can perform as a heat sink via natural circulation when it has an adequate water level and is OPERABLE.

BASES

APPLICABILITY   In MODE 5 with RCS loops filled, this LCO requires forced circulation of the
reactor coolant to remove decay heat from the core ~~and to provide proper~~
~~boron mixing~~. Two loops of RHR provides sufficient circulation for these   DCD_15.4.6-6
purposes. However, one additional RHR loop is required to be
OPERABLE, or the secondary side water level of at least two SGs is
required to be ≥ 13%. Two loops of RHR do not provide sufficient   DCD_15.4.6-6
circulation to provide proper boron mixing. Therefore, the LCO requires that
the valves used to isolate unborated water sources be secured in the
closed position when no RCPs are running.

Operation in other MODES is covered by:

LCO 3.4.4,   "RCS Loops - MODES 1 and 2;"

LCO 3.4.5,   "RCS Loops - MODE 3;"

LCO 3.4.6,   "RCS Loops - MODE 4;"

LCO 3.4.8,   "RCS Loops - MODE 5, Loops Not Filled;"

LCO 3.9.5,   "Residual Heat Removal (RHR) and Coolant Circulation
               -High Water Level" (MODE 6)," and

LCO 3.9.6,   "Residual Heat Removal (RHR) and Coolant Circulation -
               Low Water Level" (MODE 6)."

BASES

ACTIONS

A.1 and A.2

If two RHR loops are OPERABLE and in operation and either the required SGs have secondary side water levels < 13%, or one required RHR loop is inoperable, redundancy for heat removal is lost. Action must be initiated immediately to restore a third RHR loop to OPERABLE status or to restore the required SG secondary side water levels. Either Required Action will restore redundant heat removal paths. The immediate Completion Time reflects the importance of maintaining the availability of two paths for heat removal.

B.1 and B.2

If less than two RHR loops are in operation, except during conditions permitted by Note 1, or if less than two loops are OPERABLE, all operations involving introduction of coolant into the RCS with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 must be suspended and action to restore two RHR loops to OPERABLE status and operation must be initiated. Suspending the introduction of coolant into the RCS of coolant with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 is required to assure continued safe operation. With coolant added without forced circulation, unmixed coolant could be introduced to the core, however coolant added with boron concentration meeting the minimum SDM maintains acceptable margin to subcritical operations. The immediate Completion Times reflect the importance of maintaining operation for heat removal.

C.1

DCD_15.4.6-6

ACTION C has been modified by two Notes. The first Note allows separate Condition entry for each unborated water source isolation valve. The second Note requires that Required Action C.2 be completed whenever Condition C is entered.

Preventing inadvertent dilution of the reactor coolant boron concentration when there is insufficient RCS mixing is dependent on maintaining the unborated water isolation valves secured closed when there are no RCPs operating. Securing the valves in the closed position ensures that the valves cannot be inadvertently opened. Planned dilution and makeup operations are sometimes required to compensate for transient conditions which result in a continuous change in the RCS mass. This ACTION allows exception to the requirement to isolate all sources of unborated water for the purpose of performing these planned and procedurally controlled operations, but requires that the isolation status be quickly restored (within 15 minutes) following the planned activity. The Completion Time of immediately requires an operator to initiate actions to close an open valve

BASES

ACTIONS (continued)

and secure the isolation valve in the close position in a timely manner. Once actions are initiated, they must be continued until the valves are secured in the closed position.

DCD_15.4.6-6

C.2

Due to the potential of having diluted the boron concentration of the reactor coolant, SR 3.1.1.1 (verification of boron concentration) must be performed whenever Condition C is entered to demonstrate that the required boron concentration exists. The Completion Time of 4 hours is sufficient to obtain and analyze a reactor coolant sample for boron concentration.

SURVEILLANCE REQUIREMENTS

SR 3.4.7.1

This SR requires verification that the required loops are in operation. Verification includes flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.4.7.2

Verifying that at least two SGs are OPERABLE by ensuring their secondary side narrow range water levels are ≥ 13% ensures an alternate decay heat removal method via natural circulation in the event that the second RHR loop is not OPERABLE. If two RHR loops are OPERABLE, this Surveillance is not needed. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.7.3

Verification that each required CS/RHR pump is OPERABLE ensures that an additional pump can be placed in operation, if needed, to maintain decay heat removal and reactor coolant circulation. Verification is performed by verifying proper breaker alignment and power available to each required CS/RHR pump. Alternatively, verification that a pump is in operation also verifies proper breaker alignment and power availability. If secondary side water level is ≥ 13% in at least two SGs, this Surveillance is not needed. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

This SR is modified by a Note that states the SR is not required to be performed until 24 hours after a required pump is not in operation.

SR 3.4.7.4   DCD_15.4.6-6

Verify that unborated water sources are isolated from the RCS when operating with RHR loops in service and no RCPs running ensures that an inadvertent boron dilution cannot occur under plant conditions that do not provide adequate boron mixing. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

This SR is modified by a Note that state that the SR is not required to be performed if any RCP is in operation.

REFERENCES   1.   NRC Information Notice 95-35, "Degraded Ability of Steam Generators to Remove Decay Heat by Natural Circulation."

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.8 RCS Loops - MODE 5, Loops Not Filled

BASES

BACKGROUND	In MODE 5 with the RCS loops not filled, the primary function of the reactor coolant is the removal of decay heat generated in the fuel, and the transfer of this heat to the component cooling water via the residual heat removal (CS/RHR) heat exchangers. The steam generators (SGs) are not available as a heat sink when the loops are not filled. The secondary function of the reactor coolant is to act as a carrier for the soluble neutron poison, boric acid.

In MODE 5 with the RCS loops not filled, only CS/RHR pumps can be used for coolant circulation. The number of pumps in operation can vary to suit the operational needs. The intent of this LCO is to provide forced flow from at least two CS/RHR pumps for decay heat removal and transport and to require that three paths be available to provide redundancy for heat removal.

The RHR pumps do not provide sufficient circulation of water through the RCS to ensure that the concentration of soluble boron in the reactor coolant is homogeneous. Therefore, all isolation valves for reactor makeup water sources containing unborated water that are connected to the RCS must be secured closed to prevent unplanned boron dilution of the reactor coolant. DCD_15.4.6-6

In MODE 5 with the RCS loops not filled, low-pressure letdown line isolation valves are automatically closed upon detection of RCS loop lowlevel signal to prevent loss of RCS inventory. The function is effective to prevent core damage during plant shutdown, based on probabilistic risk assessment.

APPLICABLE SAFETY ANALYSES	In MODE 5, RCS circulation is considered in the determination of the time available for mitigation of the accidental boron dilution event. The ~~RHR loops provide this circulation. The~~ flow provided by two RHR loops is adequate for heat removal ~~and for boron mixing~~. The prevention of an accidental boron dilution event is ensured by requiring that all sources of unborated water be isolated from the RCS when RCS circulation is not provided by at least one operating RCP. DCD_15.4.6-6

RCS loops in MODE 5 (loops not filled) satisfies Criterion 4 of 10 CFR 50.36(c)(2)(ii).

BASES

LCO (continued)

The purpose of this LCO is to require that at least three RHR loops be OPERABLE and two of these loops be in operation. An OPERABLE loop is one that has the capability of transferring heat from the reactor coolant at a controlled rate. Heat cannot be removed via the RHR System unless forced flow is used. A minimum of two running CS/RHR pumps meets the LCO requirement for two loops in operation. An additional RHR loop is required to be OPERABLE to meet single failure considerations.

Additionally, this LCO requires that all sources of unborated water be isolated from the RCS to prevent an inadvertent boron dilution event in MODE 5. However, planned dilution and makeup operations are sometimes required during MODE 5 to compensate for transient conditions which result in a continuous change in the RCS mass. This LCO allows exception to the requirement to isolate all sources of unborated water for the purpose of performing these planned and procedurally controlled operations, but requires that the isolation status be immediately restored following the planned actions.

DCD_15.4.6-6

The LCO requires the low-pressure letdown line isolation valves to be OPERABLE to mitigate the effects associated with loss of RCS inventory.

Note 1 permits one CS/RHR pump to be removed from operation for ≤ 15 minutes when switching from one loop to another. The circumstances for stopping one CS/RHR pump is to be limited to situations when the outage time is short and core outlet temperature is maintained > 10°F below saturation temperature. The Note prohibits boron dilution with coolant at boron concentrations less than required to assure SDM of LCO 3.1.1 is maintained or draining operations when RHR forced flow is stopped.

Note 2 allows one RHR loop to be inoperable for a period of ≤ 2 hours, provided that the other two required loops are OPERABLE and in operation. This permits periodic surveillance tests to be performed on the inoperable loop during the only time when these tests are safe and possible.

An OPERABLE RHR loop is comprised of an OPERABLE CS/RHR pump capable of providing forced flow to an OPERABLE CS/RHR heat exchanger. CS/RHR pumps are OPERABLE if they are capable of being powered and are able to provide flow if required.

BASES

APPLICABILITY

In MODE 5 with loops not filled, this LCO requires core heat removal and coolant circulation by the RHR System. However, the RHR system does not provide sufficient RCS circulation to ensure proper boron mixing. Therefore, the LCO requires that the valves used to isolate unborated water sources be secured in the closed position.

DCD_15.4.6-6

Operation in other MODES is covered by:

LCO 3.4.4,   "RCS Loops - MODES 1 and 2,"

LCO 3.4.5,   "RCS Loops - MODE 3,"

LCO 3.4.6,   "RCS Loops - MODE 4,"

LCO 3.4.7,   "RCS Loops - MODE 5, Loops Filled,"

LCO 3.9.5,   "Residual Heat Removal (RHR) and Coolant Circulation - High Water Level (MODE 6)," and

LCO 3.9.6,   "Residual Heat Removal (RHR) and Coolant Circulation - Low Water Level (MODE 6)."

ACTIONS

A.1

If one required RHR loop is inoperable, redundancy for RHR is lost. Action must be initiated to restore a third loop to OPERABLE status. The immediate Completion Time reflects the importance of maintaining the availability of three paths for heat removal.

B.1

If one low-pressure letdown isolation valve is inoperable, the automatic isolation function to prevent loss of RCS inventory is lost. Action must be initiated to restore the valve to OPERABLE status. The immediate Completion Time reflects the importance of maintaining the availability of three paths for heat removal.

BASES

ACTIONS (continued)

C.1 and C.2

If less than two required loops are OPERABLE or less than two required loops in operation, except during conditions permitted by Note 1, all operations involving introduction of coolant into the RCS with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 must be suspended and action must be initiated immediately to restore two RHR loops to OPERABLE status and operation. The required margin to criticality must not be reduced in this type of operation. Suspending the introduction of coolant into the RCS of coolant with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 is required to assure continued safe operation. With coolant added without forced circulation, unmixed coolant could be introduced to the core, however coolant added with boron concentration meeting the minimum SDM maintains acceptable margin to subcritical operations. The immediate Completion Time reflects the importance of maintaining operation for heat removal. The action to restore must continue until two loops are restored to OPERABLE status and operation.

CTS-01473

D.1

DCD_15.4.6-6

ACTION D has been modified by two Notes. The first Note allows separate Condition entry for each unborated water source isolation valve. The second Note requires that Required Action D.2 be completed whenever Condition D is entered.

Preventing inadvertent dilution of the reactor coolant boron concentration when there is insufficient RCS mixing is dependent on maintaining the unborated water isolation valves secured closed when there are no RCPs operating. Securing the valves in the closed position ensures that the valves cannot be inadvertently opened. Planned dilution and makeup operations are sometimes required to compensate for transient conditions which result in a continuous change in the RCS mass. This ACTION allows exception to the requirement to isolate all sources of unborated water for the purpose of performing these planned and procedurally controlled operations, but requires that the isolation status be quickly restored (within 15 minutes) following the planned activity. The Completion Time of immediately requires an operator to initiate actions to close an open valve and secure the isolation valve in the closed position in a timely manner. Once actions are initiated, they must be continued until the valves are secured in the closed position.

BASES

ACTIONS (continued)

D.2

DCD_15.4.6-6

Due to the potential of having diluted the boron concentration of the reactor coolant, SR 3.1.1.1 (verification of boron concentration) must be performed whenever Condition C is entered to demonstrate that the required boron concentration exists. The Completion Time of 4 hours is sufficient to obtain and analyze a reactor coolant sample for boron concentration.

BASES

SURVEILLANCE REQUIREMENTS	**SR 3.4.8.1**

This SR requires verification every 12 hours that the required loops are in operation. Verification includes flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

MAP-16-404

SR 3.4.8.2

Verification that each required CS/RHR pump is OPERABLE ensures that an additional pump can be placed in operation, if needed, to maintain decay heat removal and reactor coolant circulation. Verification is performed by verifying proper breaker alignment and power available to each required pump. Alternatively, verification that a CS/RHR pump is in operation also verifies proper breaker alignment and power availability. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

This SR is modified by a Note that states the SR is not required to be performed until 24 hours after a required pump is not in operation.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.8.3

SR 3.4.8.3 requires a complete cycle of each low-pressure letdown isolation valve. This requirements mean confirmation of OPERABILITY of Instrumentation and its control (Setpoints, Channel Checks, Channel Calibrations) and valve. Operating a low-pressure letdown isolation valve through one complete cycle ensures that the low-pressure letdown isolation valve can be automatically actuated to mitigate the effects from loss of RCS inventory. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.4.8.4   DCD_15.4.6-6

Verify that unborated water sources are isolated from the RCS when operating with RHR loops in service and no RCPs running ensures that an inadvertent boron dilution cannot occur under plant conditions that do not provide adequate boron mixing. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

This SR is modified by a Note that state that the SR is not required to be performed if any RCP is in operation.

REFERENCES   None.

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.9 Pressurizer

BASES

BACKGROUND   The pressurizer provides a point in the RCS where liquid and vapor are maintained in equilibrium under saturated conditions for pressure control purposes to prevent bulk boiling in the remainder of the RCS. Key functions include maintaining required primary system pressure during steady state operation, and limiting the pressure changes caused by reactor coolant thermal expansion and contraction during normal load transients.

The pressure control components addressed by this LCO include the pressurizer water level, the required heaters, and their controls and emergency power supplies. Pressurizer safety valves and safety depressurization valves are addressed by LCO 3.4.10, "Pressurizer Safety Valves," and LCO 3.4.11, "Safety Depressurization Valves (SDVs)," respectively.

The intent of the LCO is to ensure that a ~~steam bubble~~liquid-vapor interface exists in the pressurizer ~~prior to power operation to minimize the consequences of potential overpressure transients~~to permit effective RCS pressure control during normal operation and assure the pressurizer continues to provide proper pressure control response for Anticipated Operational Occurrences (AOOs). The presence of an adequate ~~steam bubble~~volume is consistent with analytical assumptions. Relatively small amounts of noncondensible gases can inhibit the condensation heat transfer between the pressurizer spray and the steam, and diminish the spray effectiveness for pressure control. The maximum water level defined by the LCO preserves the steam space necessary for pressure control, prevents overfilling the pressurizer, and ensures that two-phase or water relief does not lead to a more severe accident in accordance with the requirements of SRP 15.0 (Ref. 2). Note that the LCO is not intended to be interpreted as an operating band. The actual operating band for pressurizer water level is controlled more tightly than this LCO and is defined by the deviation alarms associated with the programmed level which is a function of power. `DCD_16-298`

Electrical immersion heaters, located in the lower section of the pressurizer vessel, keep the water in the pressurizer at saturation temperature and maintain a constant operating pressure. A minimum required available capacity of pressurizer heaters ensures that the RCS pressure can be maintained. The capability to maintain and control system pressure is

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BASES

BACKGROUND (continued)

important for maintaining subcooled conditions in the RCS and ensuring the capability to remove core decay heat by either forced or natural circulation of reactor coolant. Unless adequate heater capacity is available, the hot, high pressure condition cannot be maintained indefinitely and still provide the required subcooling margin in the primary system. Inability to control the system pressure and maintain subcooling under conditions of natural circulation flow in the primary system could lead to a loss of single phase natural circulation and decreased capability to remove core decay heat.

APPLICABLE
SAFETY
ANALYSES

In MODES 1, 2, and 3, the LCO requirement for an adequate steam ~~bubble~~volume is reflected implicitly in the accident analyses. Safety analyses performed for lower MODES are not limiting. All analyses performed from a critical reactor condition assume the existence of a steam ~~bubble~~volume and saturated conditions in the pressurizer. In making this assumption, the analyses neglect the small fraction of noncondensible gases normally present. `DCD_16-298`

Safety analyses do~~es~~ not take credit for pressurizer heater operation; however, an implicit initial condition assumption of the safety analyses is that the RCS is operating at normal pressure (Ref. 1). `DCD_16-298`

The maximum pressurizer water level limit, which ensures that a steam ~~bubble~~volume exists in the pressurizer and prevents two-phase or water relief and pressurizer overfill, satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii). Although the heaters are not specifically used in accident analysis, the need to maintain subcooling in the long term during loss of offsite power, as indicated in NUREG-0737 (Ref. 2), is the reason for providing an LCO. `DCD_16-298`

Some Chapter 15 AOOs result in an increase in RCS temperature and resultant increase in pressurizer level. For many of these events, the decrease in reactor power following reactor trip effectively terminates this increase in RCS temperature and leads to a stabilization or decrease in pressurizer level. Therefore, such events are protected from pressurizer overfill and water or two-phase relief by the high pressurizer water level reactor trip, specified in Table 3.3.1-1 of TS 3.3.1 and Table 7.2-3 of Section 7.2 of Chapter 7. This is also true for all Chapter 15 AOOs that begin from MODES 2 and 3 because the potential heatup of the core is limited by the low (. 5%) or zero power in those MODES. `DCD_16-298`

However, certain Chapter 15 AOOs beginning from MODE 1, such as the loss of non-emergency AC power to the station auxiliaries (Ref. 3) and the loss of normal feedwater flow (Ref. 4), result in a continued increase in pressurizer water level even after reactor trip, mainly due to the presence of decay heat and reduced secondary heat sink capability. In these events, the initial steam volume needs to be sufficient to accommodate the

BASES

APPLICABLE SAFETY ANALYSES (continued)

increase in pressurizer water level without leading to overfill and two-phase or water relief. The basis for the pressurizer water level LCO value in MODE 1 is that the safety analysis of these limiting Chapter 15 AOO have sufficient margin to pressurizer overfill and two-phase or water relief when initiated from the LCO value.   DCD_16-298

LCO   The LCO requirement in MODE 1 for the pressurizer to be OPERABLE with a water volume ≤ 26681757 cubic feet, which is equivalent to 9260%, ensures that a sufficient steam bubblevolume exists. Limiting the LCO maximum operating water level preserves the steam space for pressure control. The LCO has been established to ensure the capability to establish and maintain pressure control for steady state operation and to minimize the consequences of potential overpressure transients. Requiring the presence of a steam bubblevolume is also consistent with analytical assumptions. This LCO requirement further ensures that the limiting AOO that results in an increase in pressurizer level that cannot be terminated by prior operator action will not result in pressurizer overfill and water or two phase relief even if the event initiates from the LCO. The limiting AOOs for this LCO is the loss of non-emergency AC power to the station auxiliaries (Ref. 3) and loss of normal feedwater flow (Ref. 4).   DCD_16-298

The LCO requirement in MODES 2 and 3 for the pressurizer to be OPERABLE with a water volume ≤ 2600 cubic feet, which is equivalent to 92%, is provided for the same reasons as in MODE 1. However, the LCO value is higher due to the reduced risk of pressurizer overfill or water or two-phase relief since the initial power level is low (≤ 5%).

Note that these LCO requirements are not intended to define the operating band of the pressurizer water level. The operating band is controlled more tightly than these LCO requirements and is defined by the deviation alarms associated with the programmed level which is a function of power.

The LCO requires three groups of OPERABLE pressurizer heaters, each with a capacity ≥ 120 kW, capable of being powered from either the offsite power source or the emergency power supply. The minimum heater capacity required is sufficient to maintain the RCS near normal operating pressure when accounting for heat losses through the pressurizer insulation. By maintaining the pressure near the operating conditions, a wide margin to subcooling can be obtained in the loops. The exact design value of 120 kW is derived from the use of three heaters rated at 46.8 kW each. The amount needed to maintain pressure is dependent on the heat losses.

BASES

APPLICABILITY	The need for pressure control is most pertinent when core heat can cause the greatest effect on RCS temperature, resulting in the greatest effect on pressurizer level and RCS pressure control. Thus, applicability has been designated for MODES 1 and 2. MODE 1 is the condition that provides minimum margin to pressurizer overfill and two-phase or water relief for AOOs that result in a net integrated pressurizer insurge. MODE 2 is applicable for the same reasons, although the LCO value is increased due to the lower initial power level of . 5%. The applicability is also provided for MODE 3. The purpose is to prevent solid water RCS operation during heatup and cooldown to avoid rapid pressure rises caused by normal operational perturbation, such as reactor coolant pump startup.	DCD_16-298

In MODES 1, 2, and 3, there is need to maintain the availability of pressurizer heaters, capable of being powered from an emergency power supply. In the event of a loss of offsite power, the initial conditions of these MODES give the greatest demand for maintaining the RCS in a hot pressurized condition with loop subcooling for an extended period. For MODE 4, 5, or 6, it is not necessary to control pressure (by heaters) to ensure loop subcooling for heat transfer when the Residual Heat Removal (RHR) System is in service, and therefore, the LCO is not applicable.

ACTIONS   A.1, A.2, A.3, and A.4

Pressurizer water level control malfunctions or other plant evolutions may result in a pressurizer water level above the nominal upper limit, even with the plant at steady state conditions. Normally the plant will trip in this event since the upper limit of this LCO is the same as the Pressurizer Water Level - High Trip.

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If the pressurizer water level is not within the limit, action must be taken to bring the plant to a MODE in which the LCO does not apply. To achieve this status, within 6 hours the unit must be brought to MODE 3 with all rods fully inserted and incapable of withdrawal. Additionally, the unit must be brought to MODE 4 within 12 hours. This takes the unit out of the applicable MODES.

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.

B.1

If one required group of pressurizer heaters is inoperable, restoration is required within 72 hours. The Completion Time of 72 hours is reasonable considering the anticipation that a demand caused by loss of offsite power would be unlikely in this period. Pressure control may be maintained during this time using normal station powered heaters.

BASES

ACTIONS (continued)

C.1 and C.2

If one group of pressurizer heaters are inoperable and cannot be restored in the allowed Completion Time of Required Action B.1, 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 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

SR 3.4.9.1

This SR requires that during steady state operation, pressurizer level is maintained ~~below the nominal upper limit to provide a minimum space for a steam bubble~~60% for MODE 1 and 92% for MODES 2 and 3. The Surveillance is performed by observing the indicated level. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

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SR 3.4.9.2

The SR is satisfied when the power supplies are demonstrated to be capable of producing the minimum power and the associated pressurizer heaters are verified to be at their design rating. This may be done by testing the power supply output and by performing an electrical check on heater element continuity and resistance. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

BASES

REFERENCES   1.   FSAR Subsection 15.0.0.2.2.

2.   Standard Review Plan (SRP) Section 15.0 "Introduction – Transient   DCD_16-298
and Accident Analyses".

3.   Subsection 15.2.6.

4.   Subsection 15.2.7.

5.   NUREG-0737, November 1980.

BASES

APPLICABLE SAFETY ANALYSES (continued)

    c.   Disallowing start of an RCP if secondary temperature is more than 50°F above primary temperature in any one loop. LCO 3.4.6, "RCS Loops - MODE 4," and LCO 3.4.7, "RCS Loops - MODE 5, Loops Filled," provide this protection.

The Reference 4 analyses demonstrate that either two RHR suction relief valve or the depressurized RCS and RCS vent can maintain RCS pressure below limits when two safety injection pumps and one charging pump are actuated. Thus, the LCO allows only two safety injection pumps and one charging pump OPERABLE during the LTOP MODES.

Since neither two RHR suction relief valves nor the RCS vent can handle the pressure transient need from accumulator injection, when RCS temperature is low, the LCO also requires the accumulators isolation when accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed in the PTLR.

The isolated accumulators must have their discharge valves closed and the valve power supply breakers fixed in their open positions. The analyses show the effect of accumulator discharge is over a narrower RCS temperature range (195°F and below) than that of the LCO (LTOP arming temperature and below).

Fracture mechanics analyses established the temperature of LTOP Applicability at LTOP arming temperature specified in the PTLR.

The consequences of a small break loss of coolant accident (LOCA) in LTOP MODE 4 conform to 10 CFR 50.46 and 10 CFR 50, Appendix K (Refs. ~~5~~6 and ~~6~~7), requirements by having a maximum of two SI pumps and one charging pump OPERABLE and SI actuation enabled. | MIC-03-16-0 0004

RHR Suction Relief Valve Performance

The RHR suction relief valves do not have variable pressure and temperature lift setpoints. Analyses must show that two RHR suction relief valves lifting at its specified setpoint will pass flow greater than that required for the limiting LTOP transient while maintaining RCS pressure less than the P/T limit curve. Assuming all relief flow requirements during the limiting LTOP event, two RHR suction relief valves will maintain RCS pressure to within the valve rated lift setpoint, plus an accumulation ≤ 10% of the rated lift setpoint.

RCS Vent Performance

With the RCS depressurized, analyses show a vent size of 4.7 square inches is capable of mitigating the allowed LTOP overpressure transient.

BASES

APPLICABLE SAFETY ANALYSES (continued)

The capacity of a vent this size is greater than the flow possible from either the mass or heat input transient, maintaining RCS pressure less than the maximum pressure on the P/T limit curve.

The required vent area may be created by removing SDVs with their associate block valves secured in the open position or by removal of pressurizer safety valves.

The RCS vent size will be re-evaluated for compliance each time the P/T limit curves are revised based on the results of the vessel material surveillance.

The RCS vent is passive and is not subject to active failure.

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

LCO

This LCO requires that the LTOP System is OPERABLE. The LTOP System is OPERABLE when the minimum coolant input and pressure relief capabilities are OPERABLE. Violation of this LCO could lead to the loss of low temperature overpressure mitigation and violation of the Reference 1 limits as a result of an operational transient. ~~Since neither two RHR suction relief valves nor the RCS vent can handle the pressure transient need from accumulator injection, when RCS temperature is low, the LCO also requires the accumulators isolation when accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed in the PTLR.~~ MAP-16-405

To limit the coolant input capability, the LCO requires that a maximum of two safety injection pumps and one charging pump be capable of injecting into the RCS, and all accumulator discharge isolation valves be closed and immobilized when accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed in the PTLR.

The LCO is modified by two Notes. Note 1 allows two charging pumps to be made capable of injecting for ≤ 1 hour during pump swap operations. One hour provides sufficient time to safely complete the actual transfer and to complete the administrative controls and Surveillance Requirements associated with the swap. The intent is to minimize the actual time that more than one charging pump is physically capable of injection. Note 2 states that accumulator isolation is only required when the accumulator pressure is more than or at the maximum RCS pressure for the existing temperature, as allowed by the P/T limit curves. This Note permits the accumulator discharge isolation valve Surveillance to be performed only under these pressure and temperature conditions.

BASES

SURVEILLANCE REQUIREMENTS (continued)

be performed on the RHR System when the RHR System is aligned to the RCS in the shutdown cooling mode of operation. PIVs contained in the RHR shutdown cooling flow path must be leakage rate tested after RHR is secured and stable unit conditions and the necessary differential pressures are established.

SR 3.4.14.2

Verifying that the RHR suction valve interlock is OPERABLE ensures that RCS pressure will not pressurize the RHR system beyond its design pressure of 900 psig. The interlock setpoint is set so the actual RCS pressure must be < 425 psig to open the valves. This setpoint ensures the RHR design pressure will not be exceeded and the RHR relief valves will not lift. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

|CTS-01474

REFERENCES   1.   10 CFR 50.2.

2.   10 CFR 50.55a(c).

3.   10 CFR 50, Appendix A, Section V, GDC 55.

4.   WASH-1400 (NUREG-75/014), Appendix V, October 1975.

5.   NUREG-0677, May 1980.

6.   FSAR Subsection 3.9.6.3.4.

7.   ASME Code for Operation and Maintenance of Nuclear Power Plants.

8.   10 CFR 50.55a(g).

BASES

ACTIONS (continued)

A Note permits the use of the provisions of LCO 3.0.4.c. This allowance permits entry into the applicable MODE(S), relying on Required Actions B.1 while the DOSE EQUIVALENT XE-133 LCO limit is not met. This allowance is acceptable due to the significant conservatism incorporated into the specific activity limit, the low probability of an event which is limiting due to exceeding this limit, and the ability to restore transient-specific activity excursions while the plant remains at, or proceeds to, power operation.

C.1 and C.2

If the Required Action and the associated Completion Time of Condition A or B is not met, or if the DOSE EQUIVALENT I-131 is > 60 μCi/gm , the reactor must be brought to MODE 3 within 6 hours and MODE 5 within 36 hours. The allowed Completion Time 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

SR 3.4.16.1

SR 3.4.16.1 requires performing a gamma isotopic analysis as a measure of the noble gas specific activity of the reactor coolant ~~at least once every 7 days~~according to the Surveillance Frequency Control Program. This | DCD_16-304

measurement is the sum of the degassed gamma activities and the gaseous gamma activities in the sample taken. This Surveillance provides an indication of any increase in the noble gas specific activity.

Trending the results of this Surveillance allows proper remedial action to be taken before reaching the LCO limit under normal operating conditions. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

Due to the inherent difficulty in detecting Kr-85 in a reactor coolant sample due to masking from radioisotopes with similar decay energies, such as F-18 and I-134, it is acceptable to include the minimum detectable activity for Kr-85 in the SR 3.4.16.1 calculation. If a specific noble gas nuclide listed in the definition of DOSE EQUIVALENT Xe-133 is not detected, it should be assumed to be present at the minimum detectable activity.

A Note modifies the SR to allow entry into and operation in MODE 4, MODE 3, and MODE 2 prior to performing the SR. This allows the Surveillance to be performed in those MODES, prior to entering MODE 1.

BASES

APPLICABLE SAFETY ANALYSES (continued)

    a.   Maximum fuel element cladding temperature is ≤ 2200°F,

    b.   Maximum cladding oxidation is ≤ 0.17 times the total cladding thickness before oxidation,

    c.   Maximum hydrogen generation from a zirconium water reaction is ≤ 0.01 times the hypothetical amount that would be generated if all of the metal in the cladding cylinders surrounding the fuel, excluding the cladding surrounding the plenum volume, were to react, and

    d.   Core is maintained in a coolable geometry.

Since the accumulators discharge during the blowdown phase and core reflooding phase of a LOCA, they do not contribute to the long term cooling requirements of 10 CFR 50.46.

The safety analysis assumes values of 19,338 gallons and 19,734 gallons.

For both the large and small break LOCA analyses, a nominal contained accumulator water volume is used. The contained water volume is 3434 gallons larger than the deliverable volume for the accumulators, since the flow damper is near the bottom of the accumulators and the dead volume in each accumulator is 3434 gallons. For small breaks, an increase in water volume is a peak clad temperature penalty. For large breaks, an increase in water volume can be either a peak clad temperature penalty or benefit, depending on downcomer filling and subsequent spill through the break during the core reflooding portion of the transient. The safety analysis treats the volume of water from the accumulator to the RCS isolation check valves as accumulator injection line.

The minimum boron concentration setpoint is used in the post LOCA boron concentration calculation. The calculation is performed to assure reactor subcriticality in a post LOCA environment. Of particular interest is the large break LOCA, since no credit is taken for control rod assembly insertion. A reduction in the accumulator minimum boron concentration would produce a subsequent reduction in the available containment sump concentration for post LOCA shutdown and an increase in the maximum sump pH. The safety analysis assumes that the boron has the isotopic concentration of B-10 found in natural boron (~~19.9~~ 10.9 atom percent). The maximum boron concentration is used in determining the cold leg to hot leg recirculation injection switchover time and minimum sump pH. The upper limit of boron concentration is not related to reactivity and is not dependent on the B-10 isotopic concentration.

MAP-16-406

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.5.1.4

The boron concentration should be verified to be within required limits for each accumulator since the static design of the accumulators limits the ways in which the concentration can be changed. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program. Sampling the affected accumulator within 6 hours after a 1% volume increase will identify whether inleakage has caused a reduction in boron concentration to below the required limit. It is not necessary to verify boron concentration if the added water inventory is from the refueling water storage Pit (RWSP), because the water contained in the RWSP is within the accumulator boron concentration requirements. This is consistent with the recommendation of NUREG-1366 (Ref. 5).

SR 3.5.1.5

Verification that power is removed from each accumulator isolation valve operator when the RCS pressure is ≥ 1920 psig ensures that an active failure could not result in the undetected closure of an accumulator motor operated isolation valve. If this were to occur, only two accumulators would be available for injection given a single failure coincident with a LOCA. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

This SR allows power to be supplied to the motor operated isolation valves when RCS pressure is < 1920 psig, thus allowing operational flexibility by avoiding unnecessary delays to manipulate the breakers during plant startups or shutdowns.

SR 3.5.1.6

Periodic verification ~~every 24 months~~according to the Surveillance Frequency Control Program that the isotopic concentration of B-10 in each accumulator is ≥ 19.9% (atom percent) ensures that the B-10 isotopic concentration assumed in the accident analysis is available. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

DCD_16-304

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.5.2.4

This Surveillance demonstrates that each ECCS valve manually activated during a design basis accident event actuates to the required position. This Surveillance is not required for valves that are locked, sealed, or otherwise secured in required position. SRs are specified in the Inservice ~~Testing Program of the ASME Code. The ASME Code provides the~~ activities and Frequencies necessary to satisfy the requirements.

MAP-16-407

SR 3.5.2.5

This Surveillance demonstrates that each SI pump starts on receipt of an actual or simulated ECCS actuation signal. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.5.2.6

Periodic inspections of the ECC/CS STRAINER ensure that it is unrestricted and stays in proper operating condition. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

REFERENCES	1.	10 CFR 50, Appendix A, GDC 35.
	2.	10 CFR 50.46.
	3.	FSAR Subsection 6.2.1.
	4.	FSAR Subsection 15.6.5.
	5.	FSAR Chapter 19.

BASES

ACTIONS (continued)

For affected penetration flow paths that cannot be restored to OPERABLE status within the 4 hour Completion Time and that have been isolated in accordance with Required Action A.1, the affected penetration flow paths must be verified to be isolated on a periodic basis. This is necessary to ensure that containment penetrations required to be isolated following an accident and no longer capable of being automatically ‑

CTS-01475

isolated will be in the isolation position should an event occur. This Required Action does not require any testing or device manipulation. Rather, it involves verification that those isolation devices outside containment and capable of being mispositioned are in the correct position. The Completion Time of "once per 31 days for isolation devices outside containment" is appropriate considering the fact that the devices are operated under administrative controls and the probability of their misalignment is low. For the isolation devices inside containment, the time period specified as "prior to entering MODE 4 from MODE 5 if not performed within the previous 92 days" is based on engineering judgment and is considered reasonable in view of the inaccessibility of the isolation devices and other administrative controls that will ensure that isolation device misalignment is an unlikely possibility.

Condition A has been modified by a Note indicating that this Condition is only applicable to those penetration flow paths with two containment isolation valves. For penetration flow paths with only one containment isolation valve and a closed system, Condition C provides the appropriate actions.

Required Action A.2 is modified by two Notes. Note 1 applies to isolation devices located in high radiation areas and allows these devices to be verified closed by use of administrative means. Allowing verification by administrative means is considered acceptable, since access to these areas is typically restricted. Note 2 applies to isolation devices that are locked, sealed, or otherwise secured in position and allows these devices to be verified closed by use of administrative means. Allowing verification by administrative means is considered acceptable, since the function of locking, sealing, or securing components is to ensure that these devices are not inadvertently repositioned. Therefore, the probability of misalignment of these devices once they have been verified to be in the proper position, is small.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.6.3.6

For containment purge valves with resilient seals, additional leakage rate testing beyond the test requirements of 10 CFR 50, Appendix J, Option B, is required to ensure OPERABILITY. Operating experience has demonstrated that this type of seal has the potential to degrade in a shorter time period than do other seal types. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

Additionally, this SR must be performed within 92 days after opening the valve. The 92 day Frequency was chosen recognizing that cycling the valve could introduce additional seal degradation (beyond that occurring to a valve that has not been opened). Thus, decreasing the interval (from 184 days) is a prudent measure after a valve has been opened.

MAP-16-408

SR 3.6.3.7

Automatic containment isolation valves close on a containment isolation signal to prevent leakage of radioactive material from containment following a DBA. This SR ensures that each automatic containment isolation valve will actuate to its isolation position on a containment isolation signal. This surveillance is not required for valves that are locked, sealed, or otherwise secured in the required position under administrative controls. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

REFERENCES

1.	FSAR Subsection 15.6.5.5.

2.	FSAR Subsection 6.2.4.

3.	Standard Review Plan 6.2.4.

BASES

APPLICABLE SAFETY ANALYSES (continued)

The EFW flow to the faulty steam generator is automatically terminated by the RPS (high SG water level coincident with reactor trip and no low main steam line pressure signal, and at low main steam line pressure) Sufficient flow would be delivered to the intact steam generator by the redundant EFW pump.

The ESFAS automatically actuates the EFW turbine driven pump and associated power operated valves and controls when required to ensure an adequate feedwater supply to the steam generators during loss of power. DC power operated valves are provided for each EFW line to control the EFW flow to each steam generator.

The EFWS satisfies the requirements of Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

This LCO provides assurance that the EFWS will perform its design safety function to mitigate the consequences of accidents that could result in overpressurization of the reactor coolant pressure boundary. Four independent EFW pumps in four diverse trains are required to be OPERABLE to ensure the availability of RHR capability for all events accompanied by a loss of offsite power and a single failure during non-OLM. This is accomplished by powering two of the pumps by independent emergency buses. The third and fourth EFW pumps are powered by a different means, a steam driven turbine supplied with steam from a source that is not isolated by closure of the MSIVs.

During OLM, three of four independent EFW pumps in three of the four diverse trains are required to be OPERABLE. This LCO may be changed from Required Action A or B when the EFW pump discharge cross-connect line isolation valves are closed if an EFW train becomes inoperable during non-OLM.

The EFWS is configured into four trains. The EFWS is considered OPERABLE when the components and flow paths required to provide redundant EFW flow to the steam generators are OPERABLE.

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This requires that four EFW pumps be OPERABLE in four diverse paths, each supplying EFW to separate steam generators during non-OLM.

During OLM, three FW pumps shall be OPERABLE and shall be capable of supplying EFW to any of supplying EFW to any of the steam generators. The piping, valves, instrumentation, and controls in the required flow paths also are required to be OPERABLE.

B 3.7 PLANT SYSTEMS

B 3.7.7 Component Cooling Water (CCW) System

BASES

BACKGROUND   The CCW System provides a heat sink for the removal of process and operating heat from safety related components during a Design Basis Accident (DBA) or transient. During normal operation, the CCW System also provides this function for various nonessential components, as well as the spent fuel storage pool. The CCW System serves as a barrier to the release of radioactive byproducts between potentially radioactive systems and the Essential Service Water System, and thus to the environment.

A typical CCW System is arranged as four independent, 50% capacity cooling loops, and has isolatable nonsafety related components. Each safety related train includes one 50% capacity pump, connection to one of the two surge tanks, a 50% capacity heat exchanger, piping, valves, and instrumentation. Each safety related train is powered from a separate bus. The surge tanks in the system provide pump trip protective functions to ensure that sufficient net positive suction head is available. The pump in each train is automatically started on receipt of a safety injection signal, and all nonessential components are isolated.

Additional information on the design and operation of the system, along with a list of the components served, is presented in FSAR Chapter 9 (Ref. 1). The principal safety related function of the CCW System is the removal of decay heat from the reactor via the Containment Spray/Residual Heat Removal (CS/RHR) System. This may be during a normal or post accident cooldown and shutdown. CCWS cooling to the four RCP seal thermal barriers is used for all operating modes (including accident and safe shutdown) to preclude a RCP seal LOCA in the event that CVCS is unavailable to provide required flow to the RCP seal via seal injection. Manual alignment of RCP thermal barrier cooling is achieved via the CCWS RCP cross-tie valves from the MCR in the event two CCWS trains are unavailable to supply CCWS to a pair of RCP thermal barriers.

DCD_09.02.02-84

APPLICABLE   The design basis of the CCW System is for two CCW trains to remove the
SAFETY   post loss of coolant accident (LOCA) heat load from the refueling water
ANALYSES   storage pit and other components, such as Safety Injection Pumps and CS/RHR Pumps. The Emergency Core Cooling System (ECCS) LOCA and containment OPERABILITY LOCA each model the maximum and minimum performance of the CCW System, respectively. The normal temperature of the CCW is 100°F, and, during unit cooldown to MODE 5 (T_{cold} < 200°F), a maximum temperature of 110°F is assumed. This prevents the refueling water storage pit fluid from increasing in temperature following a LOCA, and provides a gradual reduction in the temperature of this fluid as it is supplied to the Reactor Coolant System (RCS).

BASES

APPLICABILITY (continued)

In MODE 5 or 6, the OPERABILITY requirements of the CCW System are determined by the systems it supports.

ACTIONS   A.1 and A.2

Required Action A.1 is modified by a Note indicating that the applicable Conditions and Required Actions of LCO 3.4.6, "RCS Loops - MODE 4," be entered if an inoperable CCW train results in an inoperable RHR loop. This is an exception to LCO 3.0.6 and ensures the proper actions are taken for these components.

If one of the required CCW trains is inoperable, action must be taken to restore OPERABLE status within 72 hours. In this Condition, the remaining two OPERABLE CCW trains are adequate to perform the heat removal function. Required Action A.2 allows the option to apply the requirements of Specification 5.5.18 to determine a Risk Informed Completion Time (RICT). This Required Action is not applicable in MODE 4. The 72 hour Completion Time is reasonable, based on the redundant capabilities afforded by the OPERABLE trains, and the low probability of a DBA occurring during this period.

B.1 and B.2

If the CCW train cannot be restored to OPERABLE status within the associated Completion Time, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours and in 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 unit systems.

SURVEILLANCE
REQUIREMENTS   SR 3.7.7.1

This SR is modified by a Note indicating that the isolation of the CCW flow to individual components may render those components inoperable but does not affect the OPERABILITY of the CCW System.

Verifying the correct alignment for manual, power operated, and automatic valves in the CCW flow path provides assurance that the proper flow paths exist for CCW operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since these valves are verified to be in the correct position prior to locking, sealing, or securing. This SR also does not apply to valves that cannot be inadvertently misaligned, such as check valves. This Surveillance does not require any testing or valve manipulation; rather, it involves verification that those valves capable of being mispositioned are in the correct position.

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BASES

SURVEILLANCE REQUIREMENTS (continued)

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.7.7.2

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This SR verifies that CCW train leakage is within the limits necessary to assure that an adequate water volume is maintained in each CCW surge tank compartment for cooling required loads for 7 days after a postulated seismic event with no makeup water source. Successful completion of this test provides assurance that CCWS component leakage during the operating cycle would not prevent CCWS function without surge tank makeup for at least 7 days. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

The leak rate of 3 gallons per hour is based on the water volume in each tank compartment between the low-low level setpoint and instrument zero; this volume is greater than 800 gallons. A train leak rate of 3 gallons per hour would require more than 7 days to deplete the compartment of this water volume. (The leak rate value is conservatively selected to account for measurement uncertainty and margin.) The low-low level setpoint is below the normal operating level of each compartment. The zero level is above the pump suction nozzle elevation used for CCWS pump NPSH calculations. Thus, surveillance of this leak rate assures that surge tank compartment water volume is adequate to support CCWS operation for a minimum of 7 days without makeup. During the surveillance, it is necessary to minimize fluctuations in CCWS heat load and potential temperature fluctuations that could affect level indication. If the surveillance result is not within allowable limits for a CCW train, that train will be declared inoperable and additional testing may be necessary to determine if the header tie line isolation valves (NCS-MOV-007A/B/C/D, NCS-MOV-020A/B/C/D) are degraded. If it is determined that train separation cannot be achieved due to abnormal leakage through a pair of the redundant header tie line isolation valves (e.g., NCS-MOV-007A and NCS-MOV-007B), then both of the affected trains will be declared inoperable.

The duration of SR 3.7.7.2 testing should be long enough for the installed instrumentation to accurately measure the system losses with considerations of environmental changes in temperatures affecting thermal contraction and expansion of water within the CCWS surge tanks.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.7.3

This SR verifies isolation valves between safety and non-safety portions of the CCWS that cannot be tested during power operation. Such valves, notably NCS-AOV-57A/B and NCS-AOV-58A/B, cannot be tested during power operation because closure of these valves would isolate important components associated with normal operation. However, these valves are not normally cycled during power operation; thus, their leak rate is not likely to significantly change after the test is performed and the valves are restored to the position required for power operation. The valves are tested using a local leak rate test method. The total calculated leakage from isolation valves for each subsystem shall not exceed 25 gallons per 7 days. Successful completion of this test provides assurance that leakage from these valves isolating will not prevent CCWS function without surge tank makeup for at least 7 days. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

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02-49

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.7.~~2~~4

This SR verifies proper automatic operation of the CCW valves on an actual or simulated actuation signal. The CCW System is a normally operating system that cannot be fully actuated as part of routine testing during normal operation. This Surveillance is not required for valves that are locked, sealed, or otherwise secured in the required position under administrative controls. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.7.7.~~3~~5

This SR verifies proper automatic operation of the CCW pumps on an actual or simulated actuation signal. The CCW System is a normally operating system that cannot be fully actuated as part of routine testing during normal operation. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

REFERENCES   1.   FSAR Subsection 9.2.2.

B 3.7 PLANT SYSTEMS

B 3.7.9 Ultimate Heat Sink (UHS)

BASES

BACKGROUND The UHS provides a heat sink for processing and operating heat from safety related components during a transient or accident, as well as during normal operation. This is done by utilizing the Essential Service Water System (ESWS) and the Component Cooling Water (CCW) System.

The UHS consists of four 50 percent capacity mechanical draft cooling towers, one for each ESWS train. Each cooling tower consists of two cells with one fan per cell. The combined inventory of three of the four UHS basins provides a 30-day storage capacity as discussed in FSAR Chapter 9 (Ref. 1). Each unit is provided with its own independent UHS with no cross connection between the two units. The two principal functions of the UHS are the dissipation of residual heat after reactor shutdown, and dissipation of residual heat after an accident.

The basic performance requirements are that an adequate inventory of cooling water be available for 30 days without makeup, and that the design basis temperatures of safety related equipment not be exceeded. Each UHS basin provides 33-1/3 percent of the combined inventory for the 30-day storage capacity to satisfy the short-term recommendation of Regulatory Guide 1.27 (Ref. 2). There is one safety-related UHS transfer pump per UHS basin which is used to transfer water between the UHS basins.

The stored water level provides adequate net positive suction head (NPSH) to the ESW pump during a 30-day period of operation following the design basis LOCA or safe shutdown with LOOP scenario without makeup. CTS-01478

Additional information on the design and operation of the system, along with a list of components served, can be found in Reference 1.

BASES

APPLICABLE SAFETY ANALYSES	The UHS is the sink for heat removed from the reactor core following all accidents and anticipated operational occurrences in which the unit is cooled down and placed on residual heat removal (RHR) operation.

The operating limits are based on safe shutdown with LOOP. A conservative heat transfer analysis for the worst case LOCA was performed to ensure that the cooling tower capacity and the basin water inventory adequately remove the heat load for the worst case LOCA. Reference 1 provides the details of the assumptions used in the analysis, which include worst expected meteorological conditions, conservative uncertainties when calculating decay heat, and worst case single active failure ~~(e.g., single failure of a manmade structure)~~. The UHS is designed in accordance with Regulatory Guide 1.27 (Ref. 2), which requires a 30 day supply of cooling water in the UHS.   CTS-01478

The UHS satisfies Criterion 3 of 10 CFR 50.36(d)(2)(ii).

LCO	The UHS is required to be OPERABLE and is considered OPERABLE if it contains a sufficient volume of water at or below the maximum temperature that would allow the ESWS to operate for ~~removing the heat load during a safe shutdown with LOOP and cooling~~ at least 30 days following a design basis LOCA or safe shutdown with LOOP, without makeup water, and provide adequate net positive suction head (NPSH) to the ESWS pumps, and without exceeding the maximum design temperature of the equipment served by the ESWS. To meet this condition, three UHS cooling towers with the UHS temperature not exceeding 93°F during MODES 1, 2, 3 and 4 and the level in each of three basins being maintained above 2,800,000 gallons are required—a volume correspondent to the safe shutdown with LOOP conditions that bounds the LOCA condition. Additionally, three of the UHS transfer pumps shall be OPERABLE, with each pump capable of transferring flow from a UHS basin meeting water inventory and temperature limits, and powered from an independent Class 1E electrical division. CTS-01478

APPLICABILITY	In MODES 1, 2, 3, and 4, the UHS is required to support the OPERABILITY of the equipment serviced by the UHS and required to be OPERABLE in these MODES.

In MODE 5 or 6, the OPERABILITY requirements of the UHS are determined by the systems it supports.

ACTIONS	<u>A.1 and A.2</u>

If one of the required cooling towers and associated fans is inoperable (i.e., one or more fans per cooling tower inoperable), action must be taken to restore the inoperable cooling tower and associated fan(s) to OPERABLE status within 72 hours. In this Condition, the remaining OPERABLE cooling towers with associated fans are adequate to perform the heat

BASES

ACTIONS (continued)

removal function. However, the overall reliability is reduced because a single failure in the OPERABLE UHS cooling towers could result in a loss of UHS function.

Required Action A.2 allows the option to apply the requirements of Specification 5.5.18 to determine a Risk Informed Completion Time (RICT). This Required Action is not applicable in MODE 4. The 72-hour Completion Time is based on the capability of the OPERABLE cooling towers to provide the UHS cooling capability and the low probability of an accident occurring during the 72 hours that one required cooling tower and associated fans are inoperable.

B.1

With water temperature of the UHS > ~~95~~93°F, the design basis assumption associated with initial UHS temperature is bounded provided the temperature of the UHS averaged over the previous 24-hour period is ≤ ~~95~~93°F. With the water temperature of the UHS > ~~95~~93°F, long-term cooling capability of the ECCS loads may be affected. Therefore, to ensure long-term cooling capability is provided to the ECCS loads when water temperature of the UHS is > ~~95~~93°F, Required Action B.1 is provided to monitor the water temperature of the UHS more frequently and verify the temperature is ≤ ~~95~~93°F when averaged over the previous 24 hour period. The once per hour Completion Time takes into consideration UHS temperature variations and the increased monitoring frequency needed to ensure design basis assumptions and equipment limitations are not exceeded in this condition. If the water temperature of the UHS exceeds ~~95~~93°F when averaged over the previous 24 hour period, Condition E must be entered immediately.

CTS-01478

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C.1

If one or more required UHS basins have a water level not within the limits, action must be taken to restore the water level to within limits within 72 hours.

The 72 hour Completion Time is reasonable based on the low probability of an accident occurring during the 72 hours, the considerable cooling capacity still available in the basin(s), and the time required to reasonably complete the Required Action. Furthermore, there would be no significant loss in the UHS cooling capacity when the water level drops below the normal level during a 72-hour period because of sufficient cooling tower basin inventory. The UHS has a combined design heat removal capacity of approximately 20 days from two operable cooling tower basins and 30 days from three operable cooling tower basins.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.9.2

This SR verifies that the ESWS is available to cool the CCW System and essential chiller unit to at least its maximum design temperature with the maximum accident or normal design heat loads for 30 days following a ~~Design Basis Accident~~design basis LOCA or safe shutdown with LOOP.   MAP-16-409
The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program. This SR verifies that the water temperature of the UHS is ≤ 93°F.

SR 3.7.9.3

Operating each cooling tower fan for ≥15 minutes ensures that all fans are OPERABLE and that all associated controls are functioning properly. It also ensures that fan or motor failure, or excessive vibration, can be detected for corrective action. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.7.9.4

This SR verifies that each UHS fan starts and operates on an actual or simulated actuation signal. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.7.9.5

This SR verifies that each UHS transfer pump starts and operates on a manual actuation signal. Verification of the UHS transfer pump operation includes testing to verify the pump's developed head at the flow test point is greater than or equal to the required developed head. Testing also includes verification of required valve position.

BASES

ACTIONS (continued)

~~The Frequency of this SR is in accordance with the Inservice Testing Program of the ASME Code. The ASME Code provides the activities and Frequencies necessary to satisfy the requirements. Such inservice inspections confirm component OPERABILITY, trend performance, and detect incipient failures by indicating abnormal performance.~~ The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

MAP-16-409

SR 3.7.9.6

This SR verifies the correct alignment for manual, power-operated, and automatic valves in the UHS flow path to assure that the proper flow paths exist for UHS operation. This SR does not apply to valves that are locked, sealed or otherwise secured in position, since they are verified to be in the correct position prior to being locked, sealed, or secured. This SR does not require any testing or valve manipulation; rather, it involves verification that those valves capable of being mispositioned are in the correct position. This SR does not apply to valves that cannot be inadvertently misaligned, such as check valves.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk, and is controlled under the Surveillance Frequency Control Program.

SR 3.7.9.7

This SR verifies proper manual and automatic operation of the UHS valves on remote manual or on an actual or simulated actuation signal. The ~~ESWS~~UHS is a normally- operating system that cannot be fully actuated as part of normal testing. This Surveillance is not required for valves that are locked, sealed, or otherwise secured in the required position under administrative controls.

MAP-16-409

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk, and is controlled under the Surveillance Frequency Control Program.

REFERENCES

1.   FSAR Subsection 9.2.5.

2.   Regulatory Guide 1.27.

BASES

BACKGROUND (continued)

The air entering the CRE is continuously monitored by radiation detectors. One detector output above the setpoint will cause actuation of the pressurization mode~~d~~ or isolation mode as required. The actions of the isolation mode are more restrictive, and will override the actions of the pressurization mode. | MAP-16-410

A single train of MCREFS operating at a flow ≤1200 cfm will pressurize the CRE to about 0.125 inches water gauge relative to external areas adjacent to the CRE boundary. The MCRVS operation in maintaining the CRE habitable is discussed in FSAR Chapter 9, Subsection 9.4.1 (Ref. 2).

Redundant supply and recirculation trains provide the required filtration should an excessive pressure drop develop across the other filter train. Normally open isolation dampers are arranged in series pairs so that the failure of one damper to shut will not result in a breach of isolation. The MCREFS is designed in accordance with Seismic Category I requirements.

Two trains of MCRATCS will provide the required temperature control to maintain the control room between 73°F and 78°F. The MCRVS operation in maintaining the control room temperature is discussed in FSAR Chapter 9, Section 9.4.1 (Ref. 2).

The CRE habitability is maintained by limiting the inleakage of potentially contaminated air into the CRE. The potential leakage paths for the CRE include the control room enclosure (e.g., walls, penetrations, floor, ceilings, joints, etc.) and other potential paths such as pressurized ductwork from other HVAC systems, pressurized air systems (e.g., instrument air) or isolated HVAC intakes.

The periodic surveillance pressurization tests verify the integrity of the CRE with respect to potentially contaminated adjacent areas. It does not verify filtered inleakage internal to the filtration units and ductwork nor does it verify unfiltered inleakage from internal pressurized sources (e.g., instrument air). These sources of inleakage are addressed separately from TS surveillances.

The MCRVS is designed to maintain a habitable environment in the CRE for 30 days of continuous occupancy after a Design Basis Accident (DBA) without exceeding a 5 rem total effective dose equivalent (TEDE).

BASES

BACKGROUND (continued)

The annulus emergency exhaust system is discussed in FSAR Subsection 6.5.1 and Subsection 9.4.5 (Refs. 1 and 2 respectively).

| APPLICABLE SAFETY ANALYSES | The annulus emergency exhaust system design basis is SAFETY established by the large break loss of coolant accident (LOCA). The system evaluation assumes a passive failure outside containment, such as valve packing leakage during a Design Basis Accident (DBA). The system evaluation also assumes a passive failure of the ECCS outside containment, such as an SI pump seal leakage. In such a case, the system restricts the radioactive release to within the 10 CFR 50.34 (Ref. 4) limits, or the NRC staff approved licensing basis (e.g., a specified fraction of 10 CFR 50.34 limits). The analysis of the effects and consequences of a large break LOCA are presented in FSAR Chapter 15, Subsection 15.6.5.5 (Ref. 3). The annulus emergency exhaust system also actuates following a small break LOCA to clean up releases of smaller leaks, such as from valve stem packing. |

MAP-16-411

Either a complete loss of function or excessive LEAKAGE may result in less efficient removal of any gaseous or particulate material released to the penetration areas and the ECCS pump rooms following a LOCA.

The annulus emergency exhaust system satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

| LCO | Two independent and redundant trains of the annulus emergency exhaust system are required to be OPERABLE to ensure that at least one train is available, assuming there is a single failure disabling the other train coincident with a loss of offsite power. Total system failure could result in the atmospheric release from the penetration and safeguard component areas exceeding 10 CFR 50.34 limits in the event of a Design Basis Accident (DBA). |

The annulus emergency exhaust system is considered OPERABLE when the individual components necessary to control radioactive releases and maintain the safeguard component areas filtration are OPERABLE in both trains. An annulus emergency exhaust system train is considered OPERABLE when its associated:

a.   Fan is OPERABLE,

b.   HEPA filter is not excessively restricting flow, and is capable of performing their filtration function, and

c.   Ductwork and dampers are OPERABLE.

B 3.7 PLANT SYSTEMS

B 3.7.13 Fuel Storage Pit Boron Concentration

BASES

BACKGROUND	The spent fuel pit is a single region spent fuel rack design with 11.1 in center-to-center rack spacing. The spent fuel pit stores 900 spent fuel assemblies in borated water without credit for fuel burnup. The water in the spent fuel storage pit normally contains soluble boron which results in large subcriticality margins under actual operating conditions. The maximum Keff without taking credit for soluble boron is well below 0.95, which is the criticality safety design criteria in 10 CFR 50.68(b)(4) being adopted in designing the spent fuel racks. The double contingency principle discussed in ANSI/ANS-8.1-1998 (R2007), however, allows credit for soluble boron under abnormal or accident conditions since only a single accident scenario need be considered at a time.	CTS-01480
APPLICABLE SAFETY ANALYSES	Most accident conditions do not result in an increase in the reactivity of the fuel storage pit. Examples of these accident conditions, as determined from criticality analysis, are the dropping of a fuel assembly onto the top of the rack and misloading of a fresh fuel assembly of the highest anticipated reactivity into a spent fuel rack cell. However, accidents that could increase reactivity can be postulated. This increase in reactivity is unacceptable with unborated water in the storage pit. Accidents that can be postulated are associated with the mislocation of a fresh fuel assembly and rack movements in the event of seismic activity. The minimum soluble boron concentration to maintain subcriticality in the SFP during these accident conditions is 800 ppm, as determined from criticality analysis. The negative reactivity effect of the soluble boron compensates for the increased reactivity caused by these postulated accident scenarios. Subcriticality conditions, therefore, are maintained through compliance with the LCO minimum limit of ≥ 4000 ppm soluble boron. The concentration of dissolved boron in the fuel storage pit satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).	
LCO	The fuel storage pit boron concentration is required to be ≥ 4000 ppm according to the RWSP and refueling requirements. The specified concentration of dissolved boron in the fuel storage pit preserves the assumptions used in the analyses of the soluble boron credit including the potential critical accident scenarios as described in Reference 1. This concentration of dissolved boron is necessary to control reactivity during fuel assembly storage and movement within the fuel storage pit.	

BASES

APPLICABILITY	In MODES 1, 2, 3, and 4, the potential for main steam line leakage is greatest when the main steam line is pressurized.
	In MODES 5 and 6, main steam line leakage limits are not required because the main steam line pressure is far lower, resulting in lower stresses and reduced potentials for main steam line leakage.
ACTIONS	A.1 and A.2
	If main steam line leakage is not within limit, the unit must be brought to lower pressure conditions to reduce the severity of the LEAKAGE and its potential consequences.
	The reactor must be brought to MODE 3 within 6 hours and MODE 5 within 36 hours. This action reduces the main steam line leakage and also reduces the factors that tend to degrade the main steam line. 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. In MODE 5, the pressure stresses acting on the main steam line are much lower, and further deterioration is much less likely.
SURVEILLANCE REQUIREMENTS	SR 3.7.15.1
	Verifying main steam line leakage to be within the LCO limits ensures the integrity of the main steam line inside containment is maintained. Main steam line leakage would at first appear as unidentified LEAKAGE and can only be positively identified by inspection.
	An early warning of main steam line leakage or unidentified LEAKAGE is provided by the automatic systems that monitor the level of containment sump used to collect unidentified LEAKAGE and air cooler condensate flow rate. These leakage detection systems are specified in LCO 3.4.15, "RCS Leakage Detection Instrumentation."
	Also, by performance of an RCS water inventory balance, indication of containment environmental pressures, temperatures and radiation allow the determination of whether the main steam line is a potential source of unidentified LEAKAGE inside containment.
	The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program. DCD_16-304
REFERENCES	1. Chapter 3, Section 3.6 "Protection Against Dynamic Effects Associated with Postulated Rupture of Piping."

BASES

SURVEILLANCE REQUIREMENTS	SR 3.9.2.1

These valves are to be secured closed to isolate possible dilution paths. The likelihood of a significant reduction in the boron concentration during MODE 6 operations is remote due to the large mass of borated water in the refueling cavity and the fact that all unborated water sources are isolated, precluding a dilution. The boron concentration is checked every 72 hours during MODE 6 under SR 3.9.1.1. This Surveillance demostrates that the valves are closed through a system walkdown. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

MAP-16-412

REFERENCES	1.	FSAR Subsection 15.4.6.
	2.	NUREG-0800, Section 15.4.6.

BASES

LCO (continued)

The LCO is modified by a Note allowing penetration flow paths with direct access from the containment atmosphere to the outside atmosphere to be unisolated under administrative controls. Administrative controls ensure that 1) appropriate personnel are aware of the open status of the penetration flow path during CORE ALTERATIONS or movement of irradiated fuel assemblies within containment, and 2) specified individuals are designated and readily available to isolate the flow path in the event of a fuel handling accident.

The equipment hatch may be open during movement of irradiated fuel or CORE ALTERNATIONS provided the hatch is capable of being closed and the water level in the refueling pool is maintained as required. Administrative controls ensure that 1) appropriate personnel are aware of the open status of the containment during movement of irradiated fuel or CORE ALTERNATIONS, 2) specified individuals are designated and readily available to close the equipment hatch following an evacuation that would occur in the event of a fuel handling accident, and 3) any obstructions (e.g., cables and hoses) that would prevent rapid closure ofthe equipment hatch can be quickly removed.

MIC-03-16-0 0008

MIC-03-16-0 0008

APPLICABILITY   The containment penetration requirements are applicable during movement of irradiated fuel assemblies within containment because this is when there is a potential for the limiting fuel handling accident. In MODES 1, 2, 3, and 4, containment penetration requirements are addressed by LCO 3.6.1. In MODES 5 and 6, when movement of irradiated fuel assemblies within containment is not being conducted, the potential for a fuel handling accident does not exist. Therefore, under these conditions no requirements are placed on containment penetration status.

ACTIONS   <u>A.1</u>

If the containment equipment hatch, air locks, or any containment penetration that provides direct access from the containment atmosphere to the outside atmosphere is not in the required status, including the Containment Ventilation Isolation System not capable of automatic actuation when the purge isolation valves are open, the unit must be placed in a condition where the isolation function is not needed. This is accomplished by immediately suspending movement of irradiated fuel assemblies within containment. Performance of these actions shall not preclude completion of movement of a component to a safe position.

B 3.9 REFUELING OPERATIONS

B 3.9.8 Decay Time

BASES

BACKGROUND	The movement of irradiated fuel assemblies within containment or in the fuel handling area requires allowing at least 24 hours for radioactive decay time before fuel assembly handling can be initiated. During fuel handling, this ensures that suffiecient radioactive decay has occurred in the event of a fuel handling accident (Refs. 1 and 2). Sufficient radioactive decay of short-lived fission products would have occurred to limit offsite doses from the accident to within the values reported in <u>FSAR</u> Chapter 15.
APPLICABLE SAFETY ANALYSES	During movement of irradiated fuel assemblies, the radioactivity decay time is an initial condition design parameter in the analysis of a fuel handling accident inside containment or in the fuel handling area, as postulated by Regulatory Guide 1.183 (Ref. 1) The fuel handling accident analysis inside containment or in the fuel handling area is described in Reference 2. This analysis assumes a minimum radioactive decay time of 24 hours. Radioactive decay time satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).
LCO	A minimum radioactive decay time of 24 hours is required to ensure that the radiological consequences of a postulated fuel handling accident inside containment or in the fuel handling area are within the values calculated in Reference 2.
APPLICABILITY	Radioactive decay time is applicable when moving irradiated fuel assemblies in containment or in the fuel handling area. The LCO minimizes the possibility of radioactive release due to a fuel handling accident that is beyond the assumptions of the safety analysis. If irradiated fuel assemblies are not being moved, there can be no significant radioactivity release as a result of a postulated fuel handling accident. Requirements for fuel handling accidents inside containment or in the fuel handling area are also covered by LCO 3.7.12, "Fuel Storage Pit Water Level" and LCO 3.9.7, "Refueling Caivty Water Level."

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